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THE DISTRIBUTION EXPERTS™
Fortna Thought Leadership Series

Bots Will Transform Your Distribution Operations – But It's Probably Not the Way You Think

E-commerce has increased the pressure on distribution systems to increase delivery speed and add more variety to their inventory, while keeping their operational costs down. And just in time, collaborative robotics ("bots") have arrived to reduce walking, improve worker efficiency, lower your reliance on labor, increase flexibility, increase order accuracy, improve worker satisfaction, and ease integration with a scalable approach. Whew! Or will they?

Every day, Fortna's research and development team uses its unmatched technical skills to drive innovation in solving today's distribution challenges and tackling growth opportunities for our clients. We conduct an Emerging Technologies Challenge annually to seek new ideas and challenge old ways of thinking. Our most recent challenge looked at the business case for bots, identifying several bot applications and the associated "back of the envelope" business case to justify the application. In this article, we discuss four of the most compelling use cases for collaborative bots. In future articles, we will provide deeper analysis of each application.

BOT-ASSISTED CLUSTER PICKING

Bots with multiple totes or slots allow picking of multiple orders in parallel. Bots move the orders around the picking area, stopping at every location required to fill the order. Human workers do the picking into the appropriate tote or slot. Once those picking tasks are complete, the bot travels to the next location required for the order and the worker travels to the next closest bot. When all of the orders in a cluster are complete, the bot travels to a packing area.

Benefits: Bots increase the productivity of the worker by reducing walking from/to pick up and deposit stations and across zones with no picks. By increasing the productivity of the worker, the distribution center needs less labor, which reduces the costs associated with hiring, training, and retaining workers.

Challenges: Bots operate at a lower speed than humans, and load capacity constraints might limit the number of orders in a bot cluster. Because of these factors, the number of bots in the bot-assisted solution is always higher than the number of human workers in a traditional manual cluster picking operation. Furthermore, bots must wait for pickers to execute the picks, and pickers must roam

around their designated areas looking for bots (see second illustration below). The only way to minimize this dual waiting effect is to add more bots, which creates two problems: higher costs, which tend to break the business case; and congestion, which reduces the productivity. In conclusion, we find that as compared to a high-density picking operation, the benefits of bots in cluster picking are low compared to their cost.

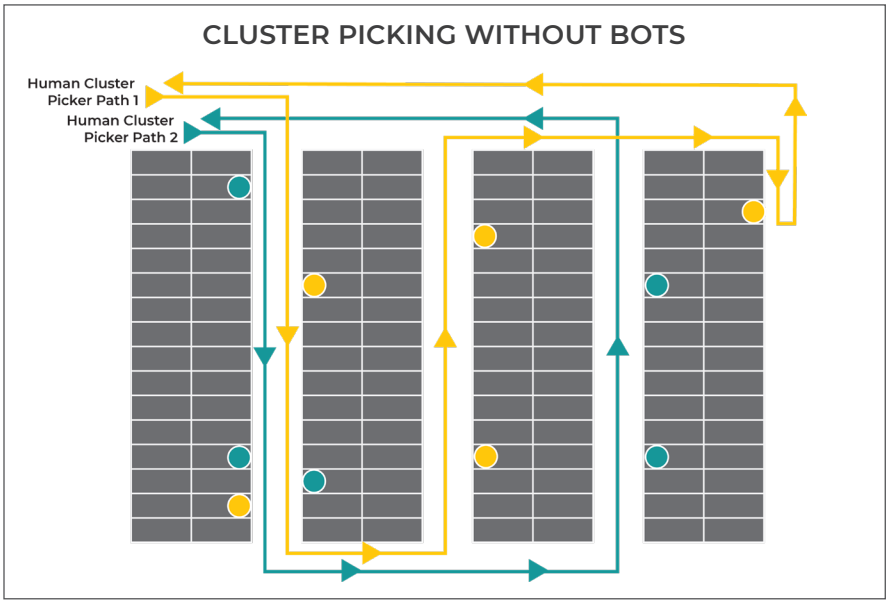


Illustration is a traditional cluster pick path where pickers retrieve carts, traverse aisles with picks, then drop the cart at the end of the pick tour.

