

THE NEW WAY TO WAREHOUSE

4 Innovations in Automation &
Robotics to Boost eCommerce
Fulfillment Productivity



TABLE OF CONTENTS



Introduction	02
A New Way to Shop: 3 Key Trends	03
How the New Way to Shop is Reshaping eCommerce Fulfillment	08
Innovating to Meet the Pressures of the On-demand World	12
Summary	19
About inVia Robotics	20
Sources	21

INTRODUCTION

The COVID-19 pandemic and the convenience of eCommerce have had a profound impact on how consumers purchase goods and how the supply chain has had to adapt to what is essentially a new way to shop.

As a critical component of the supply chain, product fulfillment and warehousing are not immune from these same changes. Online shopping and consumer expectation for rapid delivery are reshaping how warehouses are structured, operate and succeed in a robust eCommerce climate.

This paper will address how online shopping is redefining warehousing and fulfillment amid labor shortages and a multi-SKU environment. We then focus on the various ways in which fulfillment centers need to

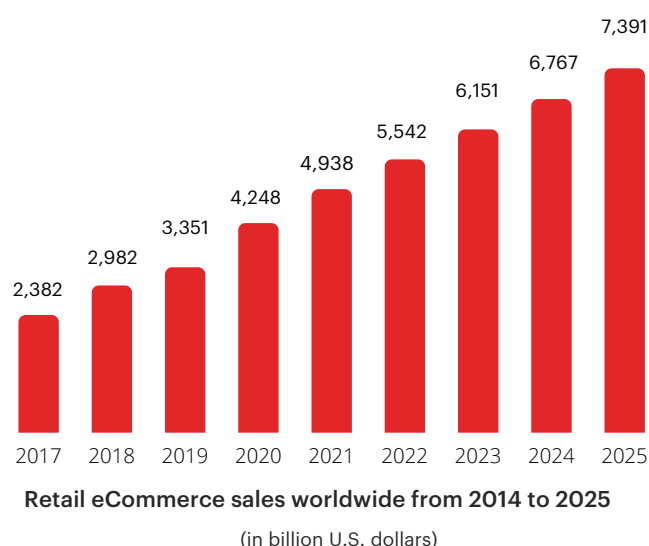
innovate to cope with the on-demand world through improved inventory management, greater productivity through technology, and the latest advances in robotics and automation.

We hope these observations and recommendations provide you with a helpful roadmap to navigate successfully through the dynamic challenges and opportunities in today's growing eCommerce reality.

A NEW WAY TO SHOP: 3 KEY TRENDS

COVID-19 has fundamentally reshaped¹ when and how consumers purchase goods and services. The shuttering of brick-and-mortar stores during the pandemic coupled with the growing popularity of online shopping has altered consumer behavior, perhaps for good, and helped encourage greater eCommerce purchasing.

The global eCommerce market amounted to approximately \$4.92 trillion in sales in 2021, representing year-on-year growth of 17%. This figure is forecast to grow by 50% over the next four years, reaching about \$7.4 trillion by 2025.¹



What we see today is a new way to shop, which is driven by three major trends: **the rise and permanence of online shopping; a new understanding of peak season; and an unwavering expectation of fast delivery.**

68%

In 2020 eCommerce sales increased by 68% in 10 weeks; the same amount of growth as the previous 10 years.²



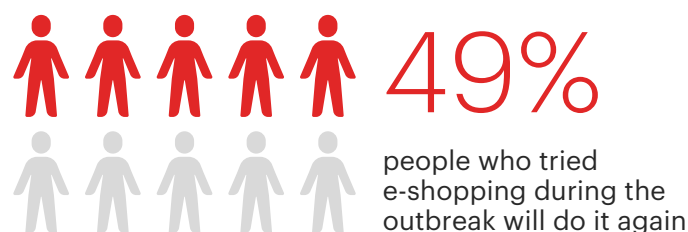
Source: istock

01 ONLINE SHOPPING HERE TO STAY

According to a McKinsey study, roughly one-half of those who tried online shopping during COVID said they would shop online more frequently once the pandemic subsides.³



With brick-and-mortar stores shuttering seemingly overnight, experts believe that the pandemic has accelerated the shift to online shopping by as much as five years.⁴ Amid soaring eCommerce demand, it would be natural to assume that traditional retail will be forever changed or even disappear entirely. The reality is that storefronts are here to stay as consumers still connect with the traditional retail experience.



