REVOLUTIONIZING THE GLOBAL SUPPLY CHAIN:
How fleets of mobile, continuously-learning robots are optimizing the operations of our world's top brands

By Dave Munichiello

Technology enables almost every facet of our lives, helping us become increasingly more efficient, more connected, more adaptable, and more aware of the world around us. One of the last frontiers to be substantially optimized by modern advances in hardware and software technology has been traditional warehousing in the global supply chain. These facilities are still full of static shelving, laced with old conveyors, and staffed by hiring loads of temporary workers to run around picking orders.

A growing set of distribution centers (DCs) are giving us a preview of the "supply chain of the future." Walgreens, Staples, Office Depot, The Gap, and Saks 5th Avenue are among the companies whose distribution centers have adopted a new technology provided by Kiva Systems, a fast growing robotics and software company based out of Boston, MA. The technology, a powerful combination of robotics and sophisticated (yet elegant) algorithms on an ever-adapting code base, is moving t-shirts, pens, pharmaceuticals, high-heels, toys, medical devices, and dresses around warehouses in increasingly efficient ways. These supply chain robots address a key flaw in the distribution aspect of the standard business model.Inside a traditional warehouse there are three fundamental activities taking place: picking, packing, and shipping orders. All three share similar problems: slow speeds, inflexibility, single points-of-failure, inaccuracy, and lack of predictability. Those problems go away in a Kiva world, as the same algorithms used to dynamically route packets on a network or defragment a hard drive can now be applied to the movement of inventory around a warehouse. These advances make each worker up to four times more productive and leave the heavy lifting, navigation, and complicated efficiency management to the robots.

Traditional Distribution Center Challenges

As more brick and mortar stores turn to the web as an equally important storefront, businesses are pushing their supply chain to keep up with the rapid change of offerings while maintaining cost effective, efficient operations, and minimizing operational risk.
A traditional DC is made up of thousands of square feet of concrete flooring with endless aisles of inventory. Products are stored on static shelves, often for retail store restocking or web order fulfillment. Many DC operations use a manual process for materials handling where workers walk up to fourteen miles per day through aisles of inventory shelving, putting merchandise into their carts. Other warehouses "automate" this process using conveyors or carousel systems similar to the types of systems seen at airport baggage claims. This form of automation often involves miles of bolted down metal and rubber equipment in winding patterns.

The manual process is slow, inaccurate, and expensive (requires many workers), while the conveyors or carousel systems require complicated installations, are inflexible to modifications in product shape and size, and are vulnerable to single points-of-failure. Further, changes to permanent fixtures (like reconfiguring a conveyer system to accommodate a new workflow or expanding the size of the available storage) typically require significant disruption to ongoing operations.

In the old world, if a retailer who previously sold sneakers decided to expand its product offerings to include apparel and sporting equipment, they may have to scrap their tilt-tray sorter (carousel) for a more manual operation. Worse yet, they may have to run two parallel operations for both sets of goods. Either option is time consuming and expensive, making it difficult to respond quickly to changes in market demand.

eCommerce Fulfillment Challenges

Today's point-and-click world leaves retailers and eCommerce providers competing aggressively for sales. In this competitive landscape cost alone is no longer enough of a competitive differentiator. Internet retailers must look for other ways to convince online shoppers to select their products over another site that offers the same product at the same price. Vast merchandise selection, item availability, and shipping options suddenly have newfound influence on the consumer decision-making process.

How does this rapid movement towards instant eCommerce impact the distribution and fulfillment

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side of a business? While a digital storefront is easy to update with new products overnight, there are thousands of square feet of cinderblock and concrete with rows of product that are not as easy to adapt to the increasing demands of direct to consumer (DTC) fulfillment. Business models are evolving quickly to capitalize on consumer preferences of their online shopping experience. Yet, traditional distribution centers struggle to adapt to these changes quickly enough.

Kiva Systems set out to address the challenges of both traditional DCs and the eCommerce movement nearly eight years ago and has been able to apply cutting-edge robotics and software technology to deliver a highly cost-effective, efficient, flexible, redundant, survivable, and scalable model for modern warehouse operations.

