

IoT at Stena Industrial Innovation Lab

Magnus Åkerman

Omkar Salunkhe

Olivia Stensöta

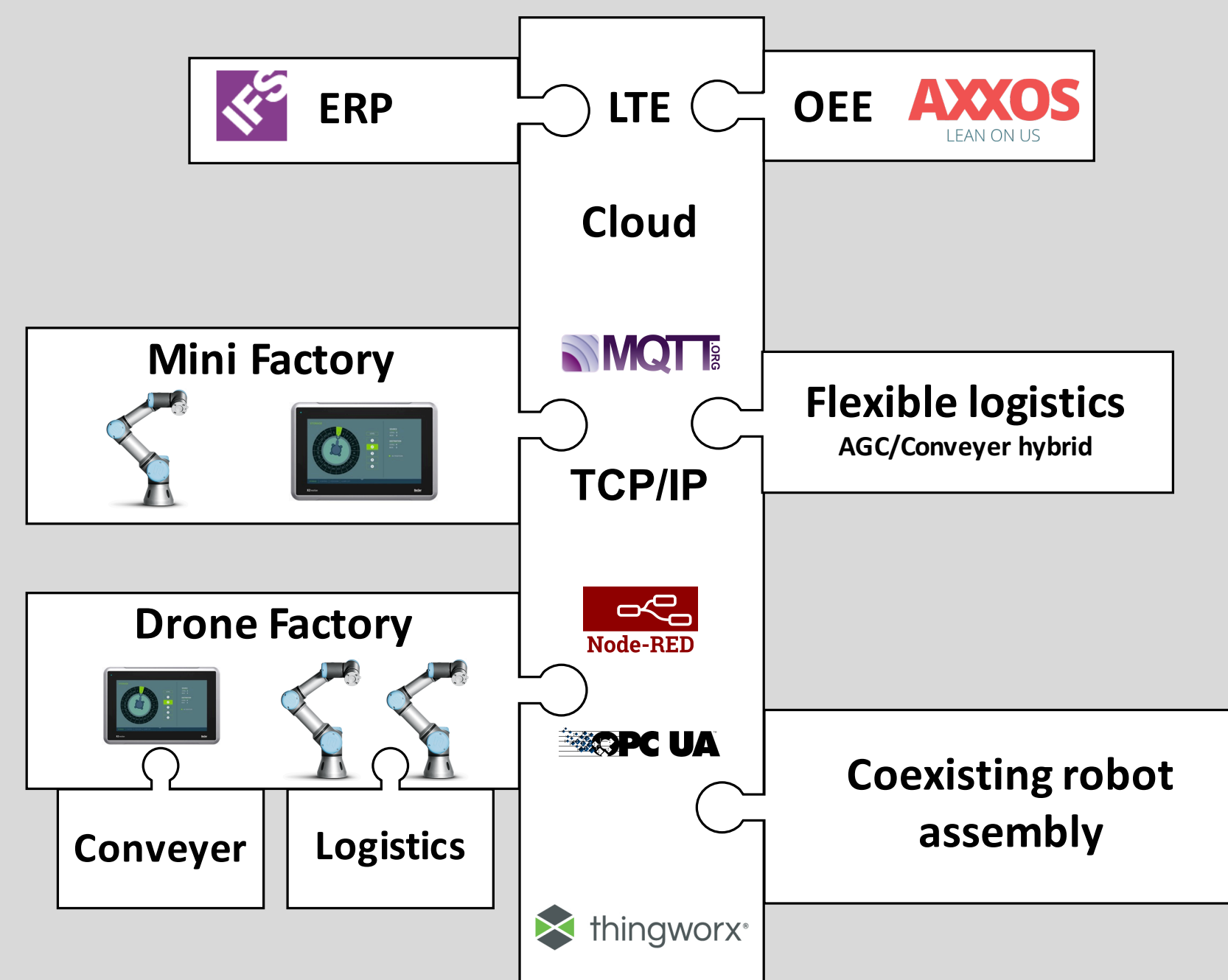
Åsa Fasth-Berglund

Concept

At Chalmers and the Stena Industrial Innovation lab, a realistic production system, with focus on human-centered assembly and logistics, is being built using current state of the art IoT technologies. The system architecture is built around the IoT platform Thingworx that enable modularized and event-driven systems.

