AUTOMATED GUIDED VEHICLES VERSUS AUTONOMOUS MOBILE ROBOTS

WHICH SYSTEM IS BETTER SUITED TO YOUR OPERATIONS?

An insightful report on how to drive operations forward

AGV or AMR? Check it out NOW! »»

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Executive summary

As industries transform at an unprecedented pace, the decision between Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMRs) has become pivotal, defining not only operational efficiency, but also scalability and long-term ROI.

AGVs have long been trusted in manufacturing and warehousing facilities for their precision and reliability, using predefined routes to navigate through a production area. Their low-maintenance requirements and predictable navigation make them an ideal choice to execute stable, repetitive tasks in structured environments.

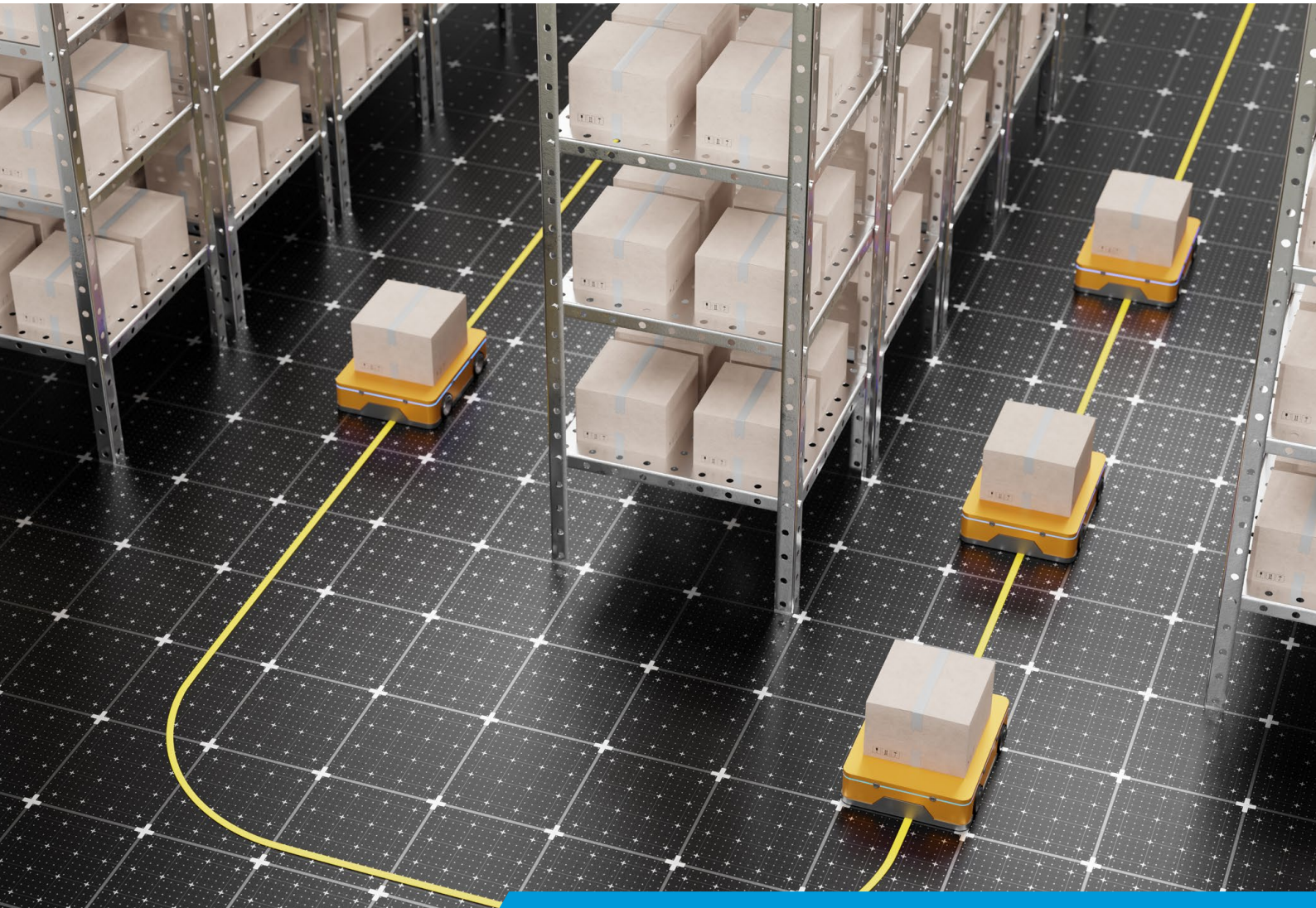
Conversely, AMRs have grown in popularity due to their flexibility and intelligent navigation capabilities. With the ability to dynamically reroute around obstacles and adapt to changing environments, AMRs are well-suited for operations that involve varied workflows, shifting layouts, and frequent task changes, especially due to their advanced sensors, AI-driven decision-making abilities, and reduced infrastructure requirements.