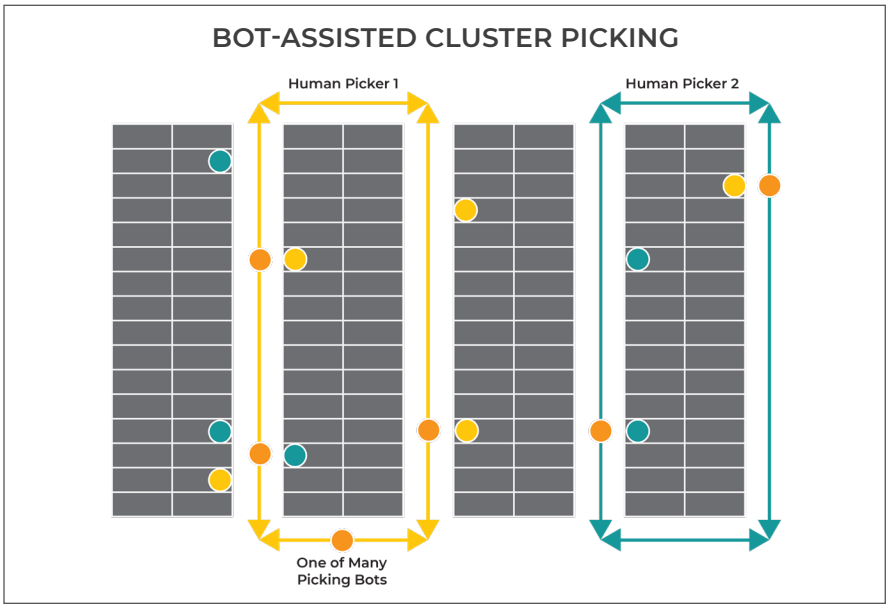


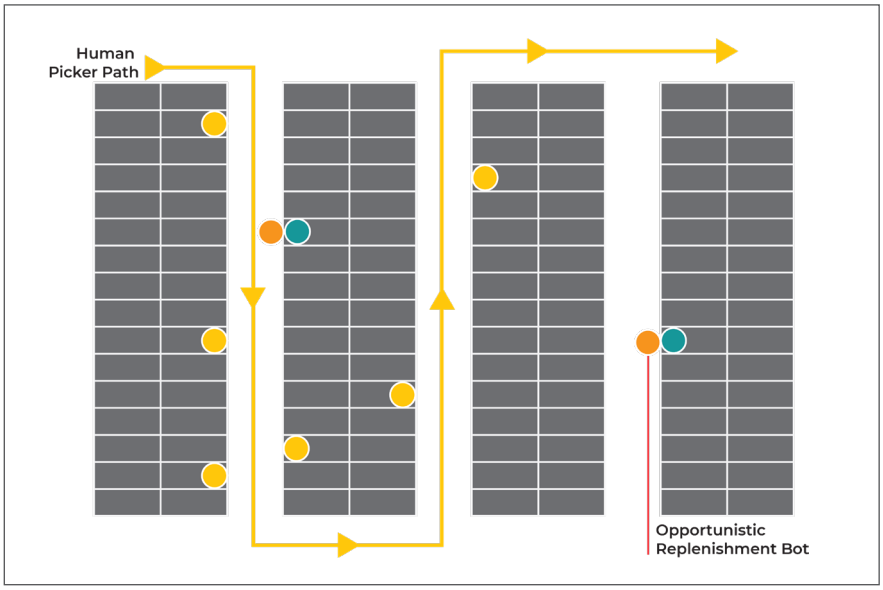
Illustration has bots traversing the pick paths, waiting for a picker to execute the pick. Meanwhile, a picker walks along a designated pick area looking for bots requesting a pick, executes the pick and moves on to the next request/bot. It's possible for a picker to walk the designated area multiple times to execute all of the picks, which might decrease the savings implied by the illustration.

The research and development team at Fortna conducted a computational study consisting of 1,200 permutations of parameters that determine the size of a cluster picking operation. We found that the cost effectiveness of using bots for cluster picking is narrow and limited to applications with specific business requirements and certain order profiles.

So, if this isn't the home-run application for bots, what is? The emerging technologies challenge highlighted three promising applications for bots.

BOTS TO ENABLE OPPORTUNISTIC REPLENISHMENT

In this application, bots transport one or more SKUs from reserve storage to forward picking areas for replenishment. Bots stop at destination locations for their carried SKUs and wait for a human worker. Human pickers performing picking tasks that encounter a waiting bot along their pick path perform the replenishment task, the bot then travels to the next SKU slot for replenishment and the picker resumes picking or replenishing. Once the replenishment tasks are complete, the bot travels to the reserve area to retrieve more SKUs or to another functional area if bots are shared across multiple functions. The figure below illustrates interaction between pickers and replenishment bots.



Picker encounters a replenishment bot along the pick path and executes the replenishment. The second replenishment bot is not along the pick path, and therefore, would be served by another pick cycle.

Benefits: Bots replace the large travel-time component for replenishment activities, which reduces operational expenses. Combining the non-travel component of replenishment with picking activities will improve the blended productivity of both processes and improve worker utilization.

Challenges: If pick density is low, the "opportunistic" part of this application might not be purely opportunistic requiring workers to divert from their pick paths to replenish, which may require higher head count, diminishing the business case. In addition, if the number of pickers is low, the waiting time that the bots experience may be long and will lead to a larger investment in bots.

BOTS AS LOW-COST SORTER

Bots can be used to replace conveyor segments used for sortation where rates are lower than 30 sorts/minute. In shipping, bots can transfer cases from packing or from a main conveyor segment to the shipping docks. Bots can integrate with Good-to-Person ("GTP") systems to move totes between the storage area and GTP workstations.

Benefits: As a replacement for conveyor segments, a bot solution provides flexibility for reconfiguration and re-assignment to other distribution center functions, enabling scalability for peak seasons and future growth. Bots are also more cost-effective than conveyors where throughput requirements are low, and the number of pickup points and destinations is high.

