2020 CSCMP Supply Chain Innovation Award Submission


# Innovative Multimodal Technology Breaks Performance Barriers

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## THE INNOVATION

FastFetch has developed a multimodal order-fulfillment solution that achieves high productivity through a synergistic combination of pick/put-to-light, voice, and barcode scanning technologies in a single system. Pick-to-light, put-to-light, voice, and barcode scanning technologies are widely used to support order-fulfillment operations. The three technologies, however, are typically employed in a stand-alone manner. The innovation described herein demonstrates that the synergistic combination of the three technologies can provide significantly better performance than is achievable with any of the technologies operating independently.

The three technologies, working together in a complementary fashion, enable pickers to fulfill multiple orders simultaneously in a hands-free, eyes-up manner without having to view a computer display or a piece of paper. This innovative order-fulfillment strategy yields productivity rates comparable to some of the best highly-automated systems, but at a fraction of the costs.

## HOW IT WORKS

The system employs a person-to-goods strategy for order fulfillment. Order pickers use carts to batch pick products for multiple customer orders during a single trip through the picking area. **Voice** is used to direct the picker to pick locations and to inform the picker of pick quantities. Similar to pick-to-light systems, product bays employ **lighted displays** adjacent to products to highlight pick locations and to indicate pick quantities. Unlike pick-to-light systems, however, lighted displays are also used to highlight cart locations into which the picked items are to be placed. Using lighted displays for both picking and placement significantly speeds the picking process and enables fulfillment of multiple orders simultaneously. **Barcode scanning** is employed optionally to confirm that the correct product was picked and to enable the picker to retrieve slow-moving items from product locations that are not equipped with lighted displays.

Fig. 1 shows a cart that supports batch picking for multiple customer orders. The cart is equipped with a mobile tablet, a barcode scanner, and a lighted numerical display beneath each cart location. Fig. 2 shows a cart in use at a picking bay that employs lighted numerical displays for highlighting pick locations and pick quantities.

### System Architecture

The system architecture is illustrated in Fig.3. The major components of the system are: A Warehouse Management System (WMS), a second software application referred to as the FastFetch host, multimodal carts equipped with light displays and tablet computers, and product bays having light displays on product locations. Tablets contain local databases that are automatically synchronized with the database on the FastFetch host, creating a distributed database environment.