They enjoy the tangible touch and feel of products, exploring options, and asking questions of store employees.

However, consumers are now accustomed to having options. The convenience and speed of online shopping, with features such as curbside pickup and same-day delivery, means that eCommerce will continue to challenge and reshape traditional shopping.

But the changes in consumer behavior run even deeper. Shopping online is more than just speed and convenience. It's where shoppers read reviews, find inspiration and seek excitement from their browsing and e-shopping experience.

As a result, brand loyalty is slipping. According to a McKinsey study, 75% of consumers tried new shopping behaviors during the pandemic while 39%, mainly millennials and Gen Z shoppers, deserted trusted brands for new favorites.

Consumers who were introduced to the convenience of online shopping are unlikely to revert completely to old shopping behaviors.



02 YEAR-ROUND PEAK SEASON

Peak season in traditional retail terms is normally thought of as the holiday buying season, October through December.

But holidays and buying periods such as Valentine's Day, Halloween, and back-to-school are surrounded by peak shopping times as well, shaped by the ease and convenience of online shopping. Retailers have also been tweaking promotional schedules to drive purchases during off-holiday months.

This trend has gained momentum in the last two years. The increase in online spending and supply chain shortages have pushed consumers to begin their holiday gift buying earlier, extending the holiday shopping season longer than ever.

In 2021, many retailers began Christmas promotions in early September, to help spread the impact of shipping- and labor-related shortages over more months. The eCommerce influx also fueled an extended returns season.

The year-round peak season is forcing warehouses to look for solutions to increase productivity

As a result, the pressures and demands of peak season are now becoming a year-round phenomenon, which is forcing warehouses to look for solutions to increase productivity to steer clear of logistical bottlenecks, overburdening their employees and managing labor shortages.



03 FAST DELIVERY IS A GIVEN

Today's consumers are accustomed to prompt delivery of their online purchases. Convenience and speed are at the top of their priority list and they have little patience for businesses that fall short.

Amazon has gotten consumers accustomed to faster delivery times for online orders, and they continue to reinforce this expectation. Speed of delivery is so important to some consumers that they base their purchasing decisions on how fast products can be delivered. 62% of shoppers say delivery speeds shape their purchasing decisions.

A vast majority of consumers (90%) see 2-to 3-day shipping as the baseline delivery promise. Any time beyond that fails to meet their expectations.

Moreover, customers interested in a product will abandon their online shopping cart shipping if fees are too high and delivery times are too slow.

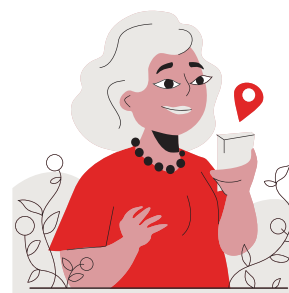
A startling 93% of consumers turn to other retailers to source products if they can save on shipping. 85% search for faster delivery providers when their expectations are not met.

This means, that shopping cart abandonment is essentially a logistics problem.



90%

of consumers see 2-to 3-day shipping as the baseline delivery promise



30%

of consumers expect same-day delivery.



62%

of shoppers say delivery speeds influence their purchasing decisions



85%

search for faster delivery providers when their expectations are not met.

HOW THE NEW WAY TO SHOP IS RESHAPING ECOMMERCE FULFILLMENT

As an evolving way to shop, eCommerce places exceptional pressure on retailers for timely product fulfillment and final delivery to customers. The fact that online shopping is here to stay, peak season has become a year-round phenomenon and consumers expect rapid delivery poses many challenges for retailers.

The eCommerce channel also has a significant impact on three important steps in the shopping supply chain: warehousing, fulfillment and worker productivity.

LABOR SHORTAGE HEIGHTENS THE PRODUCTIVITY NEED

With consumer demand for goods stronger than ever, companies are looking for ways to increase productivity and resources to ensure timely product delivery.

Of course, one way for companies to ramp up fulfillment is to hire more people. The problem is that companies and industries across the board are struggling to attract additional workers in the current labor shortage. This raises the relevant question of how to make a company's existing workers more productive.

How do you increase picking rates from 90 units per hour to 1,000 units per hour, a 10X improvement?