However, both technologies come with their unique limitations. AGVs are less adaptable to changes and require a steeper infrastructure investment. In contrast, AMRs – while flexible – are limited in load capacity and introduce operational risks in high-traffic or more complex production facilities.

To bridge this gap, Scott's latest innovation in mobile robotics, NexBot, is programmable as either an AGV or AMR. Built with a universal front-end and fully modular back-end, NexBot offers the flexibility to adapt as your needs evolve. A standardized design reduces engineering efforts, simplifies maintenance and training, and accelerates deployment across diverse applications.

Introduction

Ever wondered who keeps the heavy loads moving in a busy warehouse? Automated Guided Vehicles (AGVs) are increasingly taking on that role. Built for repetitive, structured tasks, these robotic vehicles transport loads with precision and reliability. Today, they are playing a growing part in modern operations, helping workflows run smoothly and efficiently.

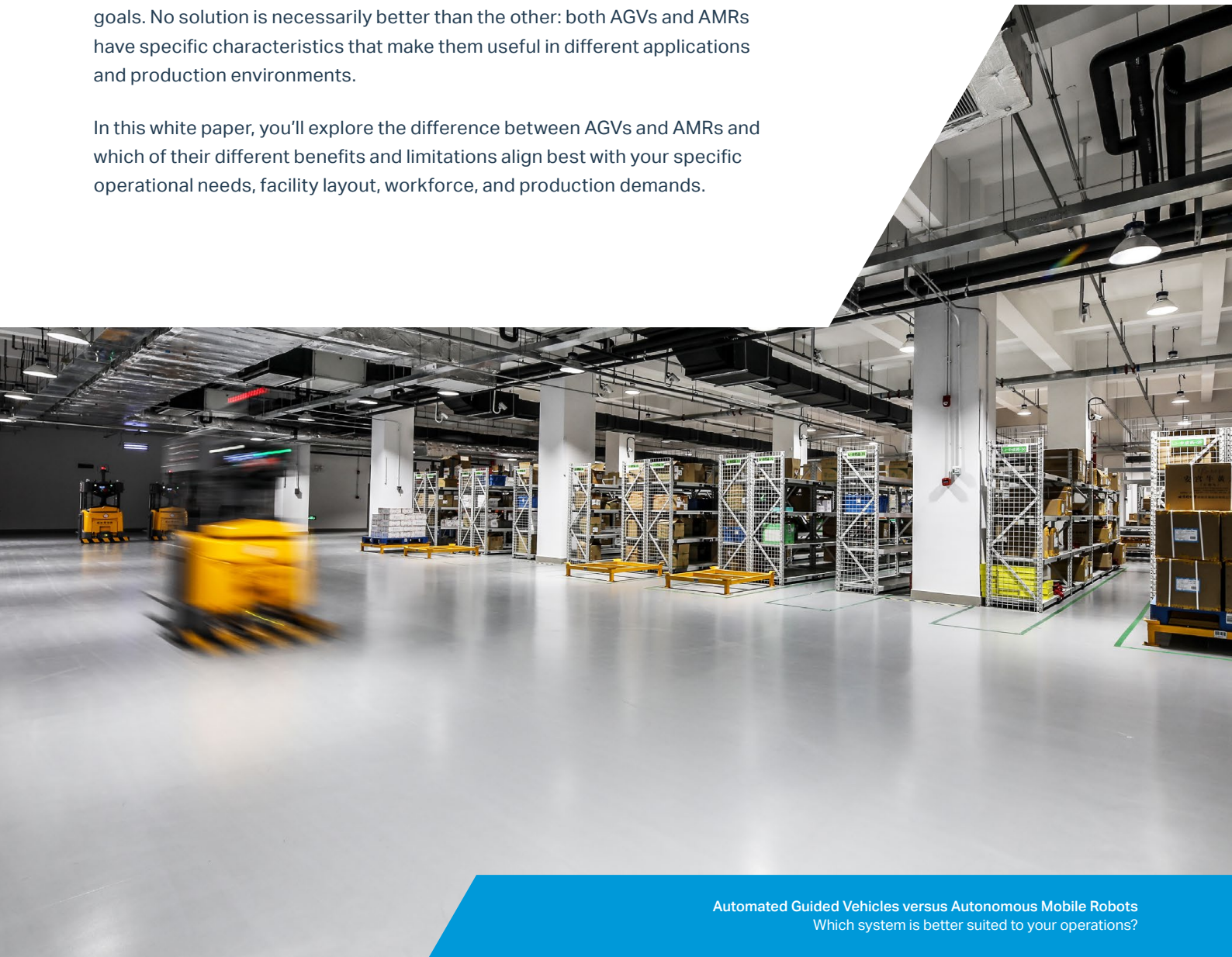


Introduction

However, Autonomous Mobile Robots (AMRs) are swiftly catching up to AGVs in terms of popularity and implementation. Using advanced navigation systems, their flexibility and broad range of abilities allow them to thrive in dynamic and rapidly changing environments.