**Fig. 1** Batch-Picking Cart for Multimodal Order Fulfillment

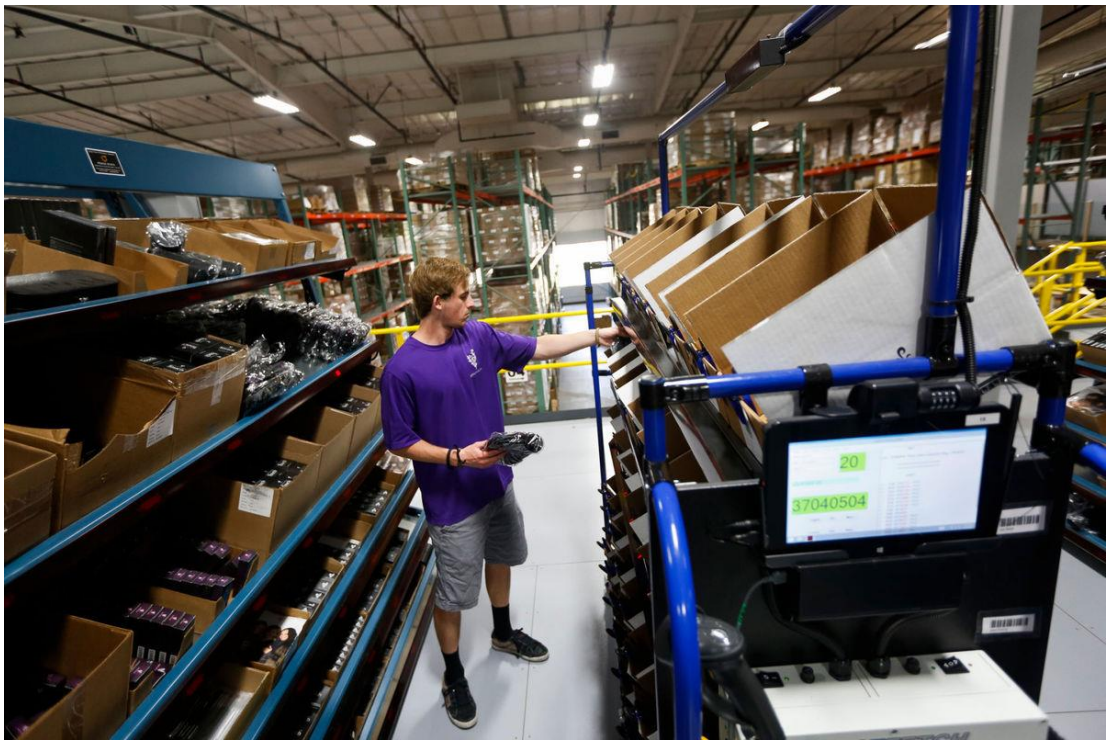


**Fig. 2** Multimodal Cart Used with Bays Having Numerical Displays Adjacent to Product Locations

## System Operation

The cart's tablet receives the list of items to be picked from the FastFetch host, typically using Wi-Fi. The information received is a rather conventional pick list containing, at a minimum, the unique order container (or pick ticket) identifier and the required quantity and location of each SKU. Optionally, information such as SKU description, product photo, UPC code, and operational flags can be specified to enable additional functionality. Voice output, in the preferred language of each individual picker, is used to direct the picker to a pick location. Lights on product bays are controlled strictly by cart tablets using an infrared link. When the cart arrives at a pick location, the tablet says "Stop" and activates lights on the bay to highlight quantities of items to be picked. Upon picking the required quantities of a given item, the tablet activates lights on the cart to highlight locations into which the picked items are to be placed.

As items are picked, the cart tablets update their local databases. Although a Wi-Fi connection between the carts and the FastFetch host can provide real-time picking results, there is no

requirement for continuous connectivity. If the network link between the FastFetch host and a cart tablet becomes unavailable (e.g., in a facility dead spot), the tablet will synchronize its local database with the FastFetch host database and the WMS database when the network link becomes available.