Companies also need sufficient labor resources to manage returns and product replenishment. But unfortunately, many don't have enough people to handle tasks in all three areas: picking, returns, and replenishing SKUs.

Employee satisfaction is also a crucial component. Providing workers with access to the latest technology can make their day-to-day roles more stimulating and productive. Allowing for more flexible work hours and offering greater variety to their jobs can also enable greater worker satisfaction.



FULFILLMENT: BULK TO INDIVIDUAL

Before the recent surge in eCommerce, warehouse automation involved managing bulk pallets with as many as 1,000 units of the same SKU. With e-tailers fulfilling orders that are directly shipped to customers, thousands of different SKUs need to be randomly accessed in small quantities.



This mix and match SKU assortment requires a very different form of automation to handle products in the warehouse and can lead to a variety of inefficiencies with worker productivity.



Travel time for manual pickers in a warehouse can occupy 60 percent or more of order picking hours.

Pickers report walking as much as 10 miles each day to perform their jobs, which is an especially unproductive use of labor when these pickers are often engaged in picking just one order at a time.

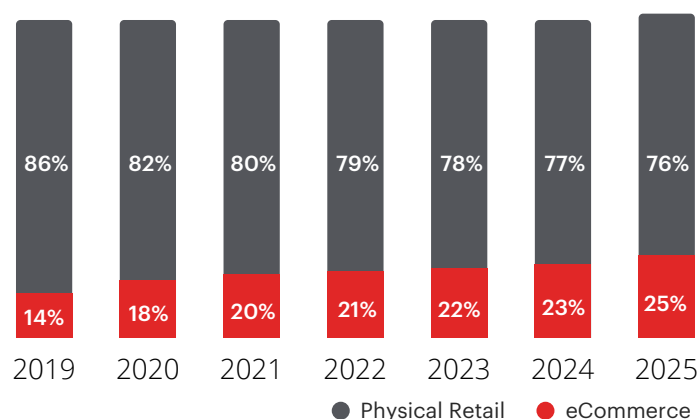
Besides productivity losses, manual order picking can take a toll on warehouse workers who are struggling to keep up with strong eCommerce demand. This can result in worker fatigue, picker errors, incomplete orders, inefficient and redundant picking routes and an overall loss of efficiency.

WAREHOUSE SIZE AND LOCATION

A new report from commercial real estate services and investment firm CBRE finds that the U.S. will need 330 million square feet of additional distribution space by 2025 just to handle the increase in online ordering in that timeframe.⁵

But since new space is often in short supply, the wisest option is for companies to make better and more efficient use of their existing space.

Global Retail Sales (2019-2025)⁶



Incorporating automation into existing infrastructures creates smarter warehouses, improves flow of goods and business output without disrupting current operations.

Warehouse location is also an important consideration for e-tailers. Traditional warehouses were often situated in rural areas with access to major transportation routes. A new wave of warehouses and fulfillment centers is sprouting up in urban areas and residential communities. These locations offer closer proximity to residents and business customers, enabling faster order response, quicker turnarounds and quicker deliveries.

Large distribution centers and urban warehouses need to optimize how they are utilizing their space.

Automation including warehouse execution systems and autonomous mobile robots (AMRs) in these facilities can improve productivity in existing warehouses without disrupting current operations.

INNOVATING TO MEET THE PRESSURES OF THE ON-DEMAND WORLD

Today's fulfillment centers need to look for ways to optimize warehouse space, intelligently manage inventory, and, increase the productivity of the existing labor pool.

One of the best routes for warehouses and fulfillment centers to be more productive is through automation and robotics, which is top of mind among many companies.

Technological advances in automation and robotics that can be tailored to a company's unique workflows and service needs combined with greater affordability of autonomous mobile robots (AMR) make these solutions even more attractive.

Here are four productivity-boosting strategies for eCommerce distribution centers to realize favorable results and quickly capture a measurable return on their investment.

01 INTELLIGENT INVENTORY PLACEMENT AND MANAGEMENT

Direct-to-consumer eCommerce fulfillment means each order is made up of multiple unique SKUs in “onesies and twosies” quantities. That’s where intelligent software technologies can add real value in simplifying and managing a broad range of products.

Whether a company is ready for robots or not, improvements in warehouse technology are the most crucial first step to boosting productivity.

