(Towards) Autonomous shuttles in automated material handling systems

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Joost van Eekelen | Hannover Messe – CPSoS The Next Challenge
Reliable partner for value-added automated material handling solutions

Baggage handling

Warehouse automation

Parcel and postal
About Vanderlande: Company profile

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<th>Global market leader</th>
<th>Established since 1949</th>
<th>3,900 employees</th>
<th>1 Billion turnover</th>
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<td>innovative systems</td>
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<td>intelligent software</td>
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<td>life-cycle services</td>
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### Baggage Handling Systems
- **8.8 million bags per day**
- **600 airports including 14 of the world’s top 20**
  - Atlanta Airport
  - London Heathrow Airport
  - Hong Kong Int. Airport
  - Amsterdam Airport Schiphol

### Warehouse Automation
- **12 of Europe’s top 20 e-commerce companies**
  - Amazon
  - TESCO
  - Zalando
  - ASDA

### Parcel and Postal Services
- **20 Million parcels sorted every day**
- **4 largest parcel and postal companies**
  - UPS
  - Deutsche Post DHL
  - TNT
  - FedEx
Joost van Eekelen

- Mechanical Engineering MSc at the Eindhoven University of Technology

- Systems Engineering PhD at the Eindhoven University of Technology

- Vanderlande (Veghel, The Netherlands)
  - Logistics Simulation Engineer (2007-2011)
  - System/Product Architect (2011-)

- Expert in
  - Systems modeling (abstract, conceptual)
  - Algorithmics
  - Robotics
Warehousing – order fulfillment strategies

**Man to goods**
- Heavy work/lifting
- Dangerous

**Goods to man**
- Ergonomically friendly

How to deliver the goods to the workstation?
ADAPTO shuttle

- Automatically stores and retrieves totes with products/parts
- Moves in 2D through racks
- Uses lifts to reach other levels (→ 3D)
- Is re-charged inside the lift
- Uses WiFi to communicate with central controller

CPSoS ?

- Dynamic reconfiguration (addition/removal of shuttles, e.g. for maintenance)
- Many interactions, both “cyber” and “physical”.
- Partial autonomous: motion control
ADAPTO Big Five

Scalability
- Step by step expansion
- Throughput flexibility
- Layout flexibility

Availability
- System availability
- Product availability
- Fast trouble shooting

Cost Efficiency
- Modular design
- Lower footprint
- Lower operational costs

Maintainability
- Off-line maintenance

Sustainability
- Reusable and recyclable materials
- Low energy consumption, little moving parts
CPSoS challenges & opportunities

> Awareness
  - Shuttles are aware of each other via Central traffic control. This has its limitations.
  - Future possible extension: have shuttles communicate/collaborate with each other to increase density.

> Shuttle sharing
  - Some companies have seasonal peaks. A ‘common shuttle pool’ might be an interesting business model.
  - Consequences for interoperability, product generation compatibility, ease of re-configuration.

> Predictive maintenance
  - Use sensor (big!) data to predict failures and schedule preventive maintenance, instead of periodic maintenance.

> Sustainability
  - Make shuttle even more light-weight.
  - Upcoming battery technologies.
Many thanks to ...

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> Professor Sebastian Engell
> Doctor Michel Reniers
VANDERLANDE