Cyber-Physical-Production-Systems at the BTU Model Factory
Cyber-physical production systems

- Significant efforts are under way in the development and implementation of Cyber Physical Production Systems
  - Exploiting fast and highly connected production systems
  - Combining them with novel industrial communication strategies

- Need for reconfigurable approaches in production planning, logistics and manufacturing execution control
  - Solutions are proposed in several industrial application sectors
  - Includes distributed production environments

- Methodology and physical building blocks and components are being tested and validated in several R&D projects
R&D application results at the BTU Cottbus-Senftenberg

- Semi-automated handling of complex geometrics in hazardous environments
- Laundry logistics and shop-floor automation in conjunction with RFID systems
- Production of small lot sizes in particular assembling processes
Semi-automated handling of complex geometrics in hazardous environments

- Solution for opening rail tank car caps
- Sensor-controlled industrial robot technology
- Visual intelligence
  - Pattern matching
  - Pattern analysis
- Adaptive algorithm and parameter databases
- Visual teaching for different caps of rail tank cars
Variants of rail tank car caps

- Four tommy screws (DIN 12561-6)
- Iron strap with screws
- Special designs

75 %
10 %
15 %
Steps of position detection

- Detection of rail tank car
- Detection of cap
- Detection of tommy screw position
- Detection of tommy screw attitude
Robot gripper for tommy screws

1. Tommy screw adapter
2. Plain bearings
3. Gripper housing
4. Compressed air motor
5. Flexible mounting for magnetic gripper
6. Pneumatic operable magnetic gripper for cap opening
Semi-automated equipment of rail tank car loading station
Laundry logistics and shop-floor automation in conjunction with RFID systems

- Robot technology significantly cheaper
  - Usage in laundry logistic increasing
  - Improved adaptation by highly integrated sensors
- Focused on the area of consignment
- For a consignment with a large throughput, a technical assistance of robots is required
  - Sensor-controlled gripper adaptable for stack size
  - RFID system that gives information of the exact position of the laundry pile
  - Process data acquisition with self-adapting report functions to fix process errors by low qualified staff
Current Consignment

- Manual movement of stacks and manual loading of containers
- RFID used in slides and in reader station
RFID requirements for usage in automatic laundry systems

• **Requirements**
  - Area-wide use of different RFID transponder
  - Certain identification of objects

• **Transponder properties**
  - Passive
  - UHF Transmission frequency (865-950 MHz)
  - Group detection
  - Transmission range < 6m
  - Pressure resistant in dewatering press
  - Temperature and pressure resistant for flatwork
  - Usage of at least 200 wash periods
  - Price under 50 cent
Consignment in future laundry systems

- Cleaned laundry will be stored and sorted locally
  - Cleaned laundry
  - Rental laundry storage
  - Custom laundry storage

- UHF-labeled laundry will be automatically removed and put together

- Optimized pack schema under consideration of completeness and further constraints
RFID-based consignment of laundry piles

- RFID reader
- Autonomic transport vehicle
- Transport belt
- Robot
- Laundry container
- Loading
- Scan der Container
- Shipment
Production of small lot sizes in particular assembling processes

- Fast switching between different products
- Easy creation of new programs without specific programming knowledge
- Handling of loosely delivered small pieces
- Assembling process with small tolerances between components
System architecture

- Image processing
- Part separation
- Sunrise controller
- Tools
- Assembly
- Product matrix
- Work order
- Display/programming
- Motion commands
- Measurements/status
- Assembly sequence
- Status/progress
- Identified parts/coordinates
- Status
Production cell

- cameras
- touch panel/GUI
- pneumatics and I/Os
- robot controller and PLC
- tool magazine
- 8 + 4 boxes
- spool magazine
- controller screw gun
Innovation Centre Modern Industry Brandenburg
Functions of the Innovation Centre

- Consultation and awareness of digitization and automation
- The main target group: small and medium enterprises (SMEs)
- Model factory to illustrate the possibilities and benefits values
- Future-oriented Information: and Presentation Offers
- Preparation of transfer payments and implementation projects
- Demand actuated transfer of knowledge to SMEs
Support of small and medium enterprises

Securing the Innovation and Competitiveness Ability of the Industrial SMEs in Brandenburg

...though the promotion and implementation of a „Modern Industry“

Showcase-function → Consulting and transfer

Laboratory and functional knowledge
Model Factory

Visitation:

- Technologies, systems and procedures
- Reference projects
- Application scenarios
Contact us

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