MAKE ROBOTICS A REALITY IN YOUR DC
December 2018
Presenter

Matt Wicks

*Vice President, Product Development*

*Honeywell Intelligrated*

- More than 23 years of experience in the material handling industry
- Expertise in the areas of controls and software integration for high-volume manufacturing and distribution systems
- Extensive experience in the field of advanced robotic solution development, including robotic solution integration
- Bachelor’s degree in electrical engineering from the University of Missouri – Rolla (Missouri S&T)
- Currently serves as 2nd vice-chair on the Robotics Industry Association Board of Directors
- Registered Professional Engineer in the state of Missouri
Polling Question

What is your industry?

- Retail / e-commerce
- General warehousing / 3PL
- Robotic integrator
- Robotic OEM / robotic startup
- Other
Overview

Abstract

Increasingly scarce labor and demanding throughput pressures have distribution centers scrambling for ways to keep up with explosive e-commerce growth. These dynamic, unstructured environments have previously posed challenges too great for robotics, but not anymore. Thanks to key technology advances, a new generation of smart, increasingly capable robotics solutions have emerged as key productivity enablers in the DC.

This On The Move webinar will explore these advanced robotics and how they can drive efficiency in a variety of applications.

Key topics

• How AI and machine learning enable robots to see better, think smarter and act faster
• How startups, academia and integrated solutions providers serve the DC robotics market
• What new robotic solutions are on the horizon to solve challenges in the distribution center
CHALLENGES
Count The Touches

1. Goods arrive via container ships
2. Boxes are unloaded by hand
3. Boxes are sorted and scanned
4. Items are placed into putaway totes
5. Items are placed into storage

Product is available for online ordering
Count The Touches

Order is placed online

Two items are ordered
*(Typical Order Size)*
Count The Touches

6. Employee picks items in a batch*

8. Items are sorted into orders*

10. Items are packed into boxes*

11. Boxes are placed onto conveyors

12. Boxes are loaded into parcel trucks

Product is on its way to the customer

*Note: two touches are assumed, one for each item ordered
Count The Touches

1. Truck arrives at sorting hub
2. Parcels are unloaded onto a belt
3. Primary sort automated
4. Secondary sort automated
5. Sort to next line haul truck
6. Load line haul truck
Count The Touches

1. Truck arrives at local depot
2. Parcels are unloaded onto a belt
3. Primary sort manual
4. Secondary sort manual
5. Sort to route van
6. Load route van
Count The Touches

Parcel delivery to customer 21

Customer receives package
A Key Productivity Enabler, Primed for Extreme Growth

Robotics in the DC are vital to handle growing order volumes and overcome labor availability and resourcing challenges

- E-commerce distribution volume is accelerating at a rate of 25% annually.
- Industry growth outpaces the labor pool by a ratio of 6:1.
- Manual operation is today's norm for 80% of DCs.

Sources:
- eMarketer, internal analysis
- Datex Corp’s Labor Shortages in the Supply Chain Workforce presentation
- DHL’s Robotics in Logistics Study, St. Onge Company internal survey of customers
Labor By The Numbers

- Nearly 30% of the workforce is age 55 or older
- Cost to rehire ranges from 25-150% of an employee’s annual salary
- 600,000 warehouse jobs were unfulfilled in 2017
- Repetitive motion injuries costs employers $80 million annually
- Industry growth outpaces the labor pool by a rate of 6:1

**Five injuries per 100** full-time warehouse workers - over 50% higher than overall average

**Annual turnover rate for warehouse workers is 36%**

Source: U.S Bureau of Labor Statistics
Polling Question

What is the top consideration when evaluating the use of robotics in the warehouse?

- Labor saving / availability
- Reducing injury rates
- Productivity gains / quality improvements
- Other
Robotics Evolution

Technology advances enable robotics leap

- Vision systems
- Sensor technology
- Grasping technology
- Mobility
- Software
- Machine learning

Completely Unstructured
- Human equivalent degree of awareness and flexibility
  Analogy: Cars off-road, free range

Partially Structured
- Aware of and adaptive to surroundings
- Tasks follow pattern
  Analogy: Cars on roads

Completely Structured
- Little or no sensing
- Highly repetitive tasks
  Analogy: Trains on tracks

Logistics labor is mainly employed in completely unstructured and partially structured environments
ANNOUNCING THE ROBOTIC SOLUTION TO ADDRESS ALL THESE CHALLENGES...
ENABLING TECHNOLOGY
Background

Many of the applications we are working on today are not new ideas, but are just now viable because they address the challenges with speed and costs.