Choosing between AGVs and AMRs requires a clear understanding of your operational priorities, infrastructure flexibility, and long-term scalability goals. No solution is necessarily better than the other: both AGVs and AMRs have specific characteristics that make them useful in different applications and production environments.

In this white paper, you'll explore the difference between AGVs and AMRs and which of their different benefits and limitations align best with your specific operational needs, facility layout, workforce, and production demands.



Automated Guided Vehicles

Automated Guided Vehicles, or AGVs, are a cornerstone of any production area. Implemented to execute precise and predictable actions, they were first introduced in the early 1950s and have become a familiar and reliable method for automated material handling over time. Find out what the benefits and limitations are to AGVs and what they could mean for your operations.

WHAT ARE AUTOMATED GUIDED VEHICLES?

AGVS NAVIGATE WITHIN PREDEFINED PATHS OR A PREMAPPED ENVIRONMENT, AND ARE MOST EFFECTIVE WHEN HANDLING STRAIGHTFORWARD, LOW COMPLEXITY TASKS SUCH AS MATERIAL TRANSPORTATION, PACKAGING, SORTING, OR DELIVERY.

FROM A TO B

An AGV travels between point A and point B on a predefined path, usually transporting or handling materials or packaging. It does not deviate from this path, remaining consistent and predictable – much like a train using its tracks. If the AGV encounters an obstruction, it stops moving and does not resume its activities until the obstacle is removed. This usually requires human intervention to remove the obstacle and physically reset the vehicle before continuing on its preprogrammed course.

NAVIGATING THROUGH THE PRODUCTION AREA

If an AGV travels on a predetermined course, how does it find its way? Its path is defined through an environmental map, composed of natural features such as walls and columns, but also mounted reflectors to indicate machinery and other obstructions.
The route is determined via several options, such as magnetic tape strips, underfloor guidance wiring, RFID pucks or spots, barcodes, or a combination of the former – duly programmed into the vehicle. Laser scanners on the vehicle examine the environment and alert the AGV to stop on time when encountering an obstacle.

OPERATING WITH EXTREME PRECISION

One of the most important advantages an AGV brings to the table is its ability to operate using extreme precision. As indicated by barcodes or RFID pucks, they dock in a predetermined location and require exact positioning before they are able to unload. For some industries, this is not necessarily required, but in others, such as the automotive industry, which operates using extremely low tolerances, precision is key.

Top feature (!)

AGVs are ideal for maintaining production rates in fixed environments.

THE ADVANTAGES OF AGVS IN YOUR OPERATIONS

WHY WOULD YOU CHOOSE TO IMPLEMENT AN AGV FLEET IN YOUR OPERATIONS? THERE ARE SEVERAL REASONS WHY IMPLEMENTING AUTOMATED GUIDED VEHICLES IS AN ADDED ADVANTAGE TO YOUR MANUFACTURING AND WAREHOUSING OPERATIONS.

Speed, accuracy and predictability
AGVs excel when executing predictable, accurate, and repetitive tasks – abilities which are especially advantageous in warehousing and manufacturing industries. If you've got a steady, structured operations set-up with clearly established travel routes, AGVs will quickly show their added value through their accuracy, speed, and increased production capacity.

Enhanced employee satisfaction
In terms of cost, AGVs provide a more consistent cost structure after initial investment compared to human labour. Menial tasks requiring heavy labour are delegated to the AGVs, leaving skilled tasks to your employees, increasing job satisfaction and reducing long-term costs related to burnout and injuries. The issue of staff shortages, frequently recurring in the warehousing industry, is also reduced as AGVs are used as an added resource for material handling.

Increased safety
Safety is increased through the various safety and prevention mechanisms of an AGV. Accidents are much less frequent with AGVs than with manually operated machinery, and maintenance costs are reduced through controlled acceleration and braking. Employees and infrastructure are less likely to encounter injuries or damage through an AGV fleet.

Seamless WMS integration
Streamline your operations and easily integrate your AGVs with existing warehouse management systems.

Fast ROI
Experience a significant return on investment – AGVs will pay back their original investment in speed and productivity over the course of one to two years.

THE LIMITATIONS OF AGVS IN YOUR OPERATIONS

ALTHOUGH AGVS ARE A GREAT ASSET TO YOUR PRODUCTION, THEY DO HAVE CERTAIN LIMITATIONS THAT MIGHT NOT MAKE THEM THE IDEAL SOLUTION FOR YOUR SPECIFIC OPERATIONS. IT'S IMPORTANT TO BE AWARE OF THESE DRAWBACKS AND DECIDE WHETHER THEY ARE A DEAL-BREAKER FOR YOUR REQUIREMENTS.

Considerable upfront costs

You'll need a considerable investment when implementing your AGV fleet. Although they are initially more reasonably priced than Autonomous Mobile Robots, time and money are required to program the machines and prepare the infrastructure accordingly with guidance indicators.

