Robotic Piece-Picking from Automated Storage

Presented by:

Chris Lingamfelter, White Systems
Yaro Tenzer, RightHand Robotics
About White Systems

Chris Lingamfelter
President, White Systems

Holding leadership positions in both Europe and the Americas for leading MHE companies, including Intelligrated, Dematic and Kiva Systems (now Amazon Robotics), he has extensive experience in logistics software consulting and sales. He has also developed innovative hardware and software systems, sold complex supply chain solutions, cultivated long-term client relationships and managed multi-national strategic sales teams.
About RightHand Robotics

Yaroslav Tenzer, Ph.D
Co-Founder, RightHand Robotics

Fluent in three languages and holding a Ph.D in Medical Robotics, Yaro Tenzer, is Founder of RightHand Robotics, Inc. Mr. Tenzer is a Post-Doctoral Research Fellow. His affiliations included Harvard Biorobotics Laboratory and Harvard School of Engineering andApplied Science Cambridge, MA. He is the co-founder of two robotics companies and on the forefront of grasping and piece picking from unstructured environments.
About White Systems

The leader in Automated Storage And Retrieval Systems
About White Systems Solutions

INTEK
A SencorpWhite Brand

Solutions

MHI
THE INDUSTRY THAT MAKES SUPPLY CHAINS WORK
Horizontal Carousels

• Introduction
Horizontal Carousels

- Light directed picking
Horizontal Carousels

- Universal Pod
Horizontal Carousels

- Multiple Pods
Horizontal Carousels

- Multiple Pods
Horizontal Carousels

• Multiple Pods
Horizontal Carousels

- One touch applications
Storbot AS/RS – Tote Shuttle System
Storbot AS/RS – Tote Shuttle System vs. The Competition

- A typical shuttle system is $1M per aisle which yields a 2x up front cost comparatively – based on client and consultant feedback.
- A typical shuttle system has 20x more mechanical apparatus.
- This 20x mechanical apparatus results in approximately 70% higher long term cost of ownership – based on client and consultant feedback.
- The StorBot AS/RS Tote Shuttle System can perform 540 Cycles per hour per Storbot, which equates to 270 deliveries per hour per Storbot. This makes the system entirely scaleable to meet the pick rate demands of the remote pick stations.
- The White Storbot AS/RS – Tote Shuttle System outperforms typical shuttle systems and far outperforms Autostore – based on client feedback.
- The White Storbot AS/RS – Tote Shuttle System outperforms Autostore in every category and is more competitively priced than Autostore for systems < 8,000 totes – based on client feedback.
Software

- Architecture Options
Vertical Lift Modules
Vertical Lift Modules

• Multi & Single Column
Vertical Lift Modules

- Multi-column configuration
Vertical Lift Modules

- Outdoor
Vertical Lift Modules

Interactive display

- Interactive
- Ergonomic
- Simple
- Accurate
Vertical Lift Module

Silo 2
146 trays 76.89”x35.31
Tray storage height 6.89
1580 cuft total storage
2 Iride interactive displays
Windows 10 PC
$152,500

Silo XL
80 trays 258”x30.75”
Tray storage height 4.92”
1808 cuft total storage
$200,000 installed
Vertical Carousels

Models

- Microvert
- MiniVert
- Model 2100
- Model 2200
- Model 2400
- Model 3600
The Piece Picking Solution
World-Class Team Tackling Each-Picking

Won DARPA Autonomous Robotic Manipulation Program (2012) while at Harvard

Launched TakkTile LLC, sales in 15 countries, 5 continents (2013)

Customers include NASA, JPL, MIT, Boston Dynamics, Stanford, & Google

RightHand technology around the world
Video of the System

- https://www.dropbox.com/s/378qsf41gop3637/SELF18_RHR_Video.mp4?dl=0
Target Industries

- Health & Beauty
- Pharma
- Apparel
- Food retails / Grocery
- Electronics and Consumer
Robotic Piece-Picking Solutions
How to think of performance

Range
100,000s of SKUs to handle
+
Rate
items must be picked rapidly
+
Reliability
>99% accuracy for manual labor
Our Approach

Grasp Intelligence

Model-Free Computer Vision
- No item-model / item-scanning required
- Works across seasonal packaging

Smart Gripper
- Soft mechanism adapts to complex items
- Sensor feedback enables system to learn

Grasp Intelligence
- Cloud-connected software backend
- Grasp new items using past experience

Smart Gripper

Computer Vision
### 3Rs – Background Technology

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<tr>
<th>Range</th>
<th>Rate</th>
<th>Reliability</th>
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<tr>
<td>- Support different grippers</td>
<td>- Vision processing super fast (&lt;150ms)</td>
<td>- Monitoring of sensors</td>
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<tr>
<td>- Combination of Suction + Fingers</td>
<td>- Path planning for robots</td>
<td>- Tactile and force sensors</td>
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<td>- Change suction cups as needed</td>
<td>- Recovery and retry</td>
<td>- Validation of placement</td>
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<td>- Learn from mis-picks</td>
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Getting better as a fleet

Range of Objects
- Learning across tasks
- Share experience between robots
  - Shared experience enables range of objects

Rate
- Analyzing repetitive tasks helps optimize performance

Reliability
- Past experience improves reliability
Things to consider to determine readiness:

| SKUs | Workflows | ROI |
What can robotic piece-picking handle today?

**GREAT if items:**

- With some opaque packaging
- Can be comfortably held with one hand

**NOT great if items:**

- Very transparent or porous
- Very large or heavy
Workflow: Kitting
Workflow: AS/RS
Workflow: Sorter Induction
Workflow: Put Wall
Workflow Examples

• Kitting
• AS/RS (vertical storage) system
• Sorter Induction (E.g. Bombay, Pouch, etc)
• Audit (pick + barcode validation)
• Sorting (e.g. Put wall)
Video with White Systems

- https://www.dropbox.com/s/d5y87hz0yovqwpc/SencorpWhiteBoothVid_02.mp4?dl=0
For More Information:

Speaker email: clingamfelter@sencorpwhite.com
Website: www.whitesystems.com

Speaker #2 email: yaro@righthandrobotics.com
website: www.righthandrobotics.com

Or visit MODEX Booth B3069 (White) & B4087 (RHR)