Enter, Robotics and Software

Using a fleet of mobile robotic drive units, moveable shelves, work stations, and sophisticated, decentralized control software to automate the pick, pack, and ship processes, Kiva Systems delivers a solution suitable for the unique challenges of modern fulfillment. It eliminates wasteful walking up and down warehouse aisles and allows operators to work from customized work stations, leaving the laps to the robotic drive units.

Mobile robotics for warehouse automation incorporates hardware and software technology to process orders of all sizes. This is different from other automated storage and retrieval systems because it is an integrated inventory storage, quality control, and order fulfillment system all in one. Inventory is now routed (tracked, stored, sorted, and moved) around a DC like packets are routed on a network. To pick orders, operators stand at stations around the perimeter of the building while inventory is stored on mobile shelving racks, called pods. These pods are arranged in a grid pattern in the interior of the building; when an operator requires an item for an order, a mobile robot brings the pod containing that item to the worker's station. The worker picks the items they need out of the pods and places them into the orders they are working on. Once the items have been picked, the mobile robots return each of the pods they are carrying to a storage location on the grid floor (which is frequently different than the one it picked the pod up from). Each worker is usually supported by 5-10 mobile robots so they are kept continuously busy filling orders. For operations with multiple workflows such as store restocking and DTC order fulfillment, mobile-robotics can easily run each activity at the same time, under one roof. This includes functionality such as order picking, shipping, inventory cycle count, returns, and customization such as giftwrapping.

Because of its portability, mobile-robotics is faster and easier to install than other traditional automated solutions. In fact, a Top 100 Internet retailer was able to pick up and successfully relocate its entire Kiva system — inventory and all — from one warehouse to another in just 48 hours. Operators logged-out of their workstations on Thursday night in one location and 48 hours later, seamlessly logged into their

new workstations 15 miles away to finish the week's orders. This same activity would have taken months to complete with any other type of automation. With the ability to set up and transport an entire warehouse of inventory quickly for commercial purposes, it's easy to imagine this same functionality applied as solutions to other global challenges. In military operational settings, every minute of response time matters. Operations like disaster relief could be enabled by using mobile-robotics to create temporary warehouses in hours; storing, sorting, and dispatching much-needed food, medical supplies, and technology in real time. Further, extreme climates, constant motion, and exhaustion serve no threat to robotic productivity in a warehouse environment.

Conclusion

Mobile robotics empowered by cutting-edge software has many unique benefits. It delivers breakthrough performance and revolutionizes an industry by solving real-world business challenges:

- Each element of the system is flexible and moveable, making it easy to set up and add inventory at any time without a permanent commitment.
- Mobile robotics is two to four times more productive than other pick, pack, and ship automation approaches because it eliminates wasteful walking, and instead the robots appear with the inventory that is needed when it's needed.
- Orders filled using mobile robotics are 99.99 percent accurate due to barcode scanning and multiple methods for confirming quantity and product accuracy, including lasers that point pick workers to the goods, and lights that show workers where to place picked inventory.
- Orders can be processed in under 15 minutes from the time the order is submitted to when the labeled package is sitting on a delivery vehicle ready to go.

As Kiva's technology spreads throughout the global supply chain creating more robust, dependable, redundant, survivable, and efficient distribution centers for large corporate players, the potential for it to enable military operations becomes increasingly clear. Q

Dave Munichiello *is the Director of Professional Services at Kiva Systems with full P&L responsibility for a 30-person team deploying (configuring, integrating, installing, testing, training) systems worldwide. He is a former United States Air Force Captain (communications & intelligence) and served in a Joint Airborne Unit leading teams to arm elite Joint Special Operations Forces around the world with cutting-edge technology. Dave previously served as an Aide-de-Camp to the Four-Star General commanding USAF in Europe, NATO Air Forces, and ISAF. He received B.S. degrees in Computer Science and Math from Emory University and an MBA from Harvard Business School.*