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ROBOTICS IN WAREHOUSE OPERATIONS

Scaling Automation for the Intelligent Enterprise

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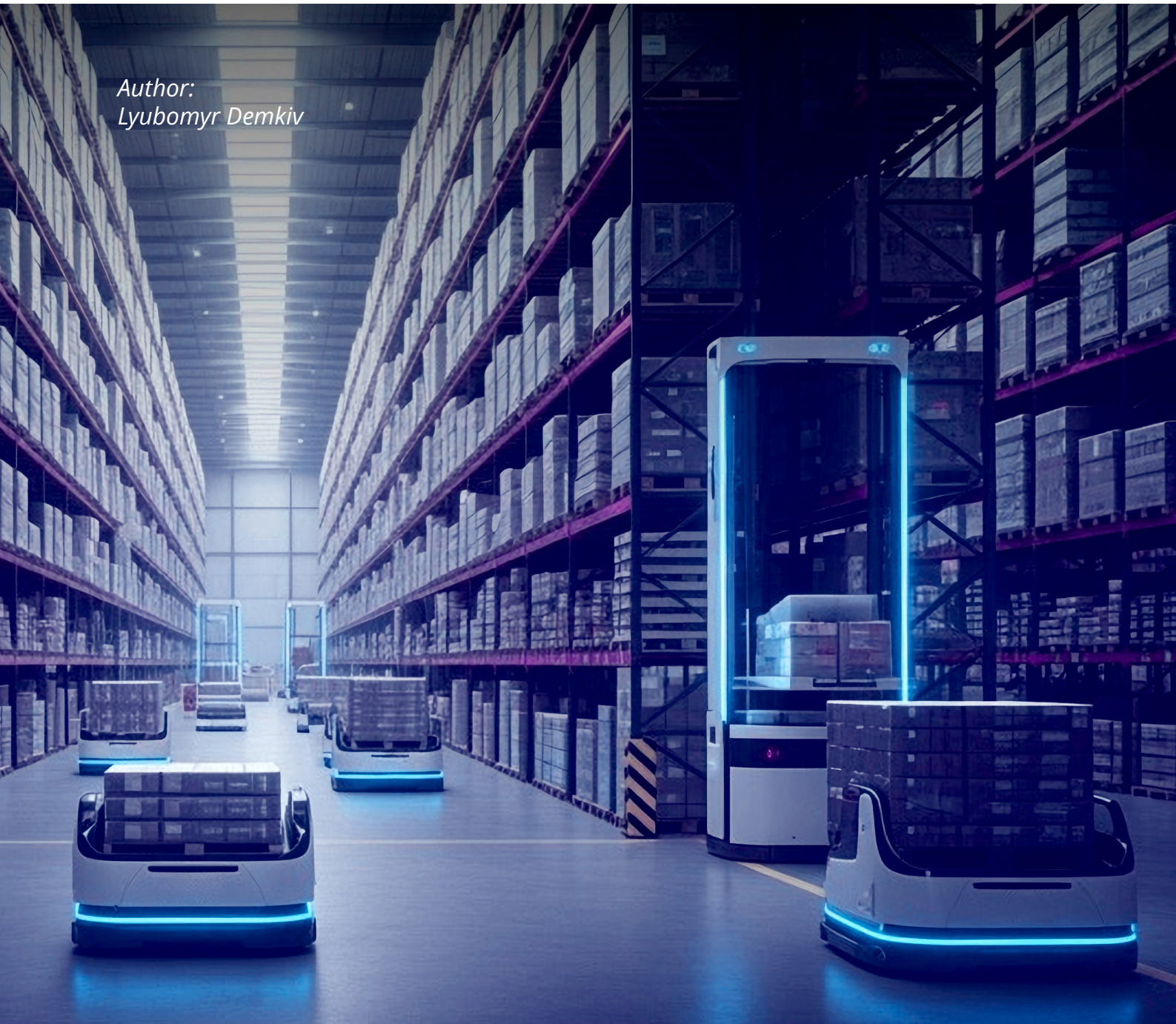
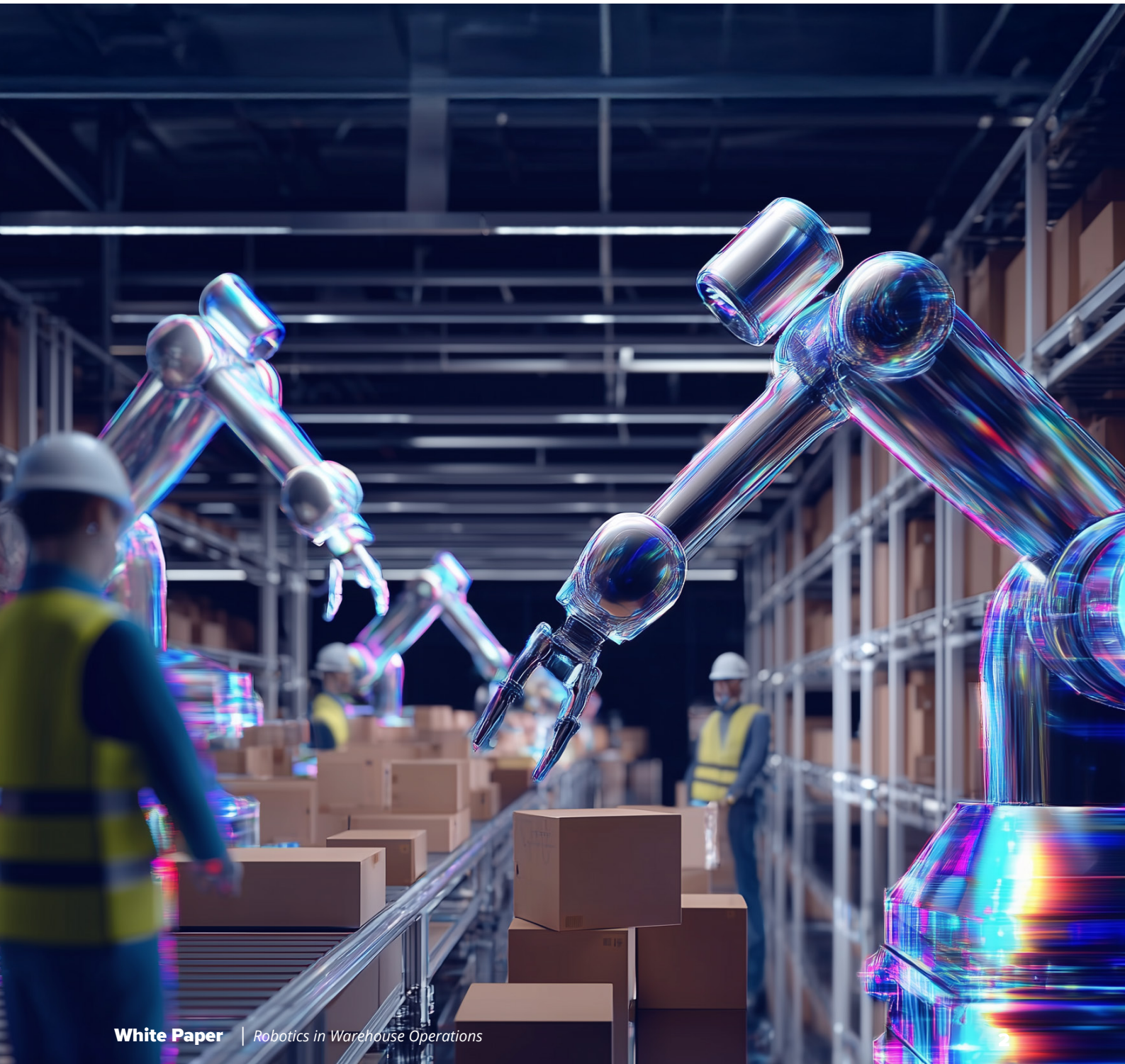