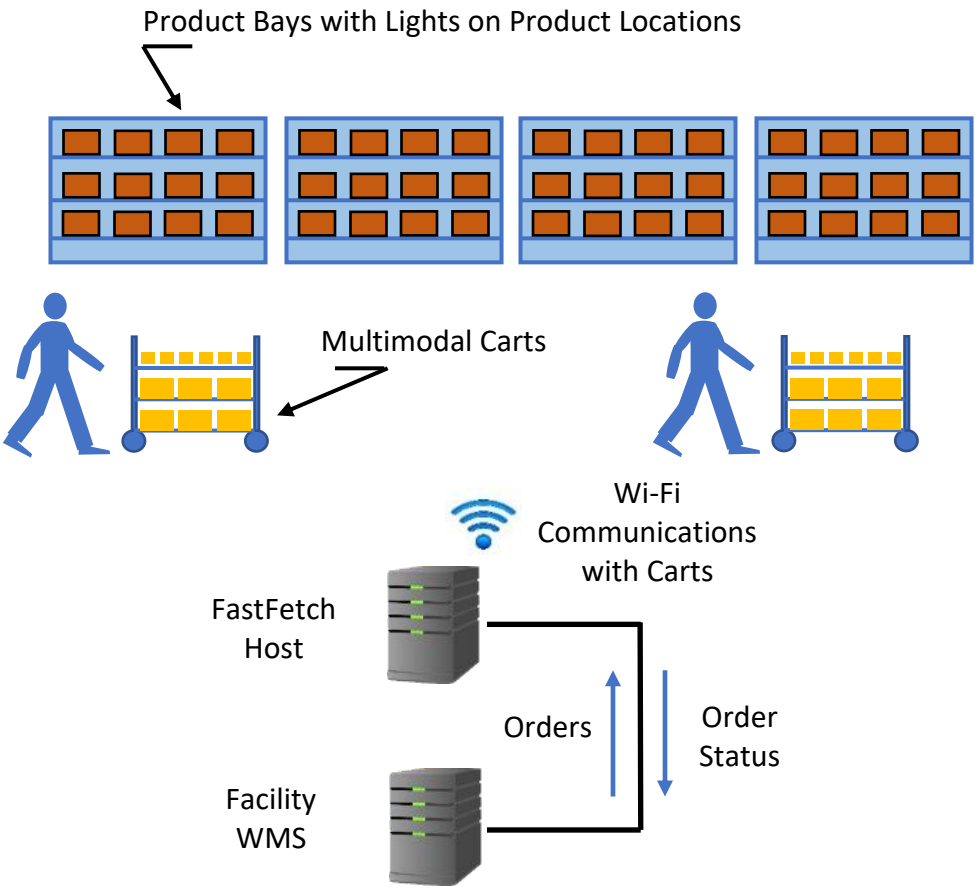


**Fig. 3** System Architecture

## RELEVANCE TO SUPPLY CHAINS

The explosive growth of eCommerce in recent years has had a drastic impact on supply chains linking manufacturers, suppliers, transporters, warehouses, distributors, retailers, and consumers. Every link in the modern supply chain has had to adapt to both higher volume and higher velocity to support the growth of eCommerce, and, as a consequence, order-fulfillment strategies have undergone a significant evolution. With the emergence of eCommerce,

distribution centers began to ship many more orders -- but with fewer items per order -- directly to end consumers. Distribution centers had to introduce new processes and technologies to handle orders in a more efficient and cost-effective manner. Because of the complex nature of order fulfillment, much larger order volumes, and increasingly shorter delivery demands, order fulfillment is recognized as one of the most challenging elements of the eCommerce environment.

## IMPLEMENTATION CASE

FastFetch's multimodal order-fulfillment system was selected by Younique Products for use in a new 72,000 square foot distribution center in Lehi, UT. Younique is a cosmetics and skin care direct-sales company and was the first direct-sales company to market and sell almost exclusively through the use of social media. Younique pioneered virtual parties to bridge the huge world of social media and the traditional home-party business model. Younique's product portfolio consists primarily of makeup and color cosmetics with a growing skin care line and a few fragrances and makeup tools. The current product line consists of more than 600 SKUs.

Typical daily order volumes range from 2,500 to 7,000 orders. Order volume is seasonable with spikes mainly around holidays and with sporadic upticks in both the fall and spring. During some of these uptick periods the distribution center must fulfill more than 20,000 orders/day for periods lasting several weeks.

### Challenges

Initially, Younique's order fulfillment strategy was paper based and employed human workers who picked a single order at a time. To improve the speed and accuracy of picking, Younique soon began to use RF guns, but productivity was limited because workers were still constrained to picking a single order at a time. Younique decided to build a new fulfillment center to keep pace with growth. Younique was seeking affordable order-fulfillment strategies and technologies that would be sufficiently scalable to support envisioned growth while providing flexibility to accommodate changing demands.

At the outset of the project, historical order records were reviewed to characterize the nature of orders. The key characteristics of Younique's order profile are as follows:

- A relatively small number of SKUs (600+) with a small percentage of slow movers;
- A small number of items per order (4 – 4.5);
- Order volume varies throughout the year with significant peak-season demands.

After analyzing the current situation and working in concert with Younique's management team to project future needs, the following goals were established for a new order fulfillment system:

- Double picking productivity
- Significantly reduce the time required for training new workers
- Provide ample agility to accommodate both normal and peak-season order volumes
- Provide ample flexibility and scalability to accommodate future needs without increasing the complexity of operations
- Provide a short ROI period

## Recommendations

To achieve the desired goals, the design team recommended two key changes in Younique's picking operations as follows:

1) Adopt batch-picking carts using multimodal picking strategies
2) Partition the picking area into multiple identical work cells

Batch-picking carts can achieve high productivity by fulfilling multiple orders on a single trip through the picking area. The recommended carts, as shown in Fig. 1, are equipped with a mobile tablet, a barcode scanner, and lighted numerical displays beneath each cart location. Rather than using totes, as many as 43 shipping cartons can be used on each cart. Twenty-four carts, all capable of transporting up to 43 customer orders, were recommended.

