Demonstrator description – Hogeschool Zuyd

QRM demonstrator supported by smart dashboards and Machine Learning Techniques

Location: Zuyd University of Applied Sciences, the Netherlands

Goal

The primary goal of QRM is lead time reduction. To achieve this, roughly 2 concepts are used: (1) autonomously operating production cells that manufacture "independently" (semi) products based on customer demand; (2) manufacturing resource planning (MRP) using POLCA (or equivalent) cards. In order to make the entire production process as efficient as possible, a factory-wide resource planning (ERP) is required in addition to the POLCA cards. This demonstrator shows a QRM implementation consisting of 3 production cells supported by smart dashboard (i.e. POLCA cards and storytelling techniques for collaboration within the production cells), and supported by a smart factory-wide planning system (using optimization techniques). In addition, some Machine Learning (ML) techniques are shown with which anomalies (production errors) are automatically detected by means of a vision system. The smart dashboard, the factory-wide planning system and the ML techniques contribute to a further reduction in lead time.

After this demonstrator, the participants will have a better idea of:

1. the practical added value of QRM implementations for lead time reduction
2. the added value of digital and visually supported storytelling for collaboration within the production cells
3. the added value of AI techniques for plant-wide planning and anomaly detection.

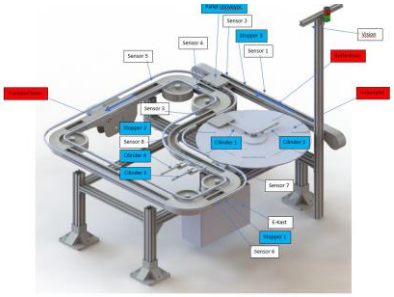
Background (technical)

This demonstrator does not require any special technical knowledge. However, some practical experience with production processes is a plus, especially for a good comparison between "traditional" low-volume high-variety production processes and QRM-based production processes.

Technical description (building blocks, figure with textual description)

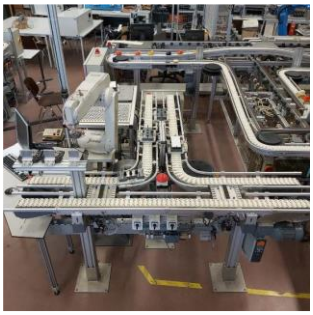
The demonstrator (flexible production automation) consists of 3 components (production cells).

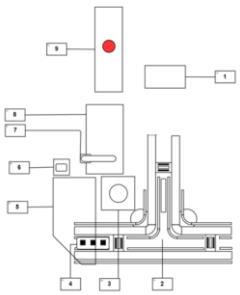
1. Index table



In the figure the layout of the index table is shown with several conveyor belts running next to it. The conveyor belts ensure the supply and removal of products. The products are pushed by means of cylinders onto the index table. The index table rotates and a vision system checks the parts on the index table. When a product is approved, it is pushed off the index table by a cylinder. The product then ends up on the discharge conveyor.

2. Robot Cell





The cell contains 4 components.

Switches are used to transfer the product carriers to the other belts. The assembly line has three turnouts.

The clamps are used to secure product carriers, so that products in the product carriers can be transferred from one clamp to another.

The robot has its own program for the two different products, which means that the robot will transfer the products from the full to the empty product carrier

The alarm is activated in the event of a fault in the control box.

3. Vison system for anomaly detection

This cell is intended for quality control. A camera system inspects the end product for deviations.

Workflow (including input, process, output)

This demonstrator shows 3 different production cells (i.e. index table, robot cell, anomaly detection). The demonstrator simulates various practical scenarios, covering the following situations:

1. Waiting time: cell B receives an A-B card, but does not hold a B-C card
2. Convergent routing: cell X needs 2 POLCA cards
3. Divergent routing: load balancing, cell M can supply cell N1 of N2
4. Different product types
5. Capacity planning: how to distribute capacity to the suppliers?