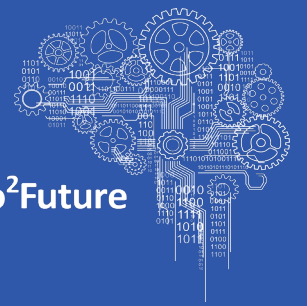# AUTOMATED PROCESS DEVIATION DETECTION
Human-Intensive Assembly Processes
Based on indirect and incomplete shopfloor observations

Pro²Future

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MOTIVATION & GOALS

- The move towards high customizable products in small lot sizes at the costs of mass production.
- **Assembly workers** remain an **integral part** of production systems assuring flexibility on the shopfloor. They perform subtle **optimization techniques** to overcome minor disturbances on the shopfloor.
- It is necessary to **monitor** the production process for **timely detection of deviations**.
- Legal regulations and union policies often limit the use of sensors for direct observations of human activities.
- Assembly process monitoring needs to rely on **indirect and incomplete observations** from the shopfloor
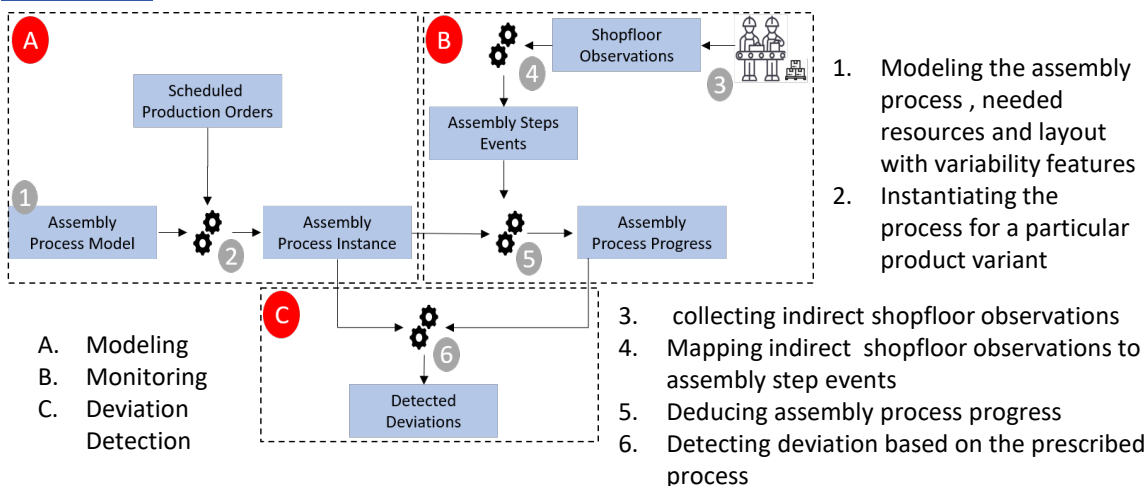
Project FactBox

Project Name A2PS
Project ID MFP 2.5-1
Duration 21 Months

Area 2
Cognitive Robotics & Shopfloors

Project Lead
Dr. Christoph Mayr-Dorn

APPROACH

1. Modeling the assembly process, needed resources and layout with variability features
2. Instantiating the process for a particular product variant

A. Modeling
B. Monitoring
C. Deviation Detection

3. collecting indirect shopfloor observations
4. Mapping indirect shopfloor observations to assembly step events
5. Deducing assembly process progress
6. Detecting deviation based on the prescribed process

CONTRIBUTION

Scientific contribution
A flexible modelling approach for human-intensive assembly covering assembly layout, resources and assembly processes in all variants.
A privacy-respecting monitoring and deviation detection approach based on indirect and incomplete observations from the shopfloor

Economic contribution
An insight on the assembly progress on the shopfloor and a deviation analysis cloud dashboard based on privacy-respecting shopfloor observations.

RESULTS

- Evaluated based on **real assembly data** from our industry partner Wacker Neuson
- Using Part Picking events as indirect observations, our approach is able to predict step completion times for key steps accurately within **1,12% of the assembly tact time**.
- We correctly identify **89%** of the **delaying steps, 71%** of the **delaying stations**.
- The approach is able to detect the sequence deviations with the error of **0.07** for one station and **0.33** for another (depending on the station's flexibility and constraints)
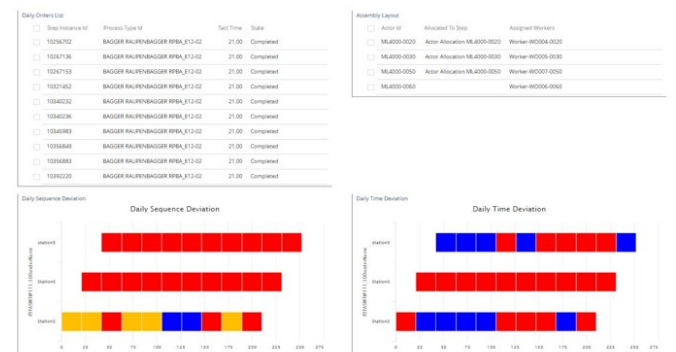
A Fabasoft cloud dashboard summarizing the daily scheduled processes progress and the detected deviations (sequence deviations, delaying steps and delaying stations)