Picture: Architecture at SII-Lab. More info: Åkerman, M., Fast-Berglund, Å., Halvordsson, E., & Stahre, J. (2018). Modularized assembly system: a digital innovation hub for the Swedish Smart Industry. Manufacturing Letters. doi:10.1016/j.mfglet.2018.01.004

System Architecture



Modularized

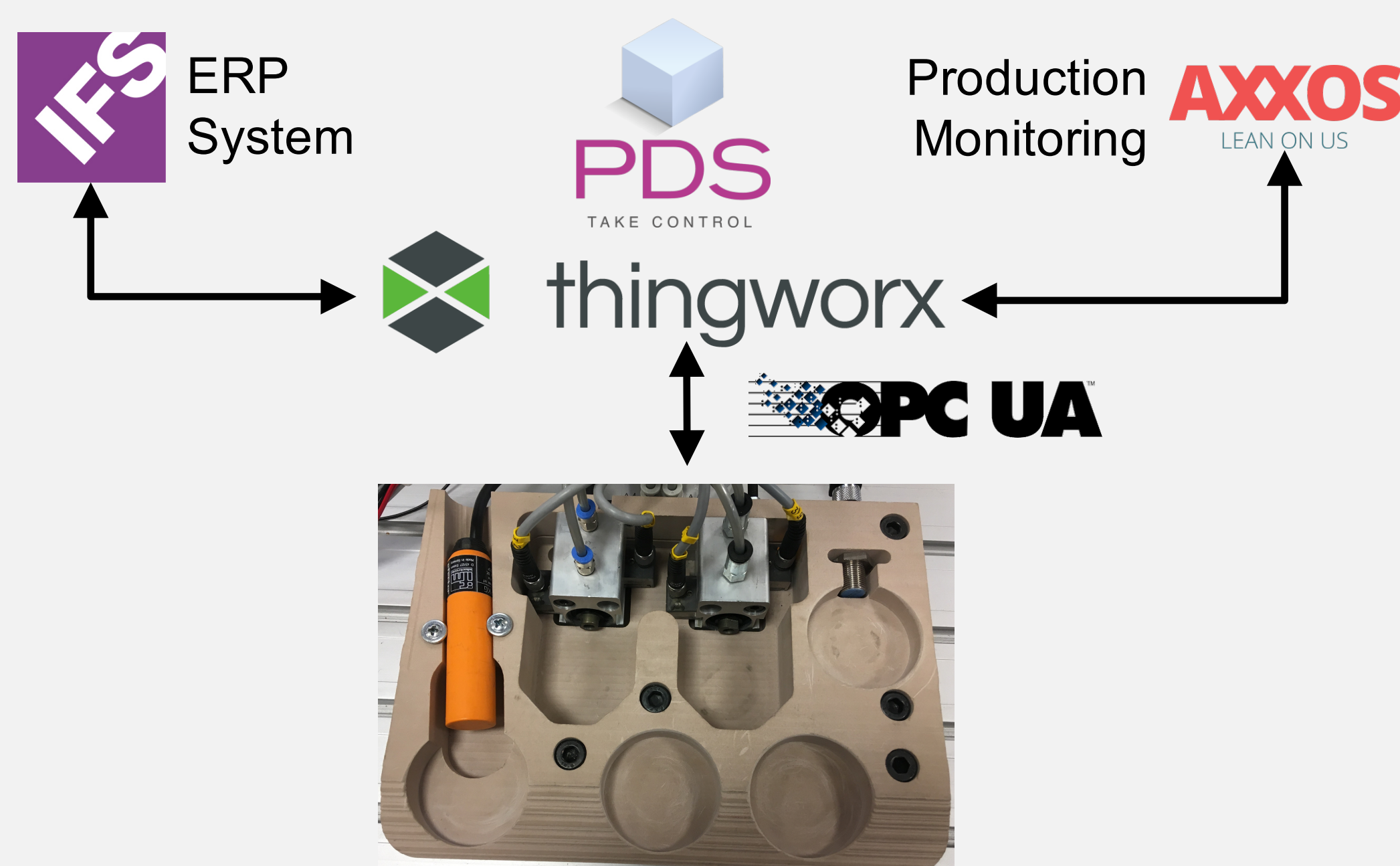
Each subsystem is built up independently with a clear interface. Such modularization increase reconfigurability and general system flexibility.