Artificial Intelligence (AI) and sophisticated algorithms are at the heart of today’s automation technology to enable random access inventory management. AI-powered smart Warehouse Execution Systems (WES) software delivers productivity gains for coordinating the movement of goods in the warehouse.

These technologies pinpoint the quickest path to take across a warehouse to pull random items. They can also place SKUs that are ordered more often closer to pack out or in close proximity to one another if they are often ordered together.

Today’s fulfillment optimization software also uses serialization and lot numbers to manage procedures like first-in, first-out (FIFO). Digitizing the warehouse can create profound improvements in fulfillment efficiency.



Source: istock

One example of intelligent warehouse execution software (WES) is **inVia Logic**, which maximizes efficiency in all warehouse fulfillment tasks for both manual picking and when incorporating inVia's autonomous mobile robots (AMRs).

The software uses AI to orchestrate the flow of people, equipment, and goods across the warehouse with a focus on providing algorithmic solutions to the "traveling salesman problem": how to find the shortest, most efficient route.

inVia's patented SmartPath algorithms direct people and inVia Picker autonomous mobile robots to retrieve goods via the fastest and most efficient path. Smart algorithms are also used for spatial batching, which assigns orders based on SKU proximity to limit the number of trips people make to the same aisle to retrieve goods.

The system calculates labor point requirements and task allocation and continuously adjusts system parameters such as density, batching and sorting, dynamic planning, and cycle time to achieve the daily SLA goals.

The result is a highly optimized waveless picking, where customers realize:



4-5 times

improvement in productivity when using robots



2-3 times

boost productivity by just deploying the software to guide their people



Traveling Salesman Problem

One of the best-known algorithmic problems in computer science and operations research focused on finding the shortest yet most efficient route for a person or robot to take given a list of specific destinations.

There are lots of different routes in the warehouse to choose from, but finding the best one, which requires the least distance and cost, is what inVia Logic helps deliver.

02 SMART LABOR PRODUCTIVITY TOOLS

Different picking methods such as zone, cluster, and wave picking have been used to make product picking more efficient. Various technologies have been helpful in this area too including the use of RF guns and pick-to-light systems.

Still, with multiple unique SKUs being ordered and the ongoing pressure for accelerated speed of delivery, picking products from inventory shelves continues to be a labor-intensive process.

For businesses that want to increase efficiency using their existing workforce, intelligent labor productivity tools offer a place to start. AI, WES software and the addition of mobile or wearable productivity tools alone can streamline processes and enable smarter use of data.

Labor productivity tools should be easy to use to help warehouse workers improve both the search and dwell time aspects of picking and replenishing orders. The technology should also be easy and intuitive for training purposes.

The picking rates in units per hour (UPH) can range widely depending on the type of picking process used