Technical improvements like:

- Sensor and vision technology
- Robotic mechanics
- Mobility
- Computational power
Sensor and Vision Technology

- LIDAR, structure light, stereo 3D cameras
- Force feedback, tactile sensors
- High resolution RGB imagery
- Sensor fusion – Multi-modal sensing (IR, Tactile, RGB, LIDAR, etc..)
Robotic Mechanics

- Soft robotics
- “Collaborative” robotics
- Advanced grasping, grasp planning
- Tactile sensors
Mobility

• Infrastructure free navigation - Simultaneous Localization and Mapping (SLAM)
• Battery technology
• Sensor integration
Robotic Mobility + Mechanics

Getting there…
Robotic Mobility + Mechanics

Getting there…
Computational Power

- Enables solutions to traditionally unsolvable challenges
- Complex algorithms can act very quickly
  - Computer vision
  - Motion planning
  - Grasp planning
  - Performance evaluation
  - Advanced simulations (physics based)
- Robotic applications require speed to be viable and achieve ROI
- Potential for predictive analysis for machine operation
Machine Learning / AI

- Human in the loop operation for training
- Integrated with Robotic Systems
Connected Robotics on a Single Platform

- Provides meaningful performance advantages and fewer operator interventions
- Identifies opportunities to make ongoing performance enhancements
MARKET APPLICATIONS
Robotics in the Warehouse

Warehouse Labor Expense

- Picking: 42.1%
- Replenishment: 10.7%
- Receiving: 2.9%
- Stocking: 16.6%
- Loading: 3.9%
- Indirect Labor: 11.1%
- Receiving: 2.9%
- Putaway: 8.3%
- Picking: 42.1%

- AGV Pallet Picking
- Full Case Slapper Line w/ Print and Apply
- Fluid Truck Unloading
- Mobile Full Case Pick
- Each Picking
- Mixed Load Palletizing
- Fluid Truck Loading
- Sorter Induction

Warehouse Labor Expense

- Packing/Checking: 6.2%
- Receiving: 2.9%
- Putaway: 8.3%
- Stocking: 16.6%
- Loading: 3.9%
- Indirect Labor: 11.1%
Robotic Palletizing

• Placing cases / totes onto pallets
• Placing cases into carts / vehicles (AGVs)
• Loading onto floors of containers trucks

Single-case pick
Multi-case pick, two load-build positions, vac tool
Row pick with vac tool
Row pick with “fork-and-clamp” tool
Robotic Depalletizing

Removing items from a pallet, cart or other type of container

- Semi-auto
- Multi-layer pick
- Layer pick
- Tigard “claw”
- Single-case pick
Robotic Loading / Unloading

Loading or unloading items from a truck, trailer or shipping container.

Robotic/Automatic

- Robotic unloader
- Articulated arm loader / unloader

Manual

- Belt vehicle loader traversing rails
- Roller vehicle loader traversing rails
Each / Item Handling – Robotic Order Fulfillment

- Each picking operations
- Multiple technology advancements required
- Robust vision algorithms for reliable, consistent object detection
- Equally robust motion and grasp planning systems
- Packing cube density challenges
Mobile Robotics – Order Fulfillment

- Fixed / roaming units (shuttle / AMR)
- Augment manual picking operations
- Goods-to-man retrieval (replenishment)
- Robot-to-robot handling (fulfillment)
- Mobile robotics for full load handling
- Replacement for long pallet conveyor runs – non-conveyable / low volume
Polling Question

Where do you see the biggest value for robots in the warehouse/fulfillment operations?

• Receiving dock
• Shipping dock
• Order picking (case / item)
• Unit load handling (storage / retrieval)
• Sortation
• Other
MAKE ROBOTICS A REALITY IN YOUR DC
Considerations for Deploying Robots

1. Recognize that much of the data for these applications does not exist and will need to be collected / understood

2. Pilot programs are critical to understanding the variability and determining the true value / ROI

3. Try to limit to the scope to keep the projects as structured as possible. Constrain the variables / applications

4. Understand what these solutions can / cannot do – It’s easy to over estimate the capabilities of robotic solutions (thanks YouTube)
Selecting a Robotic Integrator

- Should have extensive knowledge of automation in the industry
- Deep understanding of robotics across the organization
- Has a plan and can execute to it
  - Good pre-order service is an indicator of post-order service
  - Complete proposal with attention to detail
  - Installation and commissioning are two different skills; do they have both?
  - Professional project management

- Reputation
  - What kind of references do they have? Are they offering to take you to installations?
  - Are they RIA certified?

- Size matters
  - Can the company successfully execute more than one project at a time?
  - Financial security

- Remember, you are buying a system, not just a robot
Questions?