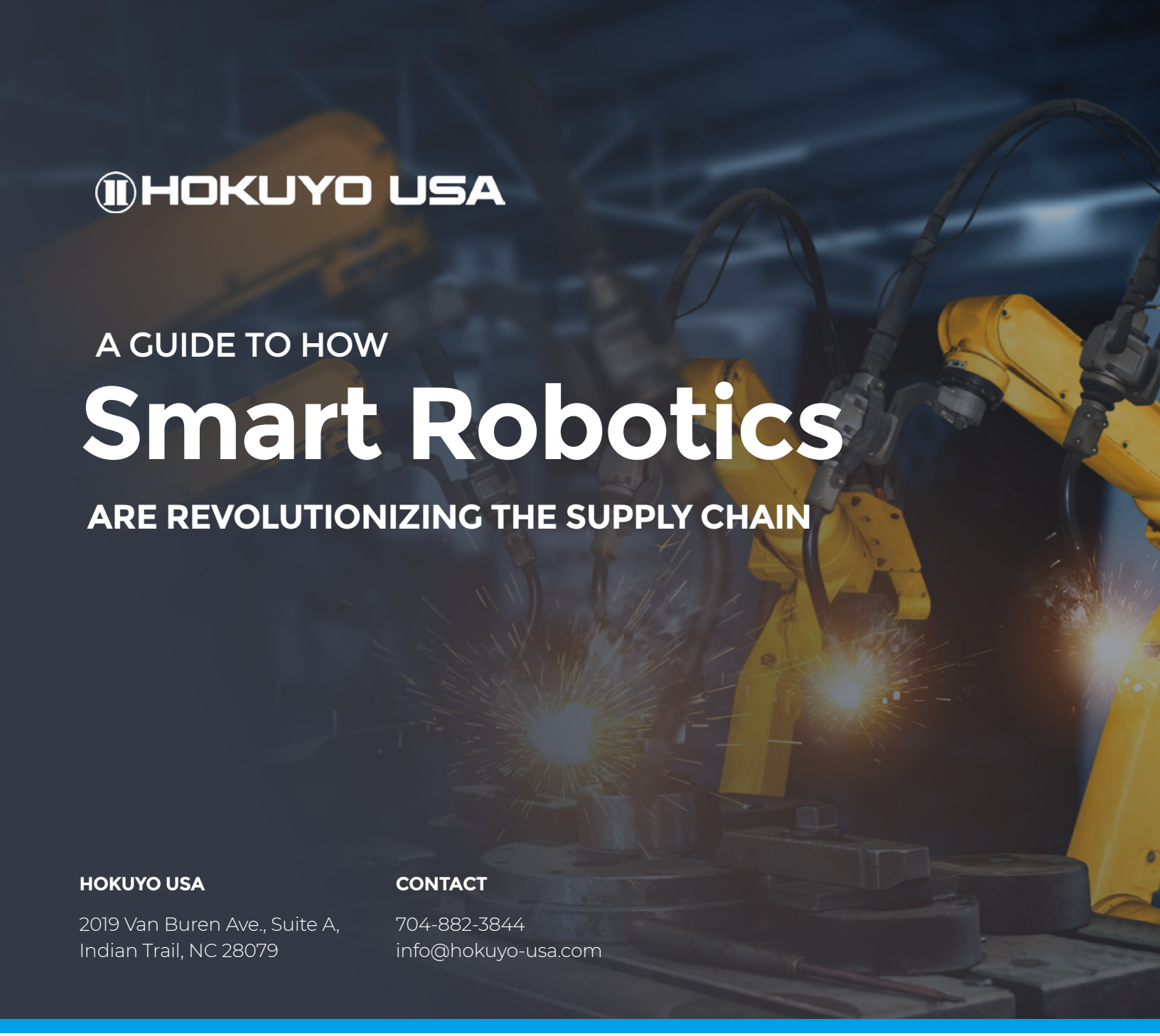

HOKUYO USA

A GUIDE TO HOW

Smart Robotics

ARE REVOLUTIONIZING THE SUPPLY CHAIN

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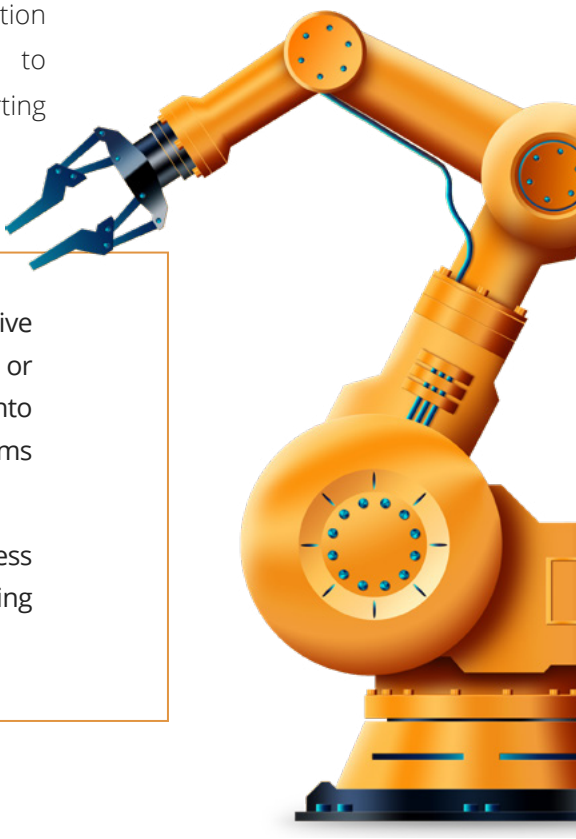
Sensing the Future.

