Institute of Information Systems Engineering
Software Engineering Unit
https://qse.ifs.tuwien.ac.at

Seminar, Project
Bakk Thesis
Master Thesis

Reference:	**QSE:PKDB**
Topic:	**Production Knowledge and Data Base**
Course Type:	Project, Bakk-/Master Thesis
Start:	As soon as possible
End:	To be defined
Partner:	TU Wien Pilot Factory
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Background

Production systems, such as robot cells to join car parts (see Figure 1), require efficient access to production knowledge, e.g., likely causes of undesired effects, such as bad product quality, to inform users and software functions regarding production data, such as the temperature of a welding head or the graph connecting a production effect to a cause. The *Production Knowledge Base* (PKB) consists (i) of a *Production Asset Network* (PAN) that describes how a production process depends on assets that automate the process and (ii) of a *Cause Effect Network* (CEN) that describes how effects relate to likely causes. The *Production Data Space* (PDS) contains engineering artifacts and run-time data regarding production assets and their attributes. Therefore, links between the PKB and the PDS facilitate validating the analysis of data in cause-and-effect graphs with production data samples to identify important factors that contribute to effects.

This project aims at designing software components with an application program interface (API) for both the production knowledge base and the production data space.

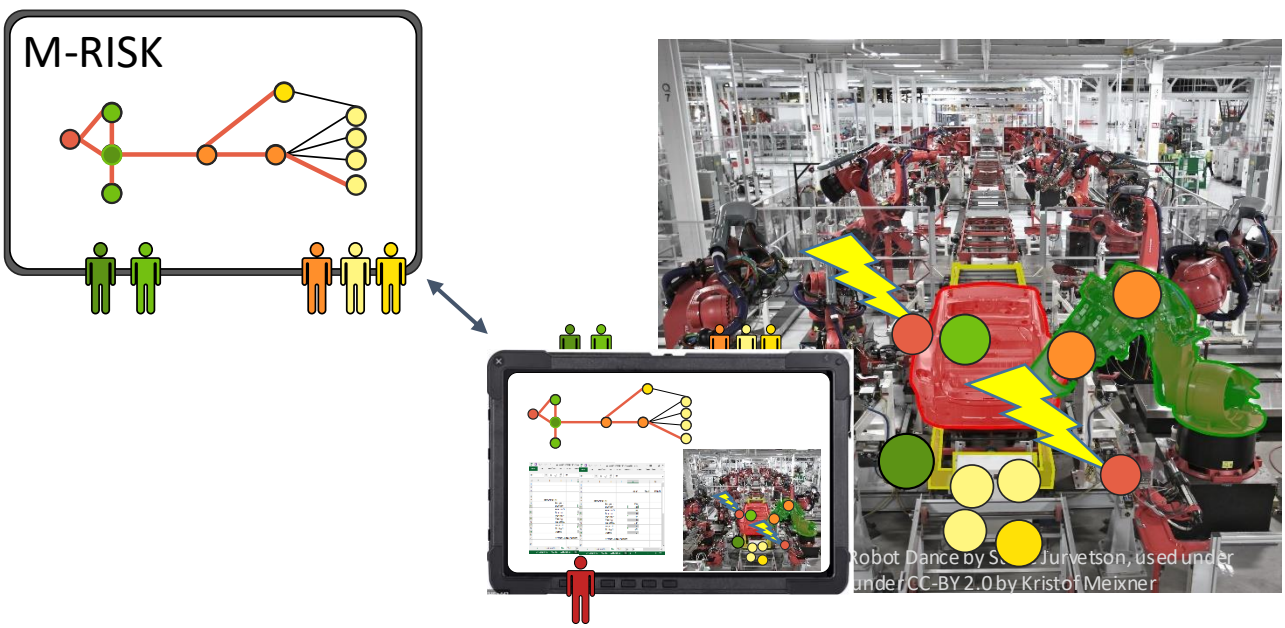

Figure 1: Cause-and-effect graph designed by several domain experts and used for production issue analysis.

Figure 2 illustrates an initial software architecture of the *Production Knowledge Base* (PKB) and the *Production Data Space* (PDS), which provide data updates to software functions for test automation, reporting, data analysis, or custom software applications.