Challenges: The current pricing of bots limits the business case, although we are seeing a downward trend in the cost of bots. The constraint of bots moving in the horizontal plane could also limit the application.

BOTS AS LOW-CAPACITY AGVS

Bots can be used to transport cases or tow carts between functional areas. Distribution centers with low volume transported over long distances can benefit from automation, but have difficulty making a business case with expensive, heavy-duty transport AGVs or conveyor systems that form a physical barrier in the facility. Low-capacity autonomous bots can provide both the automation and the business case for these environments.

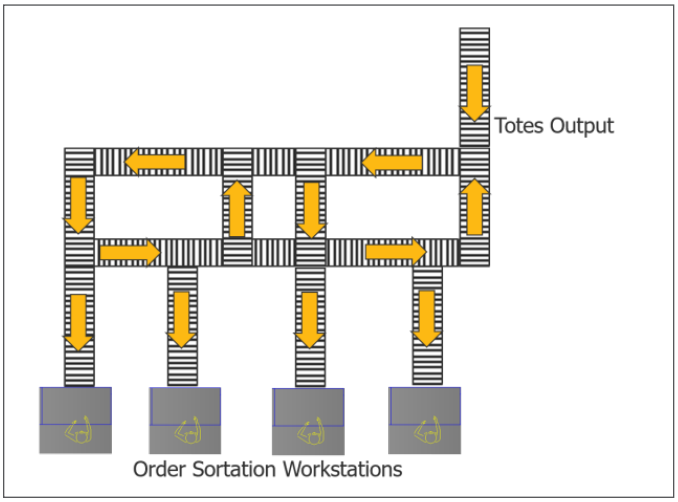


Illustration (left): shows a traditional solution for transporting totes into a set of stations using conveyor segments and loops to allow recirculation and crossovers.

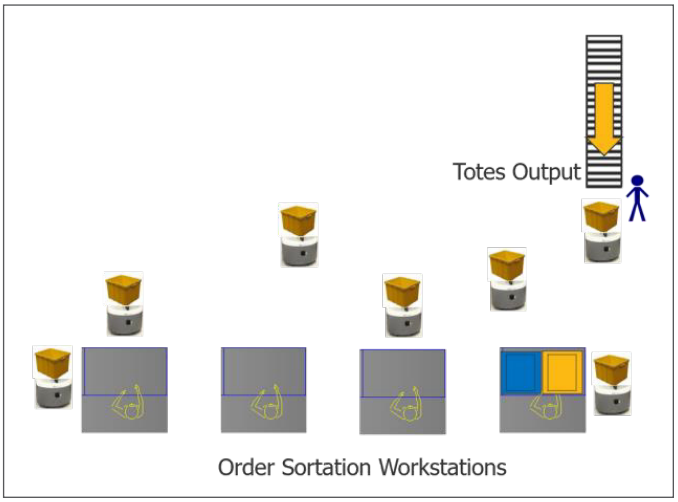


Illustration (right): demonstrates the lower cost bot sorter in which the bots move the totes between the input/output location and the workstations.

Benefits: Some bots on the market can tow loads of 600 lbs. – 1,200 lbs. and do not require wire guidance systems. They have the capacity to tow carts carrying cases of different SKUs, which provides higher efficiency. The annualized cost of the bots is significantly lower than the loaded labor cost of a human.

Challenges: The business case is limited to applications with horizontal travel, low volume and over long distances where the bots can significantly save travel time for human workers. For safety, there are speed limits on these bots, which can limit their business case in comparison to human-operated transportation devices.

SUMMARY

E-commerce customer expectations continue to increase the need for speed, accuracy, and efficiency. The list of suppliers that offer this generation of robotic technologies is growing rapidly. As the capital and operational costs of these bots decrease and the flexibility of the design infrastructures that support these robotic solutions increases, the business case for using collaborative bots to support the ever-growing e-commerce fulfillment business is getting stronger with faster ROIs.

Fortna has developed models to quantify the trade-offs between the productivity gains and investment costs associated with using bots in the above applications. In addition, Fortna's Warehouse Execution System (FortnaWES™) has been enhanced with algorithms to dynamically optimize the routing and batching decisions, which lead to additional productivity gains and labor savings in picking, sorting, and replenishment processes. The combination of optimal design capabilities and intelligent control software puts Fortna at the forefront of helping companies assess their operations and evaluate the business case for robotic technologies.

FORTNA CAN HELP

Are you trying to decide how robots might be a fit for your distribution operations? Fortna helps companies assess their operations, evaluate the suitability of different technologies and build a business case for investment.

For more information, contact The Distribution Experts at info@fortna.com.

THE DISTRIBUTION EXPERTS™

Fortna partners with the world's leading brands to transform their distribution operations to keep pace with digital disruption and growth objectives. Known world-wide as the Distribution Experts, we design and deliver intelligent solutions, powered by FortnaWES™ software, to optimize fast, accurate and cost-effective order fulfillment. Our people, innovative approach and proprietary algorithms and tools, ensure optimal operations design and material and information flow. We deliver exceptional value every day to our clients with comprehensive services including network strategy, distribution center operations, material handling automation, supply chain systems and warehouse software design and implementation.

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