Executive Summary

Robotics and physical AI are evolving how warehouses operate. They make processes **faster, safer**, and **more accurate** at every stage of fulfillment. Autonomous mobile robots improve material movement, while advanced robotic manipulators handle complex picking tasks. **Digital twins** allow you to design and test workflows before physical development. As AI, computer vision, and autonomous navigation mature, warehouse robots operate reliably at scale and adapt to dynamic, people-centric environments.

SoftServe accelerates this transformation with a simulation-first robotics approach. We validate systems in virtual replicas to **lower risks** and **cut development** time. Whether for greenfield or brownfield facilities, we help you **support automation**. Our expertise includes robot fleet management, autonomous forklifts, and embodied AI systems. We work with you to create a scalable strategy that improves throughput, accuracy, and operational resilience.



Why Your Warehouse Needs Reinvention

Warehousing is the backbone of supply chain performance, but it's facing unprecedented challenges. Many mid-to-large enterprises — especially in retail, healthcare, and manufacturing — depend on manual workflows that can't keep up with today's demands. Broader challenges like slow, outdated technology and stalled AI adoption make it even harder to modernize warehouse operations.

Here are some common challenges your organization might encounter:

Managing growing order volumes

Handling a wider variety of SKUs

Meeting faster delivery expectations

Addressing labor shortages and high turnover

Enhancing accuracy and visibility

Ensuring operational safety

Coping with unpredictable throughput

Failing to address these issues leads to bottlenecks, increased costs, and unmet customer expectations.

The solution? Intelligent warehouses that integrate robotics, AI, and digital twins. Collaboration with SoftServe gives you more than automation — your warehouse becomes a smart, efficient ecosystem ready to conquer today's challenges and support future growth.

Here are three key ways intelligent automation drives results:

1

Real-time simulation: Test and visualize operations before implementation to optimize performance.

2

Predictive optimization: Leverage AI insights to identify bottlenecks, streamline workflows, and reduce costs.

3

Lower deployment risk: Use virtual testing to minimize disruptions and ensure a seamless transition to automation.

Intelligent automation in warehouses is no longer a luxury — it's essential for staying competitive in a rapidly evolving market. The warehouse automation, digital twin, and AI markets are all experiencing rapid growth and significant investment. Our experts align with the following projections:

16.2% CAGR

Warehouse automation growth through 2030, according to Mordor Intelligence

$25.23B

Digital twin logistics market by 2035, according to Market Research Future (MRFR).

$45.12B

AI in warehousing market value by 2030, according to Grand View Research.

Let's take a closer look at how you can build future-ready operations in your warehouse.

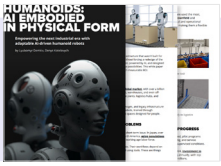
Adopt Autonomous Material Handling

Shipping delays, misplaced inventory, and errors are age-old warehouse challenges. Safety risks only add to the strain, impacting efficiency. For businesses handling high volumes or complex operations, these issues quickly escalate.

That's where autonomous material handling comes in. Smart robots move goods through the warehouse with advanced tech. They eliminate bottlenecks and take over repetitive tasks, easing the burden on your team.
The result? Safer, faster, and more reliable operations.

Key capabilities:

- Autonomous Mobile Robots (AMRs) and Autonomous Ground Vehicles (AGVs) for dynamic routing
- Humanoids and collaborative robots (cobots) for adaptive movement
- Autonomous forklifts for precise pallet handling
- Safe handling of heavy or hazardous materials
- Coordinated shelf replenishment and zone-to-zone transfers
- Centralized fleet management for congestion and workload balancing



Simulation-trained humanoid robots can step into human roles in your organization.

Curious how? Read our white paper.

SoftServe Accelerator: Humanoid Robot for Brownfield Warehouses

Understanding the intricate demands of warehouse operations, SoftServe developed an **AI-powered humanoid robotics system** to automate logistics and assembly in your existing setup — no costly upgrades required. Using **multimodal AI**, it learns from your team's demonstrations, adapts to existing workflows, and works safely alongside your staff.

How it helps:

- **Avoids Costly Upgrades:** Automates where traditional systems fail, saving on infrastructure changes.
- **Speeds Up Tasks:** Reduces manual work and keeps up with growing demands.
- **Adds Flexibility:** One robot handles multiple tasks, replacing specialized systems.

Humanoid Robot for Brownfield Automation

This solution tackles modern warehouse challenges and is ready to deploy now.

See it in action.

Leverage Robotic Picking, Sorting, and Manipulation

Managing large and diverse SKU catalogs is no small task. Slow cycle times, frequent errors, and worker strain make it harder.

Robotic picking and sorting provide a smart solution. These systems handle tasks like inspection, sorting, and stacking automatically. They improve accuracy and speed while cutting down on mistakes. By taking repetitive tasks off your team, you lighten workloads and create a safer environment.

Key capabilities:

- 3D sensing and deep learning for object detection
- Adaptive grasp planning for varied shapes and materials
- Mobile manipulators for flexible picking routes
- Vision-enabled drones for cycle counts and inspections
- Automated palletizing/de-palletizing
- AI-based inventory tracking with real-time visibility

Robotic Order Fulfillment

Case Study: Robotic Order Fulfillment

To address challenges in accuracy, costs, and delivery for one of our clients, SoftServe deployed a multi-robot solution. The system included a 7-DoF robotic arm supported by computer vision for object detection. A custom simulation environment enabled rapid testing of grasp strategies and workflow optimization before physical deployment.