Event-Driven

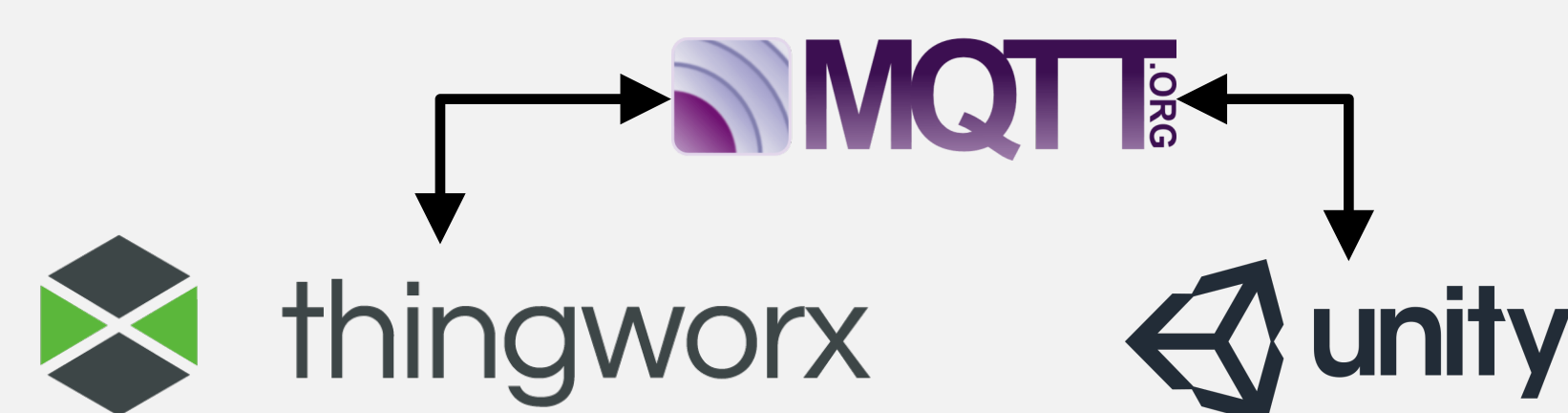
In event-driven systems, functionalities are triggered by internal or external events rather than following a pre-determined plan. This allows more advanced functionality to emerge, a prerequisite to realize the vision of Industry 4.0.

Mini Factory Demonstrator

The very first demonstrator is fully developed based on a robot training setup for students. The system consists of a collaborative robot that moves a “product” between four ”stations”. The Mini Factory demonstrator interconnects this physical system with common software such as an ERP system (IFS) and a production monitoring system (Axxos). Through relatively simple mashups in Thingworx it is possible to plan current orders and view real-time events in the web browser.