Vendor dependence

Each AGV is programmed using the software chosen by the vendor, and unfortunately, you are reliant on their choice. Complications can arise when wanting to upgrade or expand your fleet: if you choose to deploy another AGV brand, you might encounter a new installation process, different software, other route indicators... Look for an established supplier with a steady reputation to ensure continuity within your AGV fleet.

WiFi required

AGVs cannot operate without a steady WiFi connection, which requires the proper infrastructure for your production and warehousing areas – or any areas in which your AGV will be active.

Rerouting means reprogramming

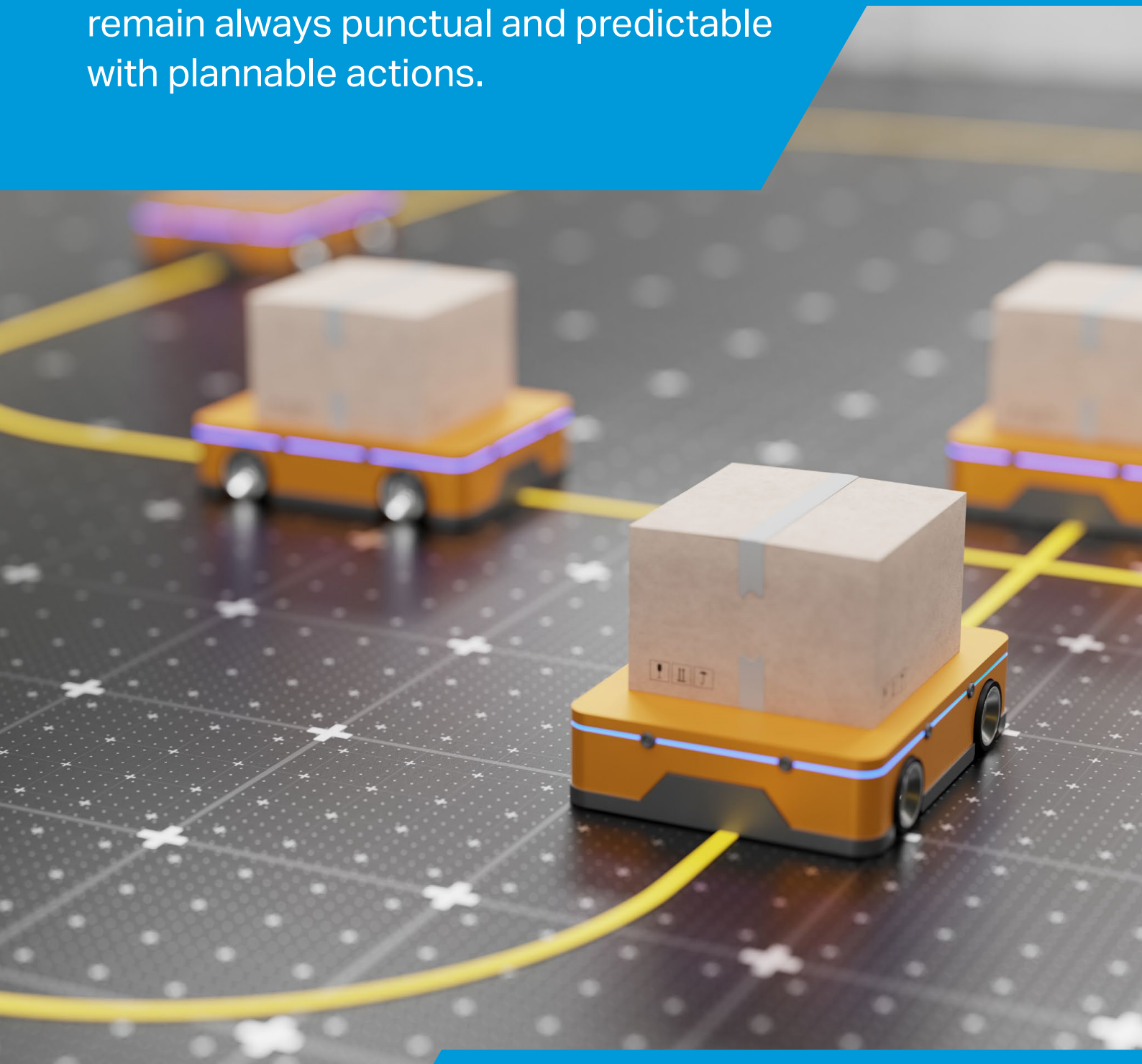
If any routes need altering, AGVs are especially inflexible. A forklift driver or an AMR can easily change and reroute if needed, but AGVs require reprogramming and potential infrastructure changes to the route indicators if changes are made to your production area.

