**Institut of Information Systems Engineering**
**Devision Information & Software Engineering**
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Seminar, Project
Bac Thesis
Master Thesis

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| **Reference:** | **QSE:IfS** |
| **Topic:** | **Instagram from Shopfloor** |
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## Background

Production systems, such as robot cells in car production (see Figure 1), require maintenance and upgrading. Defects from changes to industrial production, such as imprecise assembly in car manufacturing (see Figure 1), may lead to production downtime at the cost of up to 1 Mill. Euro per hour. Therefore, it is crucial to conduct maintenance correctly and provide feedback on issues on the shopfloor (see Figure 1), similar to an Instagram story, to the engineering models of the domain experts in the office.

Maintenance personnel require method and tool support for clear guidance on maintenance tasks and for feedback on maintenance task success or issues. This project aims at annotating task-specific knowledge on system parts in a model or picture as a foundation for providing information for guidance on maintenance and for feedback.

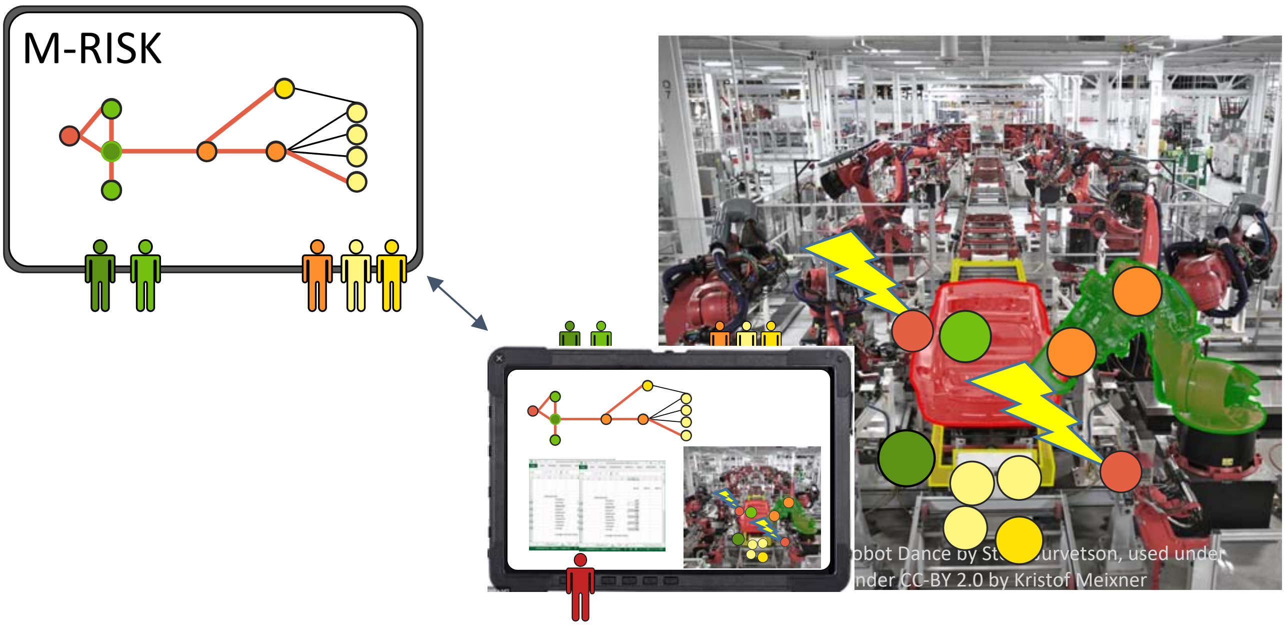


Figure 1: M-Risk cause-effect graph designed by several domain experts and used for maintenance guidance.

Figure 2 illustrates the model of a 4-color printing process as a sequence of printing and drying process steps using different colors. Further, Figure 2 shows the picture of a printer with *task-specific reference tags* (e.g., P11, P'12, R1) that represent system elements (product, process, resource). These task-specific reference tags can be used in guideline text to refer to system elements. Further, these reference tags can be used in feedback text to refer to system elements as a foundation for mapping the feedback to the corresponding system elements in the knowledge graph for future reference.