The picking area was partitioned into three identical work cells, with each work cell containing all required SKUs. Partitioning the picking area into multiple, individual work cells minimizes required travel while permitting multiple pickers to work concurrently without congestion.

The work cell layout is illustrated in Fig. 4. The picking area consists of eight 8-ft bays, each containing 60-75 fast-moving SKUs, and a single smaller bay containing 96 slow-moving SKUs. Each product location in the fast-mover bays has a numerical display to highlight the pick location and the pick quantity. The slow-mover bay is equipped with LED strips that are illuminated to indicate products required for picking. The advantage of LED strips in this application is that the width of the product locations can be adjusted to be arbitrarily small.

Work cells also host 4 packing stations. Products picked into shipping cartons are dropped off at a packing station where the cartons are prepared for shipping and placed on a conveyor for transport to the shipping area.

## TANGIBLE RESULTS

Fig. 5 shows picking rates categorized by picker experience. Trainee pickers achieve picking rates from 500 – 600 lines per hour. As they gain experience, picking rates average between 800 – 900 lines per hour. The fastest pickers consistently achieve picking rates ranging from 1,000 – 1,100 lines per hour. These speeds challenge ASRS picking technologies.

As compared to Younique's legacy picking operation using RF guns and picking a single order at a time, new pickers now achieve performance improvements ranging as high as 122%. Some

newly trained pickers are therefore achieving picking rates that are more than double the rate achieved with RF picking.