Obstacle sensitivity

Your infrastructure will need to remain tidy at all times to keep your AGVs operating smoothly. AGVs need clear pathways at all times for a steady operation. They also tend to struggle with additional challenges such as uneven floors, slippery surfaces, slopes, etc., which means your production will need to implement the necessary modifications to accommodate their travel routes.

TO CONCLUDE.

AGVs are an ideal choice for high-production environments with a low number of obstacles and stable infrastructure: they are able to take on a constant material flow and remain always punctual and predictable with plannable actions.



Autonomous Mobile Robots

Autonomous Mobile Robots, or AMRs, appeared later on the scene but have increased in popularity over time. Instead of relying on fixed routes, AMRs are flexible to carve their own path around obstacles, instead, adapting to changing environments. Their smart navigation abilities help unburden factory workers with the guarantee to deliver materials in the right place. Discover what benefits and limitations AMRs bring to the table and how this can transform your operations.

WHAT ARE AUTONOMOUS MOBILE ROBOTS?

AMRS ARE WELL-EQUIPPED TO HANDLE VARIOUS TASKS AND NAVIGATE WITHIN A PRE-MAPPED ENVIRONMENT, UPDATING TRAVEL PATHS AUTONOMOUSLY TO MANEUVER AROUND OBSTACLES.

FROM A TO B VIA ITS OWN ROUTE

An AMR travels from point A to B but doesn't necessarily take the same route every single time. If it encounters an obstacle across its path, it'll safely maneuver around the obstruction or calculate a new route to reach its destination. Similarly to how an AGV is compared to a train using train tracks, an AMR can be compared to a car driving around a fallen tree branch or deviating its route when there's a roadblock.

In the event of an obstruction, little to no human intervention is required, as the AMR will assess several routes and always take the most efficient path, rerouting and adapting where needed to reach its destination as quickly as possible. This makes it an ideal solution in a production environment where paths, products, and tasks can vary, easily adapting to the current need.

NAVIGATING THROUGH THE PRODUCTION AREA

Using LiDAR (light detection and ranging) lasers to navigate the environment, AMRs create a 3D map that helps identify potential obstacles, people, and other vehicles. This navigation is supported by cameras to detect signage, movement, and vision depth, and is further backed up by supporting sensors when traversing low-visibility environments.

Piloted by an AI system, AMRs are able to make real-time decisions when navigating through more complex environments or when performing specific tasks. An AMR is best suited for production areas that use dynamic workflows with varying demands – including picking, sorting, stowing, stock control, and sorting.

A TECHNICAL COWORKER

AMRs are often perceived as coworkers on the shop floor, instead of vehicles. The differentiating factor? The AI system helps an AMR 'think' for itself. For example, when looking to load a pallet, an AMR will look for and identify that specific pallet, dynamically adjusting misaligned pallets. They require minimal intervention thanks to their high level of autonomy and can execute all sorts of tasks from courier to maintenance.

Top feature

AMRs are ideal for ensuring their loads arrive at the intended destination with minimal intervention.

THE ADVANTAGES OF AMRS IN YOUR OPERATIONS

AMRS BRING THEIR OWN SET OF ADVANTAGES TO YOUR OPERATIONS – HERE ARE SOME OF THE REASONS WHY YOU SHOULD CONSIDER IMPLEMENTING A FLEET OF AUTONOMOUS MOBILE ROBOTS IN YOUR MANUFACTURING AND WAREHOUSING OPERATIONS.

Minimal human intervention

AMRs function with a high degree of flexibility – they travel autonomously and require minimal human intervention, safely navigating around obstacles, other people, and machinery. They are suited to perform a wide range of applications, easily adapting to operational demands, a changing environment, and different tasks of varying complexities.

High costs, high reward

Although AMRs have a higher starting cost due to increased intelligence properties in regard to AGVs, this is levelled out due to the fact that they do not require a major infrastructure overhaul. They are easy to implement in an operations facility, quickly programmed, and adaptable to any environmental changes, routes, actions, or tasks.

Enhanced employee satisfaction

As previously mentioned, AMRs are often perceived as coworkers for operational employees. They relieve labourers from performing repetitive tasks or having to act as couriers, leaving the higher-skilled jobs to their human counterparts, resulting in higher job satisfaction and enhanced productivity. Available 24/7, AMRs require no holidays or sick leave and operate with minimal maintenance requirements.

Easy scalable

AMRs are fully scalable to your operations: they can be added to an existing fleet with minimal effort, and can be added or removed according to operational demands.

THE LIMITATIONS OF AMRS

AMRS ARE A GREAT ASSET TO YOUR ORGANIZATION IN TERMS OF INTELLIGENCE AND RELIABILITY, BUT THEY ALSO HAVE SOME LIMITATIONS. DISCOVER THEM BELOW SO THAT YOU'RE ALL SET TO MAKE A WELL-INFORMED CHOICE.

Limited payload

AMRs are usually smaller in size than AGVs in order to navigate around obstacles more easily. The drawback is that they are able to carry less, which can be limiting for certain industries and operations, such as warehousing. Make sure to research what load your AMR is able to carry and if this is suitable for your operations.