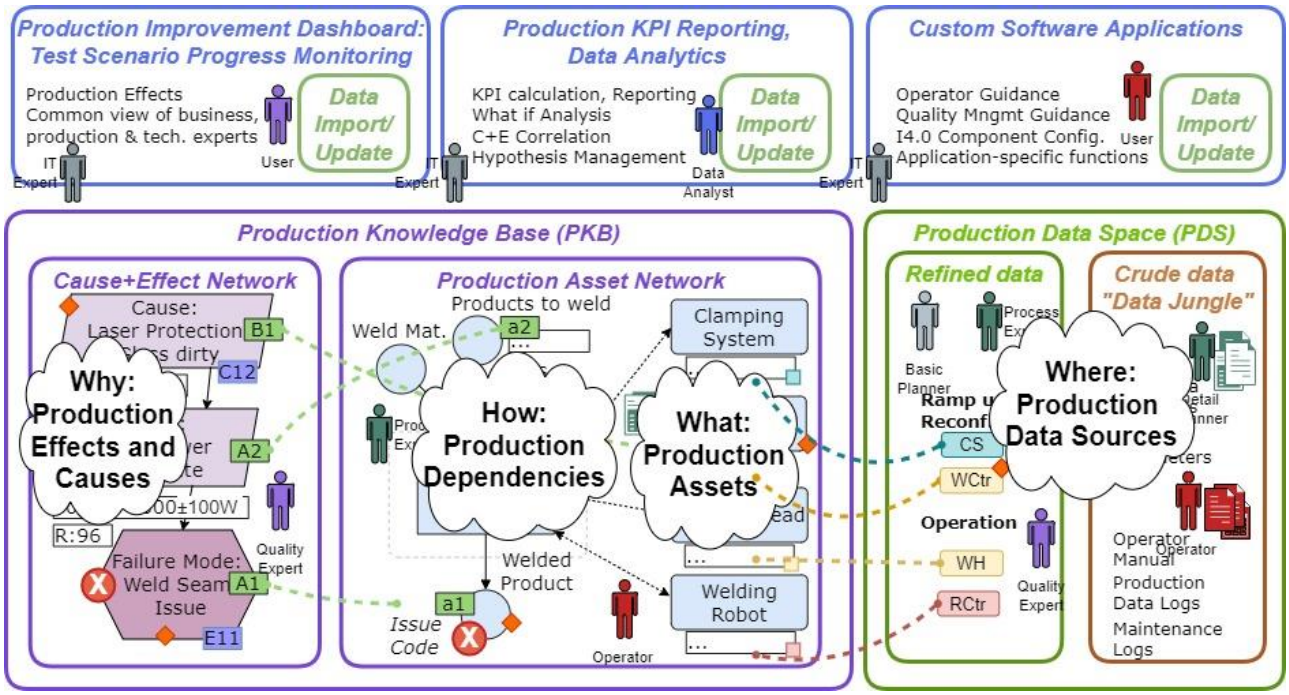

Figure 2: Software Architecture overview on a Production Knowledge and Data Base.

Goal of this project is to develop a web-based software solution for software functions that efficiently access via an API the production knowledge base and/or the production data space. This topic is provided and supervised in cooperation with our industrial/academic partner *TU Wien Pilot Factory*.

Tasks

- Detailed requirements analysis for PKB and PDS functions based on a set of practical use cases, e.g., for a robot cell in the TUW pilot factory.
- Design of a web-based software solution based on a graph database that provides functions for knowledge graph manipulation for connected models to efficiently collect several views on the system into a common graph.
- Design of APIs for the PKB and the PDS.
- Prototype implementation and evaluation of PKB and PDS access functions.
- Design and implementation of benchmarks for queries to the PKB and PDS.
- Empirical evaluation of measurement data regarding criteria for the strengths and limitations of the graph database.

Expertise

For this topic, we recommend the following set of skills (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.
- (No expertise in the production engineering domain required; interest is welcome.)

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.

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Rinker, F., Meixner, K., Kropatschek, S., Kiesling, E., & Biffl, S. (2022, August). Risk and Engineering Knowledge Integration in Cyber-physical Production Systems Engineering. In *2022 48th Euromicro Conference on Software Engineering and Advanced Applications (SEAA)* (pp. 338-345). IEEE.

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