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Robots are Being Overhyped for eCommerce

By FastFetch Corporation

Almost every trade magazine you pick up today has an article telling how great robots are for improving productivity in distribution centers (DCs). Many articles include photos and videos showing autonomous mobile robots (AMRs) moving down an aisle in a picking zone with claims of large increases in picking performance. AMRs are fine for some DC tasks in receiving and shipping, but with rare exceptions, they are poor choices and are being overhyped for fulfillment of eCommerce orders consisting of a few lines of mixed products. Most AMRs require a person to follow the AMR through a picking zone and, when the AMR reaches a target product location, the person must pick the product and to place it in a tote or shipping carton on or near the AMR. Some AMRs move to a zone where a picker is waiting. The picker then follows the AMR through the zone retrieving products and placing them into containers.

Problems are many but here are some of the most serious problems with AMR picking:

1. **Products with different shapes, sizes and surface properties.** AMR arms (if arms are part of an AMR) have end-effectors (the part that simulates a human hand and grasps an object) that are designed based on the properties of the items to picked. Suction cup end-effectors only work on non-porous, relatively flat surfaces. End-effectors that are suitable for picking large bottles of shampoo are unsuitable for picking small eyelashes. Human hands are flexible enough to pick a wide variety of item types so humans continue to be required for picking tasks.
2. **Multiple order (batch) picking.** Some current AMRs are capable of carrying 4 to 6 containers of limited size, based on the design of the AMR shelving, but are incapable of holding 50 or more containers of mixed sizes. This limitation constrains the degree of productivity that could be gained by picking numerous orders with a single trip through picking zones.
3. **Efficient packing into shipping containers.** Placing items into a dense configuration inside shipping containers during picking, in order to minimize wasted space, is beyond current AMR capabilities. Simple rearranging of items in a shipping container during picking is similarly infeasible.
4. **Large ratio of carts to pickers.** If pickers are assigned to zones to which AMRs travel to pick products, the ratio of AMRs to pickers must be high in order to avoid excessive picker idle time while waiting for AMRs to arrive. This ratio has been reported to be as high as 6 AMRs to each picker.
5. **Cost.** With the move to large numbers of micro-fulfillment DCs, expensive technologies are often prohibitive. AMRs are expensive compared to other available technologies that may produce better productivity.

An important question that should be asked when considering the use of AMRs for picking tasks is, ***"If a human must follow an AMR carrying a few orders or pushing a cart with a larger number of orders, is labor being saved? Why not just have a human push the cart?"*** One advantage of AMRs is that once picking of all orders on the cart has been completed, an AMR can move the cart to the packing/shipping area without human assistance. In many well-designed DCs, the packing/shipping area isn't far from the end of the picking area so this advantage may be minimal. In the past, Automate Guided Vehicles (AGVs) were used for take-away tasks, and some have called AMRs, ***"AGVs on steroids."*** If the distance between the end of picking and packing/shipping is large, a powered conveyor used for completed order carton/tote movement is often a better and less expensive choice.

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So, if one wants to improve eCommerce order fulfillment productivity, what are less expensive alternatives to AMRs? Several affordable methods and technologies should be considered:

1. **Batch picking with carts pushed by human workers.** If humans are required for picking, why not have them push batch carts with a large number of orders rather than walking behind an AMR with a limited number of orders? Walking is a healthy exercise!

2. **Light directed picking with lights on carts coupled with lights on picking bay locations.** New technologies now use a segment of LEDs on a picking bay to indicate a product is required for one or more orders on a cart. A numeric display on the top of the cart is used to indicate the aggregate quantity of the indicated product to be picked for all orders on the cart. Numeric displays adjacent to cart locations indicate how many of the picked product should be placed in each order carton/tote. Unlike moderately expensive pick-to-light technologies, these new LED technologies typically cost less than $200/shelf on picking bays, regardless of the number of product locations on the shelf.

3. **Put walls.** Some DCs have multiple, large picking zones or picking zones on multiple levels. Some companies use a picking method in which orders travel through all zones before being completed. This method results in large throughput times since the travel distances and corresponding times are large. Other companies use a method that divides orders into sub-orders that are picked from multiple zones simultaneously and ships each suborder in a separate carton. Both methods are inefficient and expensive.

   A better solution is to use a method called put wall fulfillment. In this method, a relatively large number of orders (e.g., 50+) are aggregated into a single "virtual order" during a bulk picking phase. Multiple carts are then dispatched to multiple partitions of the picking area to pick products in bulk for the "virtual order" into mixed product totes. Often the carts contain multiple totes targeted for multiple put walls (as described next).

   The bulk picking carts are then moved and unloaded next to "put walls" in a second phase in which the products will be separated (sorted) into individual orders. A put wall is a frame with a matrix of open-ends slots (like a set of cubby holes in a mailroom - if you're old enough to remember such things!) into which items are sorted. Each item from a mixed product tote is scanned and an LED segment (or numeric display) adjacent to the slot is illuminated, indicating the order slot into which the item should be placed. When the next item is scanned, the LED segment is extinguished and another LED segment is illuminated. When all items for an order in a slot have been scanned and placed in the slot, an LED segment on the rear opening of the slot is illuminated, indicating the slot is ready for packing. In some put wall applications, a light module displays the code of a carton ideally suited for packing. When the order has been packed, a license plate number (LPN) label is affixed to the carton and a barcode on the LPN is scanned associate the LPN with the order and to report the slot is available for reuse by another order. Multiple LED colors enable multiple pickers and packers to work on the same put wall.

4. **Pick Cells.** Pick cells are typically used for high volume order processing (e.g., 50,000+ eCommerce orders/day) where the number of different product types to be picked are limited (generally less than 200 or so depending on product size). With this method, products are stored in picking locations configured in a horseshoe shape so the last picking bay is across a narrow aisle from the first picking bay. Multiple pick cells, each containing identical products, are used to increase throughput.

   When an order container arrives at a pick cell, a container barcode is scanned and one or more lighted numeric displays in light modules are illuminated indicating where and how many of each product in the pick cell is required for the order. After each product is picked, a product or hand is placed near a flashing LED in the light module to trigger a light sensitive proximity switch to confirm the product was picked. After all proximity switches have been triggered, a special light module above a picking

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bay displays the word ***"DONE"***, indicating all products required for the order have been picked. The order container is then placed on a take-away conveyor headed for packing/shipping.

A powered, circular conveyor transports empty, barcoded shipping containers (e.g., cartons or mailers) to the set of pick cells aligned linearly alongside the conveyor. If a conveyor sensor adjacent to a pick cell detects a pick cell buffer (a short piece of conveyor that typically holds a small number of cartons) requires a carton, the next carton on the conveyor is diverted to the buffer. The conveyor control computer keeps the quantity of cartons in each pick cell buffer balanced so pick cells rarely become empty. This method is scalable since more pick cells can be added as volume increases without degrading performance.

AMRs may eventually overcome some of the problems described in this article but the likelihood of overcoming them in the next several years is small. In the meantime, existing, high-performance, low-cost alternatives should be considered as means of greatly improving DC productivity and accuracy. eCommerce won't wait!

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