Navigation issues

Although obstacle avoidance is the main selling point for AMRs, it isn't always as effective, as it depends on a site's complexity and thorough spatial planning. Bigger warehouses have several different paths: the vehicle could end up getting lost for hours before it finds the right path again – and although the AMR is guaranteed to reach its destination, it isn't specified when it should arrive. This is a lot less efficient than having well-trained employees quickly remove the obstruction, and can affect time-based operations.

Clean workspace

Similar to AGVs, AMRs require specific on-site conditions to function properly. If the floor is wet, slippery, uneven, your production site has slopes, or if it carries a lot of dust, the AMR might have difficulty operating and could potentially disrupt operations.

Risk of outdated technology

AMRs are a relatively new technology, which brings a financial risk alongside it – are they developed enough? How fast will your vehicles and the software depreciate? In this era of digital advancement, will your machines still be up to date with the latest technology and software after five years? These uncertainties, alongside a pricier starting cost, will have your management questioning the potential return on investment.

Traffic congestion

A fleet of AMRs that move around independently, alongside human-operated vehicles, and other moving parts in a production area, can quickly crowd a space. Traffic congestion is likely, and safety training should be mandatory. Careful spatial management, training, and programming can help reduce potential risks but requires time, effort, and insights to avoid downtime or collisions.

TO CONCLUDE.

Autonomous Mobile Robots (AMRs) are ideal for dynamic production and warehouse environments where workflows, paths, and tasks frequently change: they navigate flexibly around obstacles, adapt to varying operational demands, and perform diverse tasks with minimal human intervention, offering intelligence, reliability, and scalable support in complex, ever-changing settings.

Choosing what's right for your organization

AGVs and AMRs each have distinct roles in automated material handling, depending on the specific needs and constraints of your operations.

Now that you've got a better idea of how both robotic vehicles operate, as well as an overview of their individual strengths and limitations, you're one step closer to making the right choice for your operations or warehouse facility. To facilitate your decision-making process, you'll find a side-by-side comparison highlighting the important characteristics of each vehicle.

	Automated Guided Vehicles (AGVs)	Autonomous Mobile Robots (AMRs)
Navigation	Operates along fixed, predefined paths using indicative markers.	Uses real-time navigation through 3D mapping, LiDAR, cameras, and onboard intelligence to map routes.
Path planning	Follows a static path, requires manual intervention to alter or deviate from a route.	Dynamically plans and adapts to the most efficient route.
Obstacle handling	Stops when encountering an obstruction, requires human intervention to continue.	Automatically reroutes around the obstacle or calculates a new path.
Infrastructure	Requires physical infrastructure, including waypoints and markers.	Requires minimal to no changes to physical infrastructure.
Task execution	Ideal for structured, repetitive tasks that require high precision or have a time or speed limit.	Ideal for flexible, dynamic tasks, including courier services, maintenance, picking, sorting, material handling, and logistics.
Scalability	Less adaptable to layout changes, any modifications can be time-consuming and costly.	Easily scalable for facility changes and expansions.
Implementation cost	Low starting cost, additional infrastructure investment must be considered.	Higher initial cost, but minimal changes required outside installation.

Choosing what's right for your organization

AGVs and AMRs each have distinct roles in automated material handling, depending on the specific needs and constraints of your operations.

