Production2036

Well-defined

Value network modelling for the software-defined resilient production of the future

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Motivation and Research Focus

Motivation

• Static supply chains, static product models
  • Non-resilient supply chains – Market Shock
  • Conflicting Objectives (e.g. manufacturing process) are chosen once and forever
  • No tech push possible
• Proprietary, sometimes manual interfaces between organisations
  • Low reusability
  • Consistency problems due to different models
  • Limited flexibility

Research Focus

• Platform for controlling a value chain (Value Chain Execution System)
• Associated modelling of the semantics and validation on demonstrators
Vision and project objective

Vision

- Sustainable, cost-effective and self-optimized production
- Creation of resilient value networks to minimize delivery failures
- Resilience on the shop floor by increasing the security and availability of resources
- Humans as central decision-makers in the distributed, highly complex value creation network

Project objective

- Establishment of a value network with a Value Chain Execution System (VCES) consisting of three interconnected individual physical demonstrators
- Comprehensive communication of the individual demonstrators via the VCES with secure communication between the demonstrators using Catena-X
**TP 1:** Data model and specification requirements for Industry 4.0 as a Service and products

David Dietrich (ISW)

**TP 2:** Adaptive Value Chain Execution System for flexible Industry 4.0-as-a-Service orchestration

Werner Lober (DXC)

**TP 3:** Construction of a model factory for the assembly of an electric steering system

Dr. Daniel Ewert (Bosch)

**TP 4:** Production of an adaptable car body component

Anwar Al Assadi (IPA)

**TP 5:** Shared safety for autonomous and self-sufficient AGVs in flexible environments with changeable safety zones

Daniel Schmidt (Bär)

**TP 0:** Project Leader

Manuel Zürn (ISW)
Motivation
• Rigid value chains with a lack of resilience
• Proprietary and inconsistent interfaces between organizations

Objective
• Data model of a value network for the representation of production systems and flexible products
• Specification for Industry-4.0-services to describe a standardized application profile for the orchestration of value networks

Work packages
• WP1: Value chain data model
• WP2: Specification of Industry 4.0 services
• WP3: Enabling the human being
• WP4: Flexible product modeling
• WP5: Validation
TP 2: Adaptive Value Chain Execution System for a flexible Industry-4.0-as-a-Service Orchestration

Motivation
• Increasing interconnection of participants on the market without overarching control
• Distributed concepts of production require standardization of information structures and services

Objective
• Setup of an adaptive VCES system as evaluation platform to control the overall value chain
• Flexible combination of production services based on changing targets and criteria

Work packages
• WP1: Requirement and conceptual design of the VCES
• WP2: Setup of infrastructure
• WP3: Development of adaptive VCES
• WP4: Research on flexible methods
• WP5: Validation by means of use-cases
TP 3: Setup of a model-plant for the assembly of a electronic steering system

Motivation
• Overall optimized control of a production facility that is part of an overarching value chain.

Objective
• Design and implementation of an existing assembly line as a model factory
• Design and implementation of interfaces and data models

Work packages
• WP3.1 Analysis of the existing assembly line
• WP3.2 Modeling of derived Industry 4.0 services
• WP3.3 Implementation of Industry 4.0 services
• WP3.4 Inspection station for quality control and qualification
• WP3.5 Design of human-centered coevolutionary processes
• WP3.6 Integration into overarching material flows
• WP3.7 Evaluation of sustainability-optimized control
• WP3.8 Validation and evaluation, documentation
Motivation

• Component changes and model maintenance measures cause effort in robot programming

• Information gap between the CAD-CAM process chain and robot programming (assembly)

Objective

• Provision of component design and integration of change management

• Development of an adaptive CAD-CAM process chain including robot programming

• Learning robot programs in the simulation

Work packages

• Definition of requirements and concept for production

• Development of an adaptive CAD-CAM process chain based on interlinked production modules

• Component-dependent placement and assembly processes in a clamping device

• Flexible robot-based assembly automation of car body components

• Validation of the flexibilization processes and profitability analysis
Motivation
- Security measures must be configured manually on an individual basis. Cost-intensive safety elements must be provided in every AGV.
- Inflexible docking options to systems.

Objective
- Situation-dependent safety aspects of a mobile system in a changing production environment.
- Simplification and flexibilization of docking processes to production facilities.
- Software and hardware interface development for AGV orchestration.

Work packages
- WP1: Conception of a standardized interface for AGVs for the adaptable transfer of functions.
- WP2: Hardware-neutral safety.
- WP3: Integration into the value chain.