50-100 UPH

in traditional picking



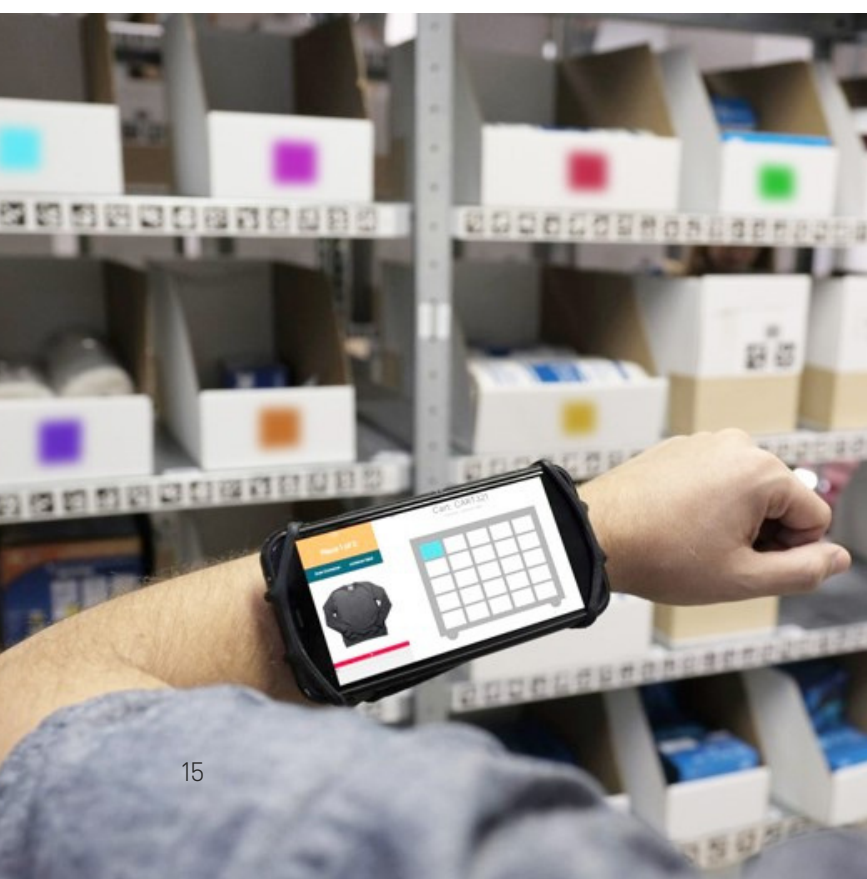
250-300 UPH

picking with WES + Productivity Tools



600+ UPH

picking with a sophisticated robotics solution such as inVia's system



At inVia, we developed **inVia PickMate**, a productivity tool with a color-based interface, which guides warehouse employees to quickly and accurately pick and place goods. The technology allows employees to utilize the intelligence that our WES system creates, doubling picking rates.

Color-coding is a proven way to boost picker efficiency by making product identification and selection faster and easier. Employees match the color on the screen with the color on the tote, minimizing mistaken orders. inVia PickMate is so easy to use, it shrinks training time from days to just 30 minutes.

03 DECOUPLING DEPENDENCIES BETWEEN PEOPLE AND ROBOTS

We've just covered ways in which to increase pick rates for manual picking by warehouse employees. When we deploy robotics and automation, we can generate even higher pick rates.

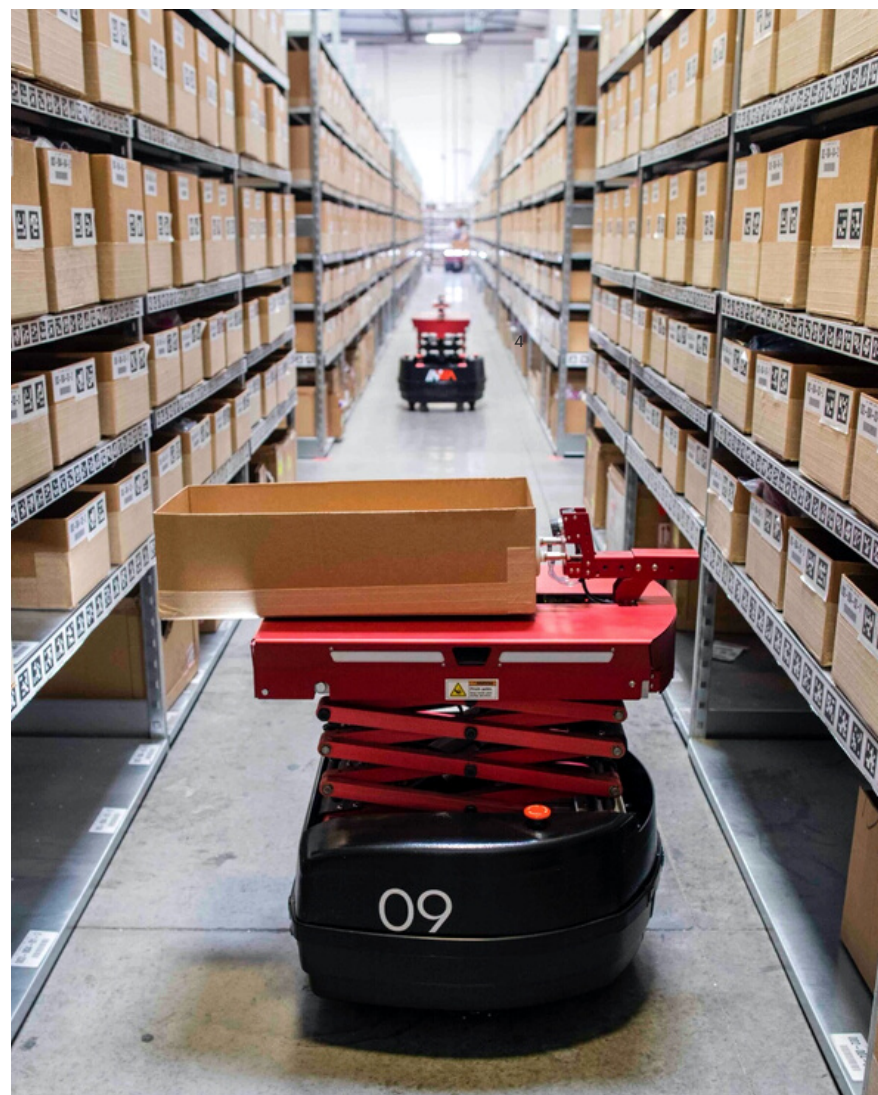
Robotics is ideal for tasks that are tedious and repetitive. To meet the demands of consumers during the ongoing surge in eCommerce, **one of the biggest challenges for warehouse workers is the long distances they travel each day for picking and replenishing purposes.**