Impact:

- **Improved picking accuracy** and reduced human error
- **Faster order processing** and shorter delivery times
- **Lower operational costs** through automation of repetitive tasks
- **Accelerated deployment** through simulation-first validation

Order fulfillment becomes easier with robotics.

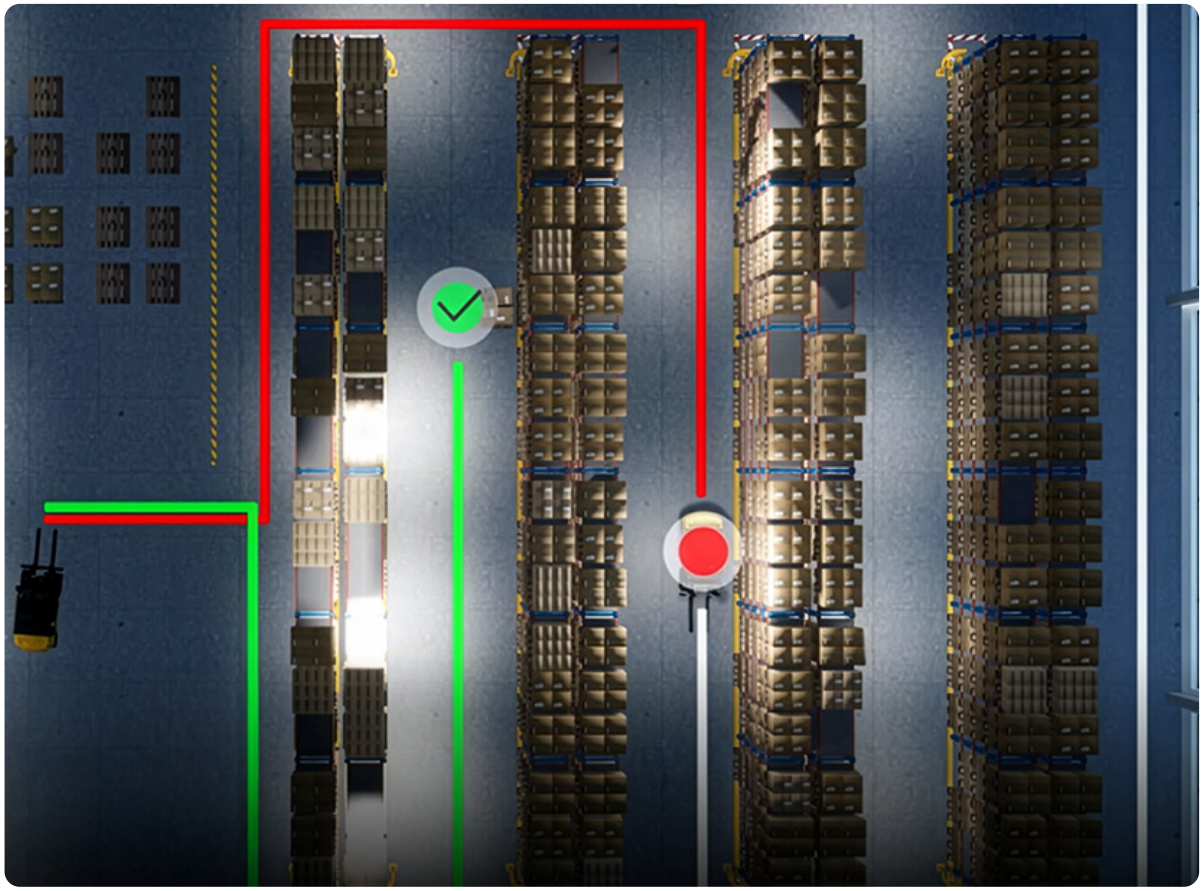
Curious to learn more? Watch the video.

Enhance Human-Robot Collaboration and Create Intelligent Workspaces

To boost productivity and maintain predictable workflows, organizations must combine human skills with robotic precision. This approach creates smarter and more efficient workspaces.

Key advantages:

- **Safe Shared Zones**: Robots adjust speed or path using LiDAR and 3D vision.
- **Collaborative Picking & Packing**: Workers manage fine tasks, while robots handle lifting.
- **Human-in-the-Loop Supervision**: Dashboards, AR interfaces, and manual overrides.
- **Human-Aware Navigation**: Controlled braking, alerts, and deceleration zones.
- **Simulation-Based Training**: Digital twins for workflow rehearsal and safety drills.