Introduction

Spurred by factors ranging from the spread of e-commerce to bustling activity at harbor freight ports and terminals, new technologies are revolutionizing the supply chain. In the near future, look for increasing automation of traditional warehouse and cargo facilities, together with the emergence of more micro fulfillment centers (MFCs) for fast product delivery to Internet shoppers. While many different new approaches are coming into play, robotic technology is one key enabler for streamlined operations. These robotic systems rely on intelligent sensors for purposes like smart navigation, positioning, measurement, obstacle detection, and optical data transmission.

Warehouse picking gets faster and more flexible

More and more these days, companies are augmenting and even replacing human labor in warehouses with machine robotics. The increasing adoption of software-based warehouse management systems (WMS) helps to coordinate warehouse activities among people and machines, supporting more flexible pick and sort methods, for one thing.



- **Batch pick and sort** is designed for rapid and cost-effective processing of high volumes of small orders. Multiple orders or shipments are picked at the same time and then grouped into individual orders, reducing the time spent on gathering items stocked in the warehouse.
- In warehouses which handle many different SKUs, a process called wave picking can add further efficiency by grouping together items for picking based on location zones.

WMS have boosted warehouse efficiency with features such as system-guided picking. As these WMS solutions have grown more powerful, they've also extended system guidance across additional activities, particularly those carried out by forklift operators.

Meanwhile, many warehouses are already leveraging autonomous mobile robots (AMRs) such as automated conveyor belts, driverless forklifts, and drones for purposes like picking and packaging. These machines can work more rapidly than humans while making fewer errors.

Steps to further automation

"Gartner is seeing a significant increase in the interest in automation in all types – everything from conventional conveyor and sortation solutions to emerging technologies like mobile robots,"

noted Dwight Klappich, Vice President of supply chain research for the industry analyst firm.

To a greater and greater extent, WMS are being integrated with Internet of things (IoT) systems which include sensors, Internet connectivity, and computer processors. For their part, the sensors in robotic systems are based on the functions of human sensory organs. These sensors gauge the robot's condition and environment. **There are two main types of robotic sensors.**

- Internal sensors such as the position sensor, velocity sensor, acceleration sensors, and motor torque sensor obtain data about the robot itself.
- External sensors provide information about the robot's environment which is also needed for the robot to function effectively. External sensors include camera sensors, range sensors (IR sensor, laser range finder, and ultrasonic sensor), and contact and proximity sensors (photodiode, RFID, touch, and IR detector), for example.

Sensor technology keeps progressing all the time. 'Significant technological advancements, such as sensors technologies (that enable an enhanced object perception and an accurate positioning system), have allowed the robotics industry to explore the untapped potential in the warehousing applications, while attaining an optimal operational flow and logistics efficiency, among other accomplishments," according to a recent **report by ResearchAndMarkets.**

Meanwhile, WMS developers have been refining user interfaces (UIs) to make software simpler and more engaging to use. Companies are working on displaying data in logical formats to package and represent information for warehouse supervisors, notes Gartner's Klappich.

Other technologies supporting increased automation include voice systems, mobile devices, automated guided vehicles (AGVs), and automated storage and retrieval systems (ASRS).

- Voice systems in WMS can help human workers select orders, assess inventory, accept shipments, and send delivery confirmations, all on a hand-free basis.
- Mobile devices such as bar code scanners and tablets can maintain **an accurate picklist** of the items in each order, along with shipping information. RFID technology goes further to show the physical locations of materials in the warehouse.

- **AGVs** are portable robots typically used to transport heavy materials through a warehouse or factory. The robots leverage smart sensors to navigate either by following marked lines or wires on the floor or through the use of vision cameras, radio waves, magnets, or lasers.
- **ASRS,** on the other hand, are robotic systems with capabilities for sorting, sequencing, buffering, and storing a wide range of goods. These systems are helping humans with order fulfillment as well as performing inventory management functions like finished goods storage and dynamic replacement.

Additional up-and coming technologies we'll see more of in future warehouses include

- machine learning (ML), blockchain cybersecurity, virtual reality augmented reality (VR/AR),
- 3D printing and scanning, and
- robotic arms capable of handling different product sizes and dimensions.