eCommerce distribution center workers can walk as much as 10 miles per day, depending on their warehouse roles. Naturally, one area to help improve productivity is to have robots do the traveling.

Today, there are many automation solutions on the market, from AS/RS systems to Autonomous Mobile Robots. They are often divided into two main categories:

1. Person-to-Goods Automation

Robotic Person-to-Goods systems act as smart carts, traveling alongside the warehouse worker. This approach improves productivity by eliminating green screen devices and paper picking while optimizing the walking process. But this format does not eliminate walking altogether.



2. Goods-to-Person Automation

Some AMRs, as well as AS/RS solutions on the market today, are goods-to-person systems that substantially limit or eliminate order picking walking altogether. This is a major step in increasing employee productivity while having a beneficial impact on their health and well-being.

While it is an improvement in productivity, many systems on the market today intertwine robotic processes with processes that direct human work. For example, a person needs to be present at their station to maintain picking flow or a person needs to be present in the aisle to pick goods for a traveling robot.

Decoupling Dependencies Between People and Robots

People work differently from robots. They are most efficient when working in bursts, whereas robots can work 24/7, unhindered from the need for breaks or meal stops.

To further maximize productivity, inVia Robotics designed the inVia PickerWall solution that eliminates dependencies between robot

inVia's patented PickerWall decouples robots from human processes, which enables an even greater productivity boost. inVia Picker robots build a dynamic wall with each day's set of ordered goods.

and human processes. With inVia PickerWall, warehouse workers can work in bursts and rotate freely across other warehouse tasks, while robots do their non-stop work, 24/7.

The system eliminates the dependencies of workers on robots and vice versa and fosters a highly functioning and symbiotic relationship between robots and people. Orders get fulfilled and delivered more quickly to customers, which pleases end users.



CREATING A FULLY ORCHESTRATED WAREHOUSE

One of the key objectives of using automation and robotics is to address inefficiencies across many areas of warehouse operations. The ultimate goal is to orchestrate all of the processes to reduce idle time and maximize productivity.

eCommerce fulfillment has made warehouses more complex, with added logistics, systems, and workflows necessary to speed up order fulfillment. An orchestrated solution coordinates tasks spanning the full enterprise of operations: picking, packing, returns, sortation, consolidation, pack-out, and replenishment. These operations need to work smarter through more intelligent allocation and orchestration of resources.

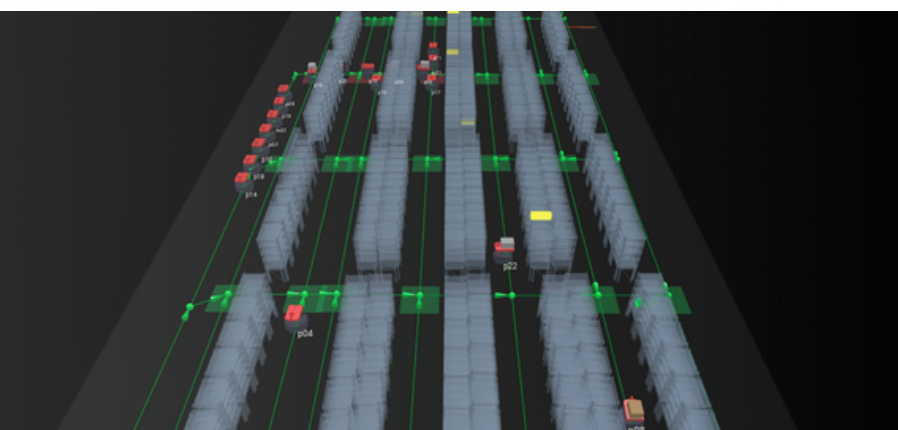
Smart technologies, such as AI, help to organize tasks for people and robots to make the most of available resources. This solves the “job shop problem” of how to reorganize jobs to reduce idle time.

