HOKUYO USA

Warehouse Robots:
A Guide to a Fully Automated Warehouse

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Sensing
the Future.

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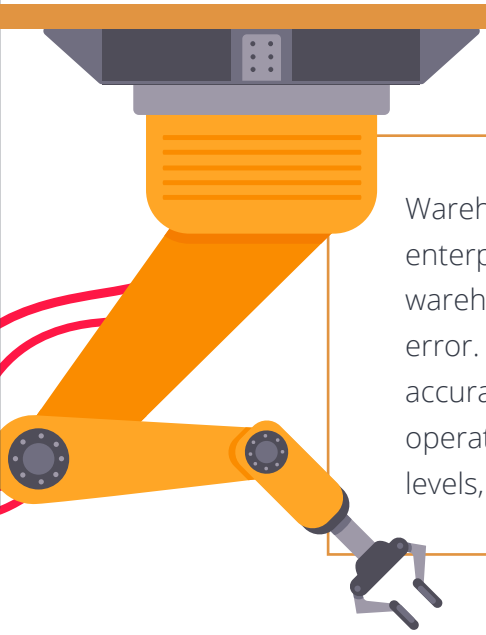
Introduction

Automation and robotics have great potential in a wide range of industrial settings today. 88% of businesses worldwide plan to invest in robotic automation for their industrial infrastructure. A general definition of automation is a piece of technology that can operate based on programmed commands without any human intervention. In robotic automation, the actions of a robot are directed by a variety of programming software, controls, and sensors. This rising popularity of robotics has also caught up with the warehousing industry. According to an estimate, more than 4 million commercial warehouse robots will be installed in over 50,000 warehouses by 2025.



Warehousing operations are critical for the success of supply chain-oriented enterprises. Those working in this industry are acquainted with the fact that warehouses are full of repeatable tasks which are process-oriented and prone to error. Robotics and automation technologies can perform these repetitive tasks accurately and help achieve more consistent, precise, and productive warehouse operations. These features can lead a company to attain higher productivity, profit levels, and better warehouse management.

Businesses with low margins and high volumes, such as eCommerce and retail, can significantly benefit from robotic automation. MHI Annual Industry Report 2020 reveals that robotics and automation are the most widely adopted industrial technologies for warehouse applications. About 39% percent of respondents are already using them, demonstrating their worth in the warehouse industry.

This whitepaper discusses warehouse automation, the types of automatic robots used for warehousing purposes, and the sensors that form a critical piece of technology to make robotic automation possible.

Automated Robots in Warehouse

Many automated robots can be deployed in a warehouse facility depending on the job required to be accomplished. With new sensing technologies, warehouse robots with enhanced functional capabilities are available today. Robots are getting much better at navigating their environments and working autonomously through these advanced sensors. This overview comprises many available technologies that will help better understand what robotics offers to warehouse automation.

AGV's and AMR's

Automated vehicles are meant to replace what was previously done by forklifts, pallet trucks, or humans. Automated guided vehicles (AGVs) and automated mobile robots (AMRs) such as automated forklifts and towing can carry out loading and unloading tasks without human supervision.

Automated guided vehicles (AGVs) have been around for over a decade. Instead of humans, AGVs use load carriers or material handling systems that help transport stock and other materials around warehouses coordinately. AGVs can navigate through their surroundings through sensors, wireless beacons on walls, magnetic stripes, or wires laid under the floor. They recognize barcodes on storage racks, allowing the machine to move the items to their destination on a predetermined path. With the help of new technologies such as LiDAR sensors (light detection and ranging), the ability of AGVs to detect obstructions and evade collisions has been enhanced.

AGVs and AMRs are often used for the conveyance of parts and materials. They are responsible for ensuring that production lines are always provided with the necessary apparatus. Automated vehicles can also fetch goods and materials on arrival to distribute them across the production lines without impeding production. Automated vehicles coupled with modern sensor technology offer higher efficiency, consistency, precision, and security in the sorting process. With the help of laser sensors, AMRs can also create routes, reroute, or avoid obstacles on their way, whether it be an object or human workers.

AMRs do not travel via predetermined routes, guided or tracks. Rather, they rely on integrated maps and an array of sophisticated sensors such as infrared or light sensors. These sensors give AMRs the ability to identify goods and objects for sorting packages and move through the facility without disrupting everyday operations. In addition, their proficiency in interpreting and understanding their environment makes them more reliable to work in warehouse facilities autonomously.

Automated Forklifts

Automatic forklifts are the most common AGVs intended to work with transporting pallets without human intervention. Automated pallet jacks are small AGVs modeled after the traditional pallet jack, which works horizontally and closer to the floor. There are also counterbalanced automated guided forklifts, usually deployed for shipping and receiving purposes, as they are ideal for moving pallets to and from the warehouse. Highly intelligent forklifts that can operate autonomously are made possible by better technologies such as laser technology, scanners, sensors, and 3D cameras.

