Robots in Warehousing

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Potential for explosive growth!

Mature market, limited growth

Advanced tooling and software for palletizing, layer pick

Mobile robots for storage & retrieval

Explosive market growth

Disruptive technology change!
Key Drivers for Warehouse Automation

- Supply chain benefits
- Capital and operating costs
- Operational constraints
Traditionally, robotics focused on manufacturing.

Over 2/3rd cost of goods on the shelf due to supply chain costs.

Even with off-shore manufacturing, supply chain is largely domestic.

Supply chain costs have greatest growth rates:
- Labor
- Workman’s comp
- Fuel
Source to Customer Supply Chain

- Factory
- Distribution center
- Order fulfillment center
- Import
- Home delivery
- Store formats
Software Used to Make Humans Work Faster

Manual case pick & palletize

Manual “pick to light”
Handling Diverse SKU Mix Required

Case Induction from Pallets

Case Storage & Selection

Mixed Case Palletizing

Cases or Layers

Cases in Sequence

Number of SKU's

Grocery / retail

Beverage
Layer Pick Tool Approaches

Mechanical bottom support

Peripheral sealed vacuum
Customer Requirements: store-friendly pallets
High SKU count mixed case palletizing
Traditional solutions for automated picking

- Pallet handling automation
- Case handling automation
- Item picking automation
Mobile robot explosion!
Why disruptive?

- Inflexible
- High

- Fixed cranes
- Fixed layout
- Fixed business model

- Low
- Flexible

- Capital cost
- Ops cost
- Space
Why disruptive?

Easy to re-configure
  • Change in SKU mix or velocity
  • Change in business model

New algorithm challenges
  • Replace fixed hardware with flexible software
  • Leverage research on autonomous mobile robots
Mobile robot system characteristics

- 2D vs. 3D layout topologies
- Variable vs. fixed storage spacing
- Manual vs. automated product handling
- Sequencing vs. non-sequencing product flow
Applications for sequenced product flow

- Truck loading
- Robot palletizing
- Batching for customer orders

Biggest challenge to system throughput
Interface to warehouse information systems
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Two transformational trends

Mixed SKU at factory

Multi-channel DC

Import

Store formats

Home delivery
Transforming urban delivery

- Enabled by small footprint, low operating costs
- Transportation savings
- Fast, flexible delivery
Contact Information

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