inVia’s systems were designed to orchestrate and coordinate tasks and adapt to ever-changing situations. **inVia Logic, our AI-powered WES monitors each warehouse order and orchestrates a seamless handoff between human and robot labor to ensure that all orders are completed.**

Job Shop Problem

Known in computer science and operations research, Job Shop Scheduling is an optimization problem, in which multiple jobs are processed on several machines. Each job must be performed in a given order and processed on a specific machine. The problem is to schedule the tasks on the machines to minimize the length of the schedule. The key is identifying roadblocks that slow or stall the process and rearranging resources in real-time to minimize idle time.

The system can see and plan in both space and time and know when someone has paused. It can reroute robots and people, reducing bottlenecks for orders to ensure business SLAs are met.



m01	Now	A L W	77%	24.6V	NONE	No Action		Recover E-Stop Operating Mode
p03	Now	A L W	74%	25.3V	En Route, Place	14239	Recover E-Stop Operating Mode	
p04	Now	A L W	90%	24.3V	NONE	No Action		Recover E-Stop Operating Mode
p06	Now	A L W	90%	25.7V	En Route, Place	14496	Recover E-Stop Operating Mode	
p07	Now	A L W	100%	25.8V	En Route, Point		Recover E-Stop Operating Mode	
p08	Now	A L W	81%	25.0V	En Route, Station Queue	16355	Recover E-Stop Operating Mode	
p09	Now	A L W	96%	25.4V	NONE	No Action		Recover E-Stop Operating Mode
p10	Now	A L W	98%	24.9V	En Route, Point		Recover E-Stop Operating Mode	
p11	Now	A L W	96%	24.8V	En Route, Traffic Mitigation	18	Recover E-Stop Operating Mode	
p12	Now	A L W	100%	24.3V	En Route, Point		Recover E-Stop Operating Mode	
p13	Now	A L W	73%	25.5V	En Route, Point		Recover E-Stop Operating Mode	
n14	Now	A L W	74%	25.9V	En Route, Point		Recover E-Stop Operating Mode	

SUMMARY

As eCommerce gains even greater traction as a preferred shopping channel, companies need to innovate their sales process, fulfillment operations, and delivery capabilities to meet shopper demand. It's not just a matter of choice. For many companies, it's a matter of "adapt or die".

Clearly, online shopping is here to stay and will only become more pronounced with changes in retail structures and continued evolution in

e-commerce to buy, discover, compare and inspire shoppers. This new way to shop is reshaping what warehouses are, how they function, and ultimately how fulfillment operates.

The fulfillment sector faces its own challenges, most notably how to attract workers, make them more efficient, and the need to drive greater productivity to ensure the timely and accurate delivery of more and more orders.

The solution?

The new smart way to warehouse, where AI-powered automation and robotics provide intelligent inventory management, optimal use of space and resources, labor productivity tools, and sophisticated orchestration of goods, people and equipment to deliver highly efficient and scalable fulfillment operations.

Automated warehouses enable faster fulfillment of online orders, better management of inventory and optimal use of labor resources, both human and robotic.

The end result is faster, more accurate execution of customer orders, often delivered in just one day's time. That's a formula that will keep today's eager consumers happy, each and every delivery.

ABOUT INVIA ROBOTICS

inVia Robotics is an award-winning automation company that provides the next generation of warehouse optimization solutions.

Our system leverages autonomous mobile robots and AI-driven warehouse orchestration software to help eCommerce businesses and 3PLs automate and optimize material flow across fulfillment centers.

We deliver our comprehensive automation services as a subscription. Our systems are built to deploy quickly and without disruption to existing operations.

Our systems are built to deploy quickly and without disruption to existing operations.

The results are a 4-5X increase in productivity and accuracy rates of 99.9% - at a fraction of the cost of traditional automation.

Learn more about how we can optimize your operations at www.inViaRobotics.com

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