Enter the MFC

Warehouses are changing in other big ways, too, as e-commerce providers discover that price is no longer the major competitive differentiator. Instead, fulfillment responsiveness – or the length of time it takes from order receipt to final delivery – is coming to the fore.

In a recent survey by ARC Advisory Group,

77%

of respondents predicted that

fulfillment responsiveness

will increase in importance over the next three years.

Likewise, observers expect that reverse logistics for returns processing will also become more significant as a differentiator, with impulse buys rising as social media platforms like Instagram make online shopping easier to do.

Online giant Amazon has responded to these trends by greatly expanding its network of **fulfillment centers** throughout the US. In turn, with recent shifts toward greater online grocery ordering, some smaller supermarket chains have been creating their own Micro-Fulfillment centers (MFCs).

While pandemic-related restrictions and concerns have given online grocery shopping a major boost, the trend got started even before that.

In 2018, 23.1% of consumers went online to place grocery orders, at least at some point.

By 2019, that number had leaped to 36.8%, according to the Food Marketing Institute (FMI).

Typically created in collaboration with technology partners, emerging MFCs are designed to combine the efficiency of large, automated warehouses with localized "click and collect" in-store pickup, and sometimes with last mile delivery to the customer, too.

Some MFCs are co-located within stores, others are located elsewhere, usually in urban areas, and may be shared among multiple retailers.

MFCs generally measure about
10,000 to 20,000 square feet in size,

although they can be as small as
5,000 square feet.

In contrast, regional distribution centers servicing supermarket chains can take up as much as 600,000 square feet or more, and they're typically located outside of cities, meaning that they aren't handy for making quick deliveries to large populations of customers. What's more, space in large distribution centers can be costly for retailers to lease.

Generally speaking, grocers are looking to MFCs for containing costs associated with warehousing, distribution, and logistics while at the same time increasing the speed and volume of order fulfillment.

One supermarket chain, Albertsons, has enjoyed a

five-fold increase

in fulfillment speed after opening MFCs in two of its Safeway stores in the San Francisco Bay Area, according to **Progressive Grocer**.

MFCs, though, are well suited not just to supermarkets but to many other types of retailers. These include fashion clothing stores and general merchandisers, for example.

Some observers foresee the day when warehouses of all sizes will be almost completely automated through WMS and supply chain robotics. At that point, perhaps, managers and technicians will simply monitor the WMS remotely from their homes, making minor tweaks as necessary from their laptops or tablets and only going to the warehouse occasionally to get hands-on with machinery or inventory.

Advanced robotics at freight harbors

Robotic automation is making its way into cargo ports and terminals, too.

In fact, in another recent report, **ResearchAndMarkets** predicts that the ports and terminal operations market will grow by

$4.6 billion

from 2020 to 2024, citing **automation of port operations** as a prime reason.

In a different study, predicting global port trends through 2030, Deloitte points to the need for **"technological solutions like robotics and IoT"** for better productivity.

"This would result in more automatic, digitally connected supply chains where less physical labor force is needed. It helps the port ecosystem transform from simple logistics and transport node to an open and efficient community that can participate in the global landscape of integrated world trade."

according to Deloitte.

Modernization of seaport facilities is an ambitious undertaking. It calls for automation of the huge cranes used for loading and unloading cargo together with orchestrating the movements of 20- and 40-foot containers around the storage yard so that specific boxes can be located when needed. Still, robotic automation is already bringing efficiency to these processes. As innovation marches onward, other benefits are appearing, too.

Highly advanced robotics are already in place at cargo terminals in Asia and Europe as well as several ports in the US, including those in New Jersey, Virginia, Los Angeles, and Long Beach, CA.

In Rotterdam, the Netherlands, Maasvlakte II claims to have turned into the first

zero-emission terminal

for CO2, NOx and particulate emissions by introducing fully electrified equipment and green energy with robotic AGVs for moving containers around the terminal.

- The city of Caofeidian, China became a **fully automated harbor** in 2018 by replacing 20 human-driven terminal tractor-trailers with self-driving models. A central control system is used to coordinate the new tractor-trailer system with the port's automated crane system.
- The ports of Los Angeles and Long Beach recently collaborated with GE on a pilot program to digitize maritime data and build a computer dashboard providing insights across the port supply chain. GE has since released software known as **Port Optimizer** which uses data from RFID and other sensors to make whereabouts of cargo containers **visible in realtime** to all **parties in the intermodal supply chain**: shippers, truckers, terminal operators, carriers, railroads and chassis providers.

Learn about our robotic sensors

Clearly, demand is soaring for greater automation in conventional warehouses and newer MFCs as well as at ports and terminals.

HOKUYO USA

Hokuyo provides a broad range of high-end sensors

for raising robotic performance, safety, and overall productivity

whether the solution is based on automated conveyors, fork-lifts, AGVs, cranes, or driverless or partially autonomous vehicles, for instance.

For more information about our robotic sensors, click here.

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