Warehouse Forklift Navigation & Safety

Case Study: Warehouse Forklift Navigation and Safety

For one of our clients, SoftServe developed a high-fidelity forklift simulation using **NVIDIA Isaac Sim™** to address challenges in navigation, perception, and collision detection. This solution enhances forklift safety awareness while optimizing routing and path planning.

Impact:

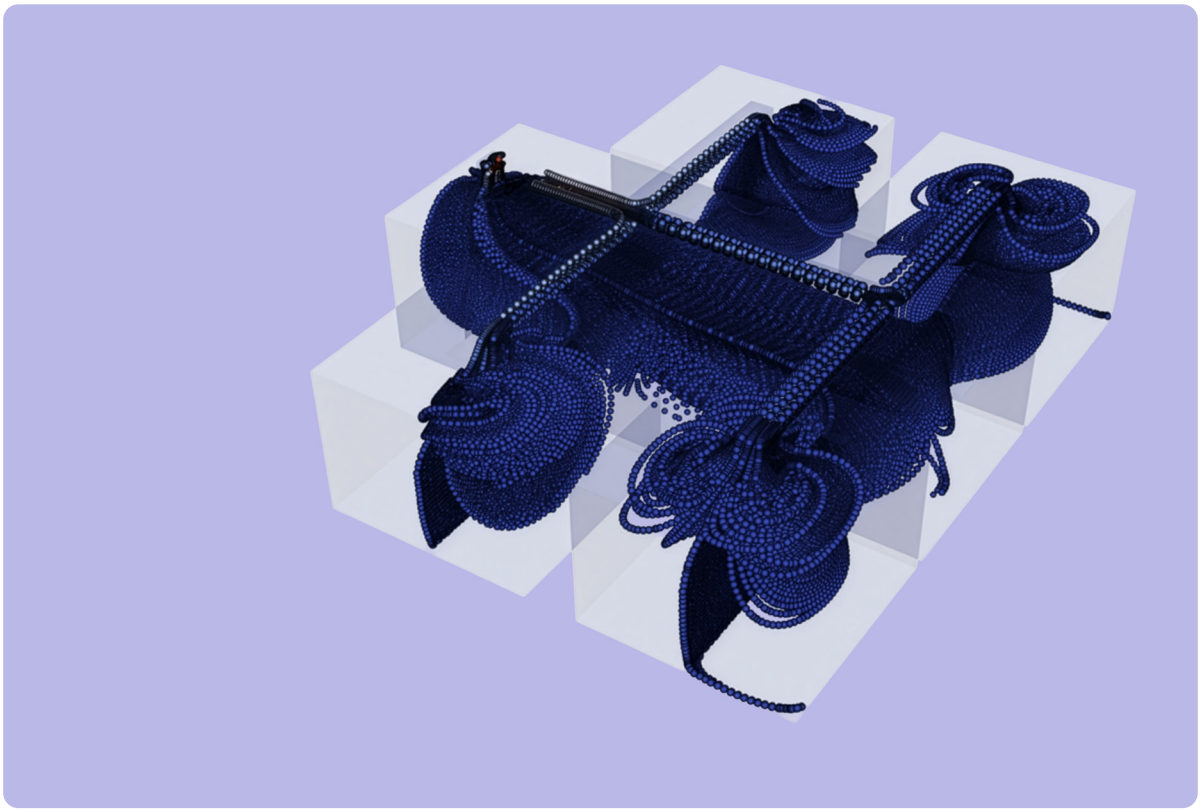
- The client experienced **fewer safety incidents** thanks to real-time collision avoidance.
- **Process quality and reliability improved** significantly.
- **Human-robot collaboration became smoother** and more effective.
- **Development timelines shortened** with simulation-first testing.

Drive Operational Intelligence and Predictive Maintenance

Unplanned downtime slows your operations and reduces productivity. Operational intelligence and predictive models provide real-time insights to address these challenges. These tools help you track equipment health, improve workflow efficiency, and maintain safety conditions.

Key capabilities:

- Workflow bottleneck detection
- Predictive maintenance for robots, forklifts, and conveyors
- Safety and anomaly detection
- Forecasting for inventory, labor, and resource allocation
- Energy optimization driven by real-time demand



High-Fidelity Simulation of HVAC System in Warehouse

Case Study: High-Fidelity Simulation of HVAC System in Warehouse

SoftServe built a detailed HVAC simulation for a major pharmaceutical company to manage temperature-sensitive environments. Using OpenFOAM, the team created a full-scale digital model to simulate airflow, heat transfer, and dynamic temperature variations.

