Reference:	**QSE:FMEA**
Topic:	**An Integration of Quality and Technology in Advanced Manufacturing Systems.**
Course Type:	Master Thesis
Start:	As soon as possible
End:	To be defined
Partner:	STIWA Group
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Join us on a cutting-edge journey at the intersection of quality assurance and technical system design with our industrial partner, the STIWA Group. This supervised Master's thesis offers a unique opportunity to dive into cyber-physical production systems engineering, pivotal in today's production industries.

Background

Production systems, like the robotic cells used in automobile manufacturing (see Figure 1), are complex networks that require the coordinated efforts of multidisciplinary teams. Ensuring these systems operate in an optimized way is not just about technical precision but also about preempting potential failures. This dual focus requires a holistic approach to both the qualitative and technical aspects of system design.

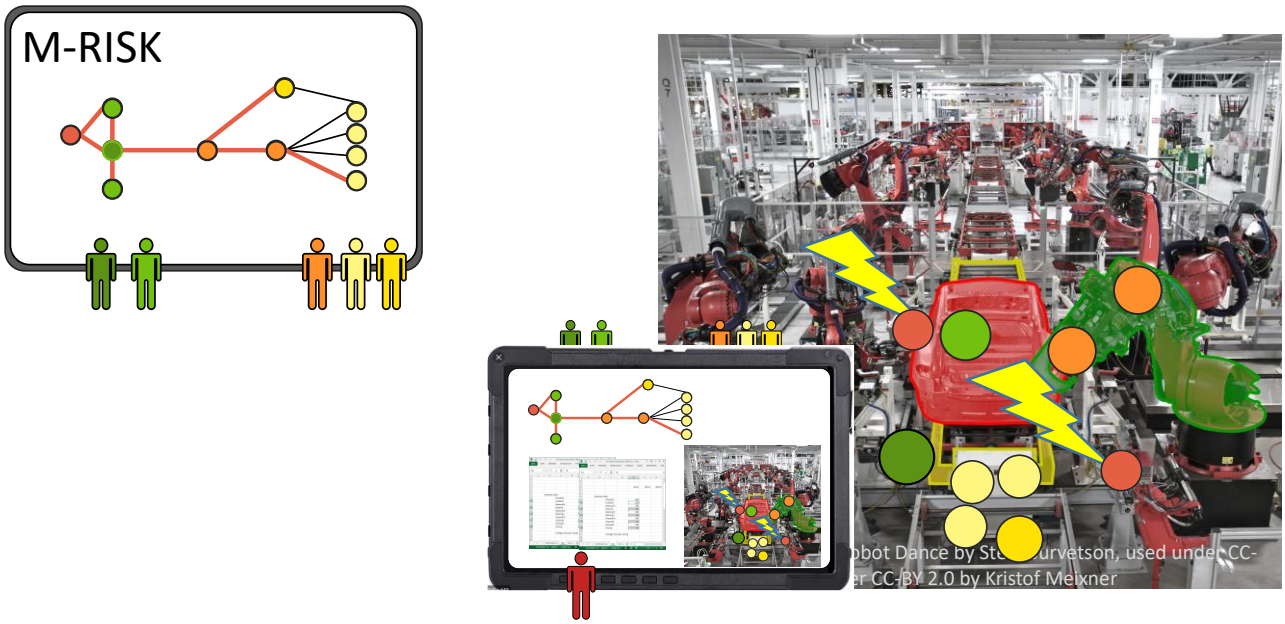

Figure 1: PPR asset network designed by several domain experts.

Your Challenge

You will develop an integrated modeling approach that combines the robustness of Failure Mode and Effect Analysis (FMEA) with the dynamic capabilities of the Product-Process-Resource (PPR) model. FMEA helps in identifying possible failures before they

occur, enhancing reliability and safety. PPR is instrumental in mapping out the technical workflows and resources, ensuring every part of the production line is optimized for efficiency and effectiveness. By this, you aim to address the following challenges:

- Data Synchronization: How do you manage missing keys in one model without compromising the integrity of the other?
- Model Transformation: What strategies can be employed to convert FMEA models into various proprietary formats used by the industry?
- Template Utilization: How can templates be effectively used to generate FMEA artifacts tailored to specific configurations?
- Version Control: What are the best practices for managing versions of both models when they are used in tandem?

