An intelligent bin system for decentrally controlled intralogistics systems in context of Industrie 4.0

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Control of intralogistics systems
Requirement for decentralized control systems

**Industrie 3.0**

- Predefined material flows based on predefined, standardized processes
- Intralogistics system based on complex, centralized material flow controller architectures

**Industrie 4.0**

- Regulation and reconfiguration of the material flow required at any point of the material flow system → Decentralized control systems → hybrid decision making
- Intralogistics system is composed of cooperating functional units (entities) of conveyor modules, transport units and (software) services

**Challenge:** Real-time configuration, control and decision making based on intelligent logistic entities
Logistics in cyber-physical production systems
State of research

Control of versatile material flow systems
- Replacement of central material flow computers with decentralized control systems [BUL 2007] [GÜN 2008b] [GÜN 2014]
  - Reduction of system complexity
  - Increase of versatility and responsiveness of material flow systems can be increased
- The basis for decentralized material flow control are cooperating functional units (entities) of conveyor modules, transport units and (software) services [GÜN 2008a] [GÜN 2014]

Decision making
- decision making and optimization of the system is done proactively and iteratively within autonomous controlled systems [KÜH 2015]
- Hybrid decision making: Interactive human-machine decision making combining the specific capabilities of humans and machines synergistically [KÜH 2015] [BOU 2011]

Intelligent bins
- Transcontinental level: Smart standard ISO Containers to track position and condition of goods [LAN 2011] [CHU 2016]
- Small load carrier level: “iBin” integrated into industry service for c-parts and “inBin” prototype of Fraunhofer IML [GÜN 2014]

- The logistical object takes over the tasks of information processing, decision making and execution [HÜL 2006] [NEU 2006]
- Capability to capture, feedback and evaluate events [WIN 2006]
### Intelligent bin system

#### Intelligent bin module building set

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<th>Parts</th>
<th>Bins</th>
<th>Standardized component</th>
<th>Adaptable component</th>
<th>Hardware</th>
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- Decentralized data storage
- Coupling of material and information flow
- Cooperation/Communication with other logistic entities
- Enabler for centralized material flow systems

**Microcontroller**
- WiFi
- Build in LiPo Charger
- Loudspeaker (ultrasonic based location)

**Hardware**
- Sensors
- Actuators
- Displays (3D printed)
- Inlays
Intelligent bin system - Future fields of application
Decentralized, autonomous material supply & Decentralized assistance

Set creation / Order picking

Integrated assembly assistance

Autonomous material transport

Autonomous manufacturing execution

Manufacturing (Self) Execution
- Integration of legacy systems and specialist systems
  - Simulation
  - Personnel planning
  -...

Visualizer
Coupler
/MDC
Prioritization
Event Channel
Relay

Machine-Machine Communication

Cf. Prof. G. Bitsch
ESB Logistics Learning Factory

Vision: Decentralized control of cyber-physical logistics system

Establishment of a CPPS scenario at ESB Logistics Learning Factory


Embedded in various research projects
Thank you for your attention!

Questions

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