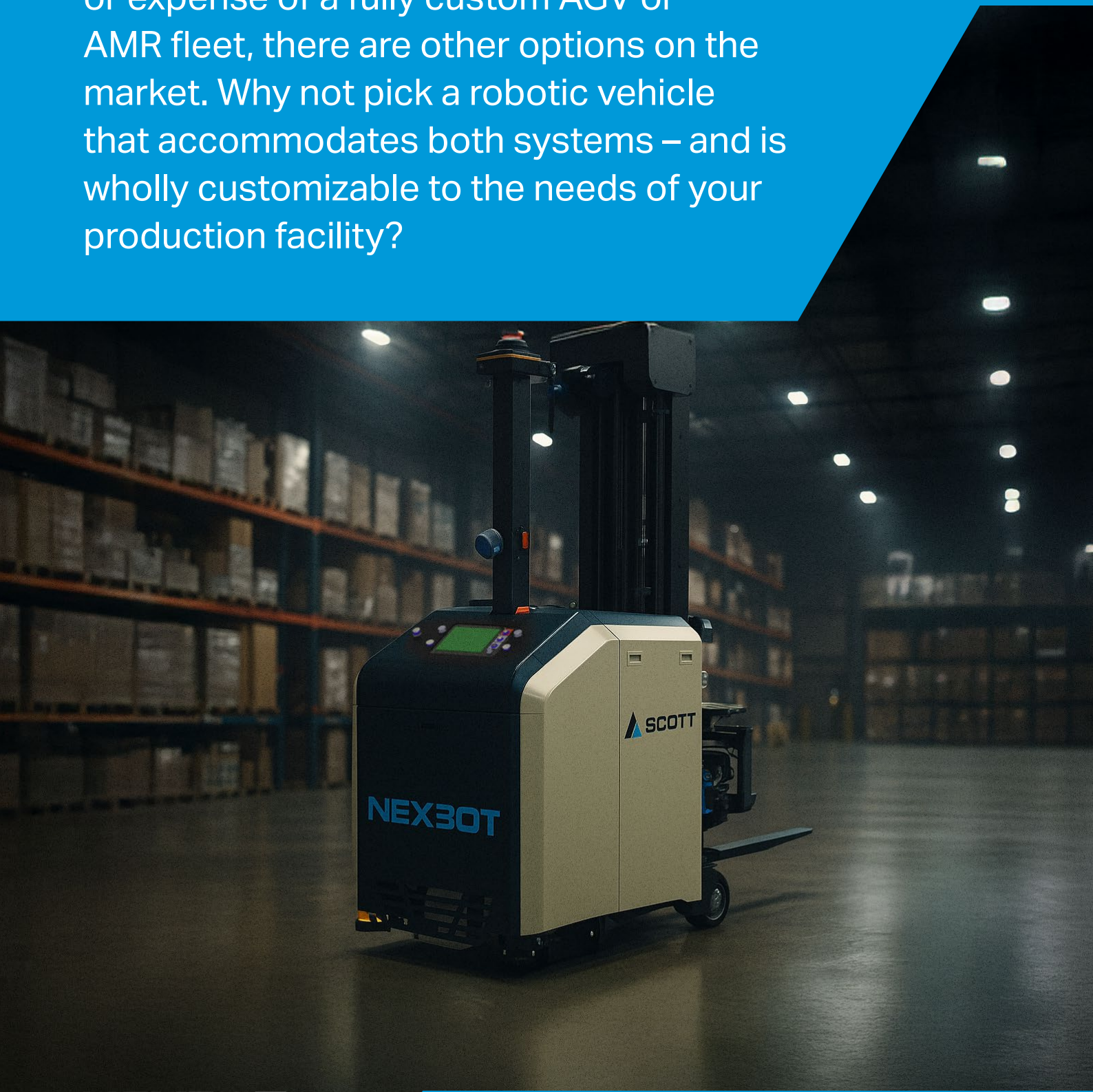
AGVs are your ticket to a dependable, reliable performance in a structured environment with consistent tasks and familiar routes. Their precision, safety, and ability to maintain production pace are an absolute asset in operations where predictability and timings are critical.

In contrast, AMRs offer a high degree of flexibility, adaptability, and intelligence. They excel in dynamic environments that experience frequently changing workflows, and where minimal human intervention and autonomous decision-making are a necessity.

Although you might experience limitations for both systems – a requirement for rigid infrastructure with AGVs and the need to avoid operational complexity with AMRs, you'll experience measurable benefits when implementing the right system in the right place.

Introducing NexBot

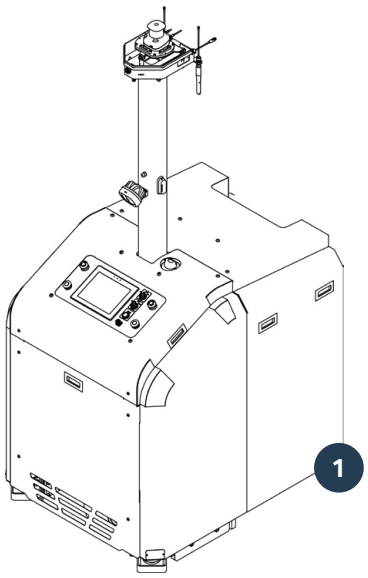
If you're reluctant to accept the complexity or expense of a fully custom AGV or AMR fleet, there are other options on the market. Why not pick a robotic vehicle that accommodates both systems – and is wholly customizable to the needs of your production facility?



WHAT IS NEXBOT

NEXBOT, SCOTT'S LATEST TRANSBOTICS INNOVATION, IS A VEHICLE THAT CAN BE PROGRAMMED AS AN AGV AS WELL AS AN AMR. A UNIVERSAL FRONT-END WITH SIX DISTINCT BACK-END CONFIGURATIONS MAKES IT FULLY CUSTOMIZABLE, SCALABLE, FLEXIBLE, AND EASILY DEPLOYABLE.

Pick the configuration that suits your exact workflow – whether it's handling palletized loads, facilitating conveyor-based transfers, or towing wheeled carts. Integrating effortlessly into your existing warehouse and logistics ecosystems, NexBot is engineered to improve the efficiency in your warehousing, manufacturing, and distribution facilities.