Figure 2 illustrates a visual PPR model and a screenshot of APIS, a state-of-the-art FMEA modeling tool. These should give you an insight to the challenge.

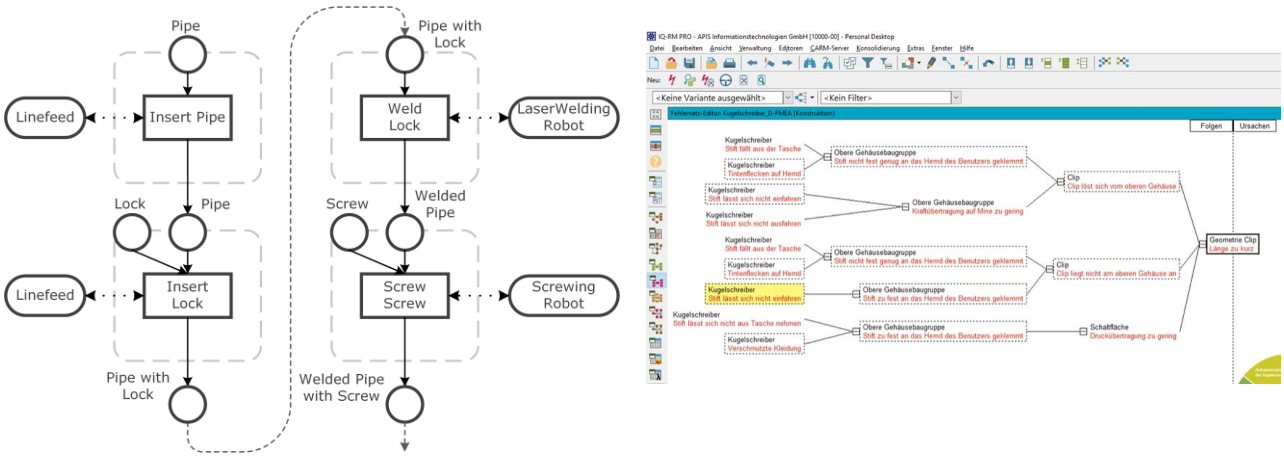

Figure 1: FMEA and PPR model (VDI 3682) of a welding process.

Real-World Application

This thesis will not only tackle these theoretical challenges but also test your solutions in a practical setting. You will exemplify and validate your integrated model through a real-world use case provided by STIWA—a high-speed welding system. This hands-on project will allow you to directly influence manufacturing processes, offering a tangible impact on production efficiency and product quality. A part of the thesis should/might be conducted at the location of our partner STIWA Group in Attnang-Puchheim.

Impact

By harmonizing these models, your work will directly contribute to refining the operational backbone of STIWA, a leader in automation solutions based in Upper Austria and Vienna. STIWA specializes in planning and executing complex production systems for a global clientele and manufacturing high-quality products on these platforms.

Tasks

- Domain analysis of the welding system use case in the context of the industry partner
- Elicitation of the requirements for an integrated modeling approach
- Design of a modeling approach and integration process for FMEA and PPR model
- Design and implementation of a prototype for the approach.
- Evaluation of the approach prototype employing the waiting system use case with stakeholders from STIWA

Expertise

For this topic a set of skills is recommended (at least two are mandatory).

- Software and Stakeholder Modeling
- JSON and XML Modeling with respective querying mechanisms, such as XPath
- DOTNet

References

Biffl, S., Lüder, A., & Gerhard, D. (Eds.). (2017). Multi-Disciplinary Engineering for Cyber-Physical Production Systems: Data Models and Software Solutions for Handling Complex Engineering Projects. Springer.