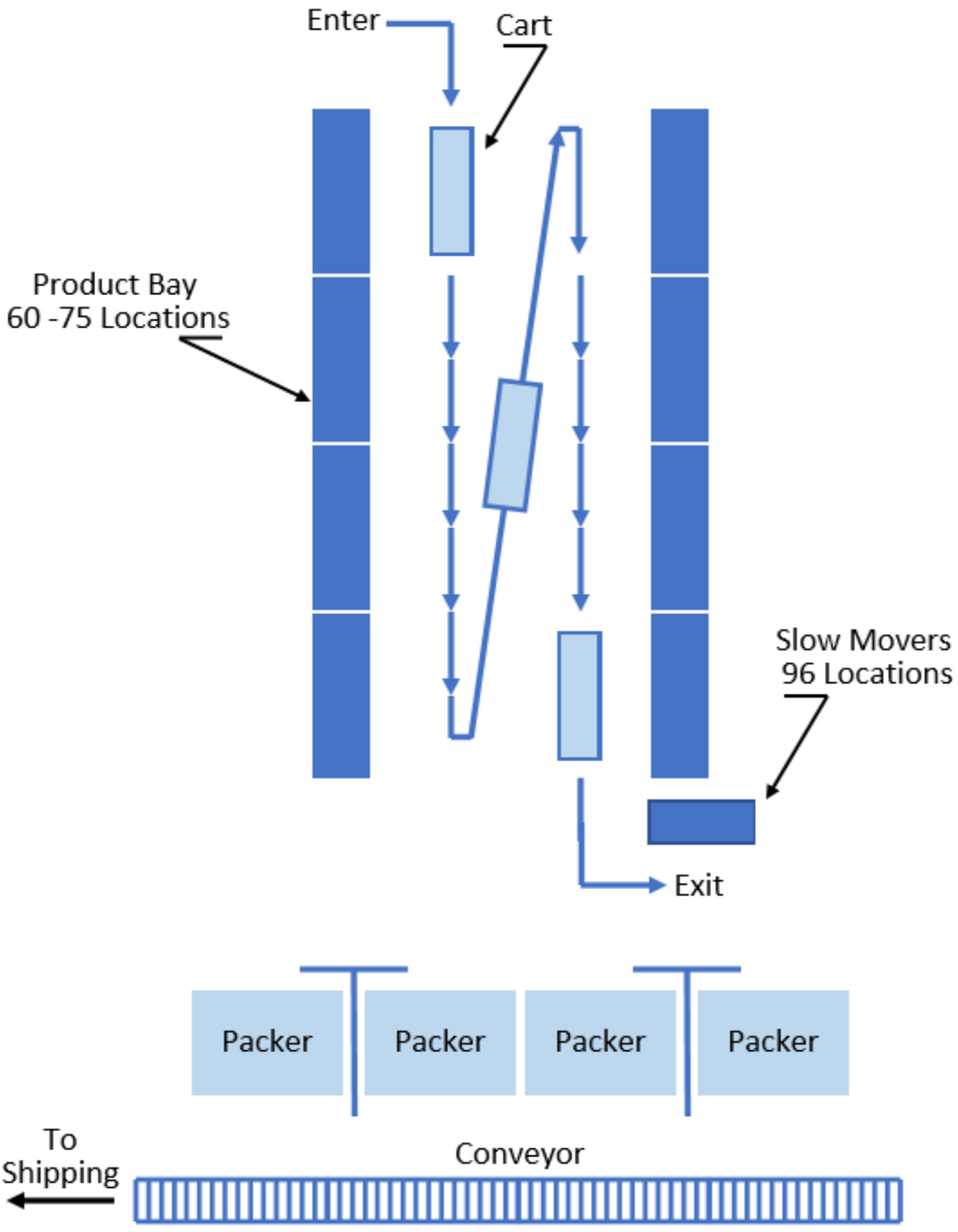


**Fig. 4** Work Cell Layout

As pickers gain experience, the performance improvement is even more pronounced. The improvement in productivity achieved by experienced pickers ranges from 196% - 233%. This means that experienced pickers are now picking at rates averaging 3 times that achieved using RF picking.

The performance of the top pickers is impressive. The improvement for the top pickers ranged from 270% - 307%. The top pickers now pick at rates ranging from 3.7 to more than 4 times that achieved using RF picking.

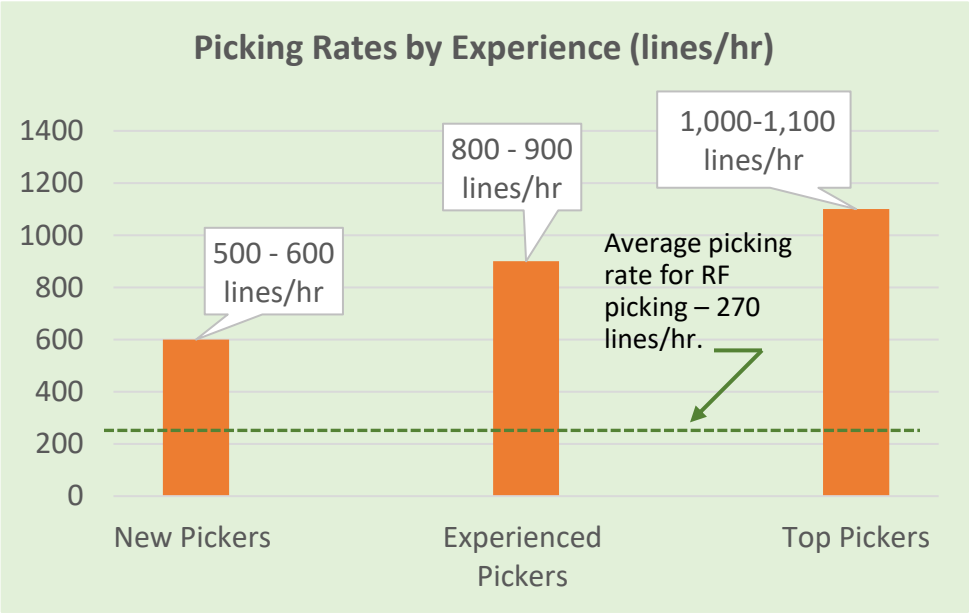


**Fig. 5** Picking Rates by Experience