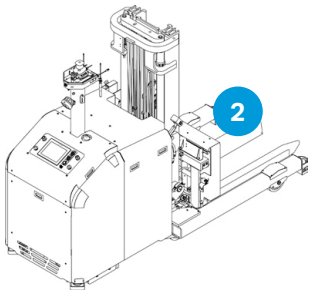


DISCOVER THE DIFFERENT MODULES

Base Module 1

NexBot's base module is the base foundation for your custom application. Programmable as either an AGV or AMR, it is designed to navigate dynamic environments with easy maneuverability. This standard component helps minimize costs, reduce lead times, and engineering for each robotic vehicle project.

APPLICATION-SPECIFIC AUTOMATIONS



Outrigger or straddle fork 2

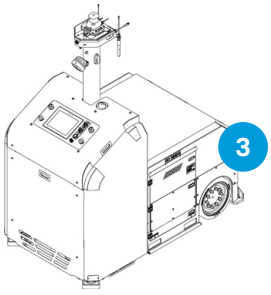
The outrigger, or straddle fork, is used to automate material handling and transportation tasks. The stabilizing arm on the back-end of the vehicle is used for vehicle stabilization when lifting loads.

Tugger 3

The tugger is used to efficiently tow or pull carts, trolleys, or trailers via automatic or manual coupling.

Conveyor deck 4

The conveyor deck is used as a conveyor extension to index pallets, drums, boxes, totes, and skidded items to and from conveyor locations.

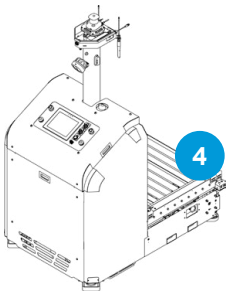


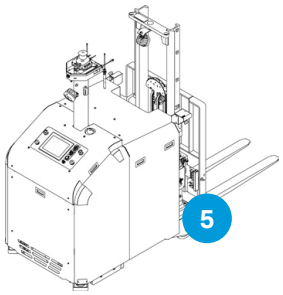
Counterbalanced Fork 5

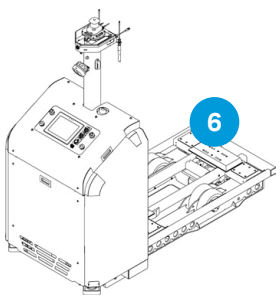
The counterbalanced fork is used to automate material handling and transportation tasks, using a counterweight front end to balance the loads.

Under-rigger lift deck 6

The under-rigger lift deck is used to automate material handling and transportation tasks, using short-stroke cylinders to lift/lower loads to and from tooling locations.







WHY CHOOSE A ROBOTIC VEHICLE WITH A UNIVERSAL FRONT END?

Whether you choose to use your robotic vehicle as an AGV or an AMR, or whether you only require one or multiple applications, there are a number of advantages to a vehicle using a universal front end.

1. Commonality of spare parts
If your entire fleet is built using an identical front-end, all your spare components will be the same, minimizing costs and delays.

2. Easy maintenance and training
Your engineers only need to master one vehicle, and your entire fleet only requires one maintenance schedule.

3. Commonality of the fleet
Although your back-end might differ depending on the task output, your fleet is still uniform, and your base front-end can always be reused in a different application, minimizing your initial investment.

4. Consistent AGV and AMR guidance
NexBot uses 2D and/or 3D Natural Feature Navigation to provide highly accurate and consistent AGV/AMR guidance. For AGVs, you no longer require the use of supporting infrastructure such as magnetic tape, RFID pucks, or underground wiring.

BY COMBINING THE PROVEN STRENGTHS OF BOTH TECHNOLOGIES INTO ONE INTELLIGENT, SCALABLE PLATFORM, NEXBOT DELIVERS A NEW, FUTURE-PROOF LEVEL OF EFFICIENCY, FLEXIBILITY, AND MODULARITY IN MOBILE ROBOTICS.

Interested in learning how NexBot can support your operations?

Get in touch with our sales team to discuss your needs and configure the right solution for your operations.

us.sales@scottautomation.com
+1 704 362 1115

Conclusion

Choosing between AGVs or AMRs isn't about selecting one technology over the other – it's about finding the right fit for your unique operational demands.

With AGVs, you're guaranteed consistency, precision, and proven performance in a controlled environment with predictable workflows. AMRs, on the other hand, give you flexibility, adaptability, and hands-off intelligent navigation, working best in a dynamic setting. While both systems offer clear advantages, they also come with their own set of limitations, which can impact your business choices.

As industrial automation evolves, it's necessary to weigh the right factors to ensure your business investment aligns with long-term production goals and the reality of your business operations.

For organizations looking to future-proof their material handling requirements, selecting a solution that balances efficiency, scalability, and ease of implementation is paramount. Modular, adaptable technologies such as NexBot offer the best of both worlds, designed to meet the demands of current and future operations.

Explore how this flexible, configurable robotic vehicle can meet the specific needs of your operations.

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scottautomation.com

us.sales@scottautomation.com
+1 704 362 1115