Impact:

- Ensured **consistent** and **reliable** temperature distribution across the facility, preventing hotspots and protecting sensitive products.
- **Optimized HVAC system design**, improving efficiency and reducing operational costs.
- **Enabled data-driven decision-making** with highly realistic simulation insights.

Digital Twin-Driven Warehouse Planning and AI Training

Digital twins provide a safe and accurate way to test automation before deployment. They help solve problems like inefficient layouts and untested robotic behaviors. Executives use them to refine workflows and train AI systems with realistic, physics-based data. This reduces integration time and makes scaling automation easier.

Key capabilities:

- Virtual layout and workflow validation
- Real-time operational mirroring
- Scenario testing and predictive optimization
- Fleet-level navigation and path planning
- Synthetic Data Generation (SDG) for training perception models

Digital Twin Solution for Simulating Forklifts

Case Study: Digital Twins for Autonomous Forklifts

As a global leader in warehouse automation, **Toyota Material Handling (TMH)** sought to improve forklift precision and reduce costly testing cycles. Traditional physical trials were time-intensive and limited in scope. Utilizing **NVIDIA Omniverse™, Isaac Sim™, Cosmos™**, and **ROS2**, SoftServe created digital twins of autonomous forklifts, virtual replicas that are continuously synchronized with their real-world counterparts.

These twins allowed engineers to simulate complex warehouse conditions, test maneuverability in tight aisles, and refine perception algorithms before deployment. AI-driven models detected pallet edges, interpreted depth data, and optimized motion sequences for smoother operations.

Impact:

- **Adaptability to the environment,** ability to work with stochastic objects, and wobbly pallets
- **Improved navigation** precision and operational efficiency
- **Shorter time-to-market** through iterative simulation
- **Reduced commissioning** time by resolving challenges in virtual environments
- **Safer deployment** through predictive scenario testing

Overcome Automation Challenges: From Constraints to Scalable Solutions

Automation offers huge benefits, but challenges like outdated systems and physical constraints often slow progress. SoftServe helps you overcome these hurdles with tailored solutions.

Greenfield vs. Brownfield Deployment

Even new facilities aren't always built for future automation. Poor design choices limit autonomy from the start, while in older brownfield sites, legacy equipment and irregular layouts make automation even harder.

SoftServe uses a simulation-first approach to solve these challenges. Teams can test layouts, workflows, and robot behaviors before implementation. This ensures solutions work seamlessly in both perfect conditions and real-world constraints.

Legacy Systems and Facility Constraints

Outdated systems and fragmented infrastructure make automation harder. They block access to the data robots need to work efficiently. Narrow aisles, congestion zones, and multi-level shelving add even more obstacles, slowing deployment.

SoftServe addresses these challenges by integrating robotics with your existing WMS, WES, and MES systems. Using sensor fusion and digital twins, we ensure compatibility and provide real-time visibility. This approach helps your warehouse overcome constraints and move forward with automation.

Confident Automation Scaling

Unplanned growth disrupts throughput and compromises safety. It creates challenges that slow operations and increase risks.

SoftServe ensures smooth scaling with advanced tools. We use physical AI, fleet management, and scenario-based simulations to test multi-robot operations. This approach identifies bottlenecks and validates performance before deployment, which enables predictable and efficient growth.

SoftServe's expertise bridges the gap between current challenges and future-ready solutions. We work with your existing infrastructure, so there's no need for costly replacements. As a vendor-agnostic partner, we ensure different robotic systems work together without issues. With experience from over 100 projects and a team of 60+ robotics experts, we focus on solving real problems and delivering measurable improvements.

Build a smarter, scalable warehouse that drives long-term success. Contact us today to start your automation journey.

CONTACT US

About Us

SoftServe is a premier IT consulting and digital services provider.

We expand the horizon of new technologies to solve today's complex business challenges and achieve meaningful outcomes for our clients. Our boundless curiosity drives us to explore and reimagine the art of the possible. Clients confidently rely on SoftServe to architect and execute mature and innovative capabilities, such as digital engineering, data and analytics, cloud, and AI/ML, physical AI, robotics and advanced automation.

Our global reputation is gained from more than 30 years of experience delivering superior digital solutions at exceptional speed by top-tier engineering talent to enterprise industries, including high tech, financial services, healthcare, life sciences, retail, energy, and manufacturing.

Visit our website, blog, LinkedIn, Facebook, and X (Twitter) pages for more information.

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