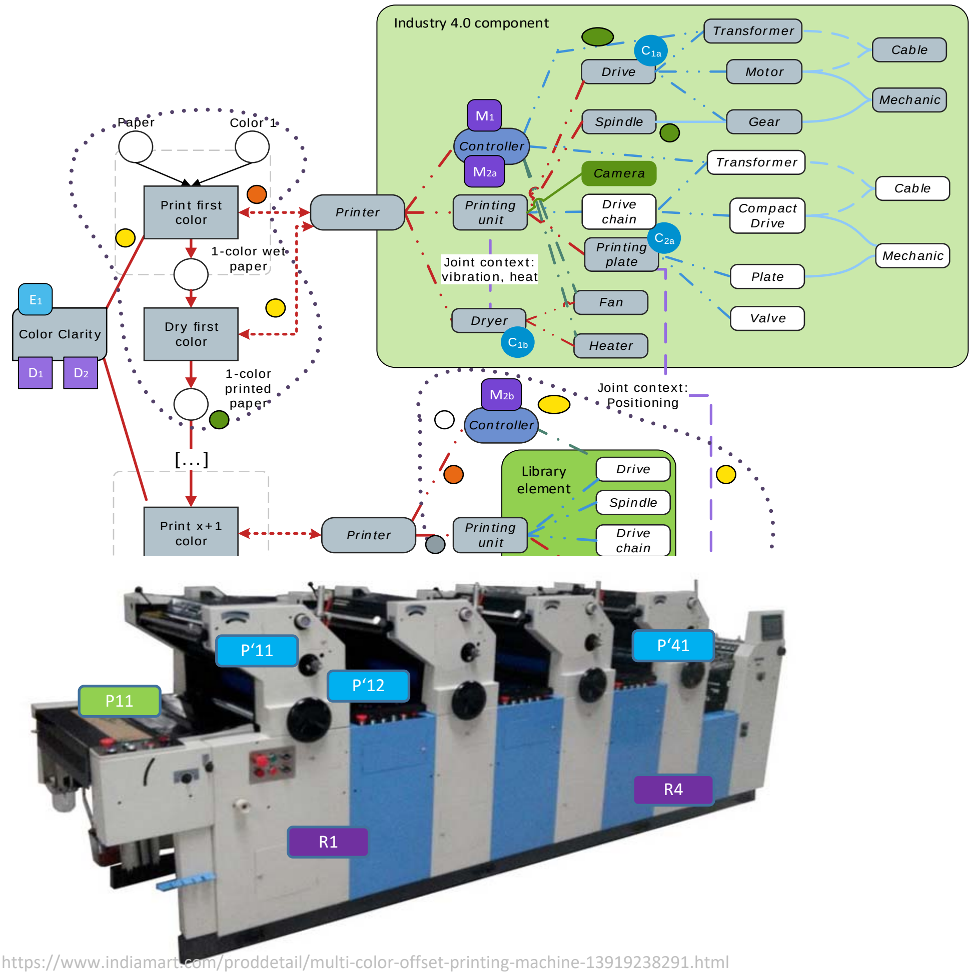


Figure 2: 4-color printing process with reference tags for guiding maintenance tasks and for feedback.

Goal of this project is to develop a web-based application for guiding maintenance tasks and feedback: (1) collecting system element data from several sources as a knowledge graph; (2) mapping system elements from the knowledge graph to task-specific reference tags; (3) using these task-specific reference tags in guidance text and in feedback text; and (4) mapping the task-specific reference tags in the feedback text back to the system elements as a foundation for providing the knowledge graph via a graph database with evidence on the success of and issues from maintenance tasks.

This topic is provided and supervised in cooperation with our industrial/academic partner *TU Wien Pilot Factory*.

### Tasks

- Detailed requirements analysis for maintenance guidance/feedback functions.
- Design of a web-based application based on the MDRE Platform, a front-end platform that provides functions on graph manipulation for connected models.
- Design of basic graph placement for adding elements to the graph.
- Mapping of selected objects to task-specific reference tags.
- Mapping of task-specific reference tags in feedback from on-site tasks to knowledge graph.
- Tablet-based application for guidance for on-site tasks and for feedback.
- Prototype implementation and evaluation of maintenance guidance/feedback functions.
- Empirical evaluation of guidance/feedback process.

### Expertise

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

- Java programming skills
- Graph database skills, e.g., Neo4J/Cypher.
- Data modeling
- Empirical evaluation, e.g. case study, pre/post comparison.

### 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.

Biffl Stefan, Arndt Lüder, Kristof Meixner, Felix Rinker, Matthias Eckhart, and Dietmar Winkler. Multi-View-Model Risk Assessment in Cyber-Physical Production Systems Engineering. In Slimane Hammoudi and Luís Ferreira, editors, Proceedings of the 8th International Conference onModel-Driven Engineering and Software Development, MODELSWARD 2021, online, February 8-10,2021, pages 1–8. SciTePress, 2021.

Biffl Stefan, Arndt Lüder, Kristof Meixner, Felix Rinker, Matthias Eckhart, and Dietmar Winkler. Multi-View-Model Risk Assessment in Cyber-Physical Production Systems Engineering. Technical Report CDL-SQI-2020-05, CDL-SQI, Institute for Information Systems Engineering, TU Wien, November 2020.https://qse.ifs.tuwien.ac.at/cdl-sqi-2020-05/