The recombination of human and machines is integral to Amazon’s ability to deliver an extraordinary variety of retail goods—including in some cases perishable groceries—on-time with accuracy and low-cost. As a result of its acquisition of Kiva Systems in 2012, Amazon now operates one of the world’s largest fleets of industrial robots in its warehouses. These devices, resembling turtles because of their low center of gravity and broad backs, are guided by computers to pick up pallets, deliver them to central stations where employees select items in line with a pick list, and return pallets to their previous location—saving miles of walking on the part of fulfillment center workers. As Amazon senior vice president Jeff Wilke explained, “Technology is unlocking human potential. Technology is allowing humans to spend less time doing non valuable things like walking to spend more time on process improvement for customers and the company.”

Recombination at Amazon and Kiva Systems: balancing human and machine capabilities

Robert J. Thomas, Alex Kass and Ladan Davarzani
Software-houses

In the Kiva Systems robotic warehousing solution, a central computer system controls an army of robots that do all the heavy-lifting of retrieving and bringing the stock to the work station where a "pick worker" can put the correct item into a box. Through the technology, robotic equipment can sense and adapt to location as well as position information. In particular, QR-code stickers allow them to "see" where they are and where is space to travel so as not to ram into other robots or pods, which are constantly changing position—thereby interacting autonomously with the warehouse environment. Moreover, robots travel in the most efficient way possible, whether it is underneath a row of untouched pods or detouring slightly to allow another pod to pass. They keep each operator operating at a sustained rate of one new pick face location every 6 seconds, which means no one operator is over-burdened nor the other experiencing intervals of down time. They know not to line up too-many-at-a-time at a station and also understand when to allocate more work to faster workers.

In the past, warehouses would have to shut down operations for months to change a process (such as a new sorting system or shipping procedure). In traditional hardware solutions, machines are bolted into the foundation of the building—following a fixed set of operations. Because Kiva robots run on software, the system is able to continuously add enhancements and improve efficiency through digital upgrades without causing the warehouse to skip a beat.

Regarding daily operations, after an item is picked, the robots bring the pod back to an area of the warehouse that is determined by what is left in the pod. Additionally, the computer system is able to detect if an item left over is a hot seller, and will park the pod closer to the work station. For example, during the days leading up to a particular holiday, pods with relevant items would transition to the front of the building.

A new way to process orders

Typically, products enter the warehouse in bulk after completing their transit from production facilities. At the receiving point, products are identified and sorted by type and number and then moved to an assigned, recorded location in the warehouse where they are stored until ordered. In the order fulfillment process, products are retrieved from storage and brought to locations within the warehouse were they are identified, "picked" and packed to assemble complete orders, which are recorded. The orders are then transported to a shipping point within the warehouse, where shipping information is recorded. On a product level, the basic functions of warehousing thus include receiving, identification and sorting, dispatching to storage, placing in storage, retrieval from storage, order picking, packing, shipping and record keeping.

The entire process usually requires multiple points of humans being in the loop. Workers are good at sorting big items/boxes from small ones, or delicate ones from heavy, sturdy ones. They know how to replenish aisles most efficiently because they can see the amount of space available. They can identify an item, take it out of its bin and put it in an appropriately-sized box. It doesn’t require intensive intellectual skills, but it can’t conceivably be done by a traditional machine either.

However, with the Kiva robots, the work of retrieving items is effectively done by the robot—transforming long-standing work practices in the process. Kiva warehouse robots combine machine intelligence and learning with a human capacity for spotting improvement opportunities. Warehouse robots can be choreographed to move in complex and shifting patterns based on fluctuations in market demand, improvement suggestions made by teams of warehouse employees or continuously updated supply chain data.

Reconsider the aforementioned case of holiday orders. In the days leading up to Valentine's Day, racks with relevant items such as chocolates in heart-shaped boxes are automatically moved closer to packing stations.

Amazon’s online commerce business is in selling all kinds of goods (from books, consumer electronics and kitchen items to apparel, food, jewelry, furniture and groceries, etc.), some of them its own and many from thousands of merchants. One of its biggest success factors in running such a diverse stock of merchandise? Its back-end logistics and fulfillment technologies. The efficiency and scale at which Amazon mobilizes its large warehouse network complete with advanced technology and operations management is what allows Amazon to make tens of millions of dollars’ worth of sales to innumerable individuals each day.
Notes


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