Articulated Robotic Arm

The articulated robotic arm is a multi-jointed mechanical limb that can pick up, move, and place down objects. These robots are highly versatile and can be programmed to perform various tasks, from picking and packaging to vehicle loading. In addition, robotic arms can handle objects that are unsafe or too heavy for humans, while their ability to move large amounts of inventory tirelessly also maximizes the warehouse's productivity.

These strong mechanical arms maintain a sufficient amount of sensitivity by determining the required force through torque sensors. AMRs are also coupled with robotic arms to repeatedly pick objects from the shelf or fetch them from a distance. By adding mobility to these robotic arms, warehouses can improve their internal logistics and automate small and repetitive tasks.

Automated Inventory Management Robots

Automatic inventory management robots can track inventories, keep stock tallies, and update goods-related information into a warehouse management system (WMS). AMRs can use a range of 2D and 3D sensors to detect paths and objects.

The 3D technology helps a robot analyze the object and determine the best picking method based on its structure. These robots can also perform inventory checks autonomously by scanning Radio Frequency Identification (RFID) tags for product identification.
AMRs save time by obeying set tasks determined to suit the requirement. In addition, they help cut down on operational costs by optimizing inventory management and minimizing waste labor.

8 Advantages of Warehouse Automation

- An automated warehouse drives customer satisfaction by improving operational efficiency and addressing the growing customer demand. In addition, due to their ability to immediately restock and resupply, smart warehouses allow services such as same-day delivery.

- Automation reduces labor costs, improves performance, optimizes handling, eliminates risks of mishandling, and reduces storage costs and inventory errors. All of this leads to better and enhanced ROI.

- Warehouse automation significantly helps the human workforce by taking over mundane and labor-intensive tasks. This allows employees to leverage their potential into more thoughtful operations.

- Warehouse operations often involve high-risk tasks. Automated robots can deal with high shelves, cluttered workspaces, heavy pallets, and toxic materials, adding up to the safety of the warehouse environment.

- Warehouses can optimize maintenance by using IoT and AI technologies for condition monitoring and predictive maintenance. Warehouses can prevent downtime and ensure a robust infrastructure by keeping track of machinery.

- Robotics allows warehouses to scale operations according to market developments and customer demand. For instance, during festive seasons, warehouses can shift to a more robust module of automated work to meet higher requirements.

- A fully automated warehouse gains more resilience than those which are highly dependent on human labor. An automated approach further helps prepare for unanticipated events like the COVID-19 pandemic.

- Warehouse management systems and other automation technologies help companies reach their environmental goals by making space for green practices such as recycling into operations. Moreover, tools such as data analytics, condition monitoring, and warehouse management software help better manage warehouse resource use and optimize space usage.

Key Sensors for an Automated Warehouse Robot

Sensors allow a robot to interact with its surroundings and function in accordance with its purpose. Some of the sensors that complete automated robots and equip them with the power to perceive the perceptible are given below.

LiDAR Sensors:

LiDAR sensors give autonomous robots a high-definition 2D and 3D map of their surroundings. These sensors emit pulsated light waves and determine positions through the feedback time. LiDAR creates a precise 2D and 3D map by repeating this process millions of times per second.

Laser Distance Sensors:

Laser distance sensors help a robot collect distance, speed, and acceleration readings on the surrounding objects. These sensors work by emitting a pulse of light in a specific direction and measuring the time till it returns to the sensors to quantify the distance. Laser rangefinders do not deviate more than a couple of millimeters, even at long distances.

2D and 3D visual Sensors:

Visual sensors give robots an observable sense of their surroundings. These sensors can feed information to a system that works to identify objects, products, and obstacles through their visual attributes. Based on this information, the robot can proceed with the programmed course of action.

The Future of Warehouse is Automated

As distribution channels seek to enhance efficiency and reduce operational costs, robotics and automation technologies are bound to gain popularity. With a booming e-commerce industry, many retailers are already embracing these advanced technologies to boost productivity and improve their delivery services.

With rising warehouse automation, sensors will play a key role in building more capable robotics and automation systems that can handle specific tasks or automate entire facilities. Amidst the shortage of blue-collar workers and a demanding e-commerce market, forward-looking businesses must start investing in automation and robotics technologies to secure their future.

As one of the pioneers of sensor technology at Hokuyo, we are willing to make headway toward devising sensing instruments with higher capabilities. Our cutting-edge sensors are ideal for autonomous mobile robots for warehouse applications. With a combination of thorough product distribution, reliable technology, and unprecedented customer support, Hokuyo aspires to fulfill the technological needs for automation across different sectors.

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