Current Implementations

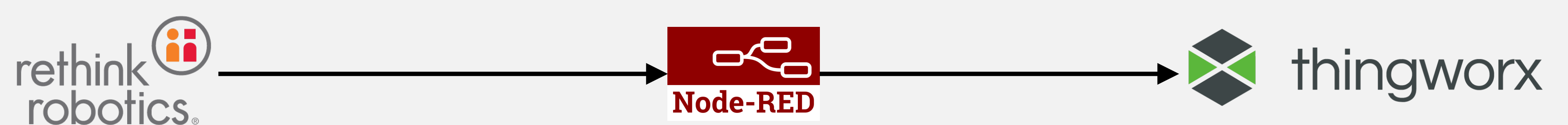
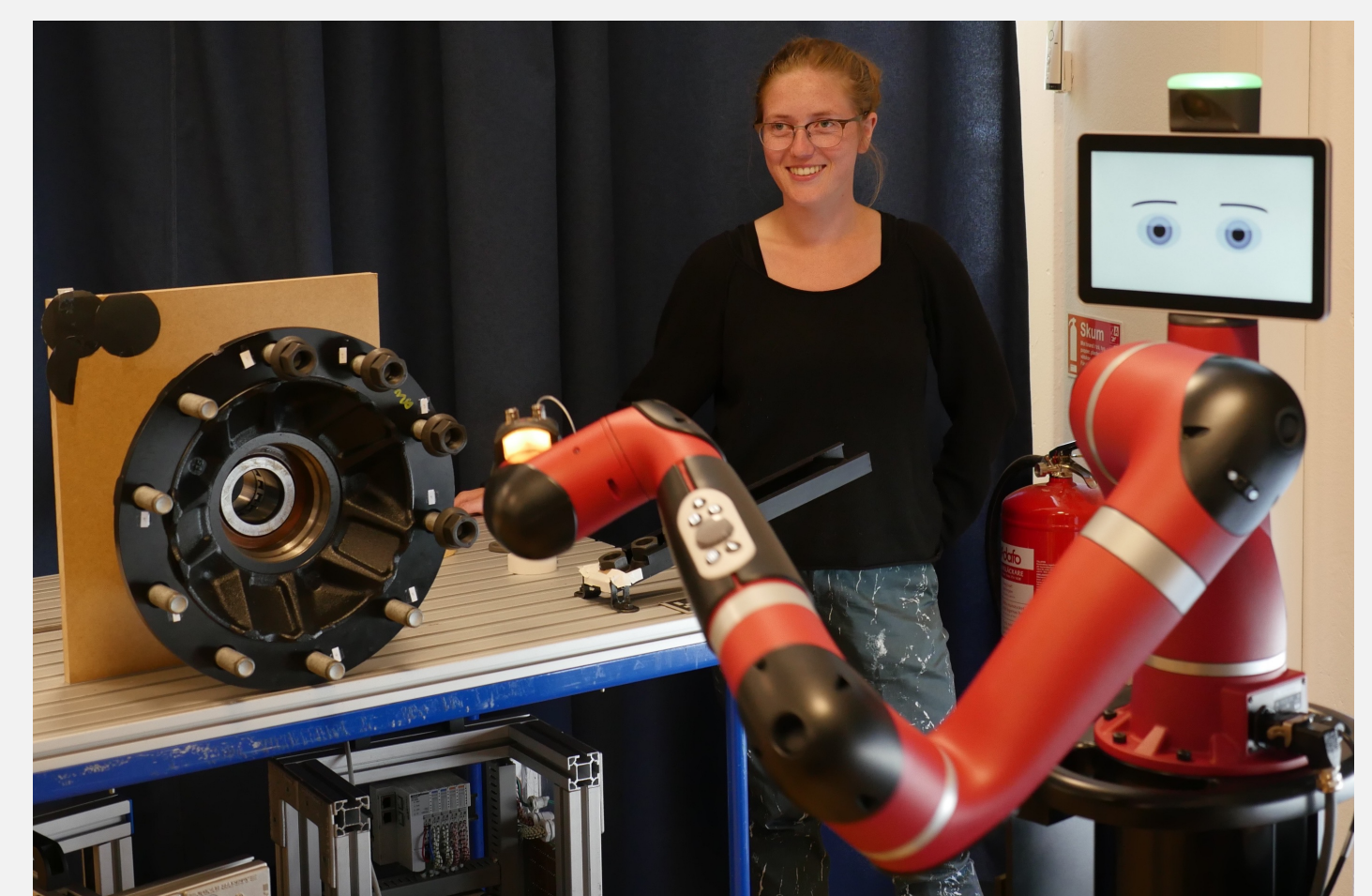


Realtime Data in VR

The status of production can be visualized in meeting rooms by connecting VR model with the production environment/digital shadow. This is achieved by letting the VR application, created in Unity, subscribe to MQTT messages published by the IoT platform.

Cobot Experiment

In an experiment we are conducting together with Volvo Trucks we let a Sawyer robot do the entry for all the nuts during wheel assembly. The purpose is to measure how accurate and fast this task is which requires a multitude of measurements. We utilize the IoT infrastructure to constantly measure both time and quality. The setup was easily created by interconnecting Sawyers built-in TCP connectivity support, Node-RED, and Thingworx.



Drone Factory

A full scale production system is in the making that will produce drones. Using a real and customizable product is important to really emphasize the importance of reconfigurability and modularization. The components of the Mini Factory will be scaled up and the simulated factory is replaced with a conveyor, four assembly cells, logistics, and manufacturing.



Future Implementations

Cobots with real-time feedback

Building on the robot nut entry experiment, multiple robots will be connected to IoT platform for demonstrating and testing real-time feedback loop for assembling nuts at the Volvo Trucks assembly. The idea is that to have multiple cobots self-adjusting according to product variant (different number of wheels). The quality measurements (currently used for experimentation) that are scaled can also be used to trigger certain corrective actions.