
Reference: QSE:CDP-OPC

Topic: Automatic extension of the PPR model using OPC UA in knowledge graphs

Course-Type: Bakk-/Masterarbeit

Start: As soon as possible

End: To be defined

Industry Partner: Center for Digital Production (CDP)

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Background

In previous projects, the QSE and CDP team has developed a knowledge graph approach for integrating multiple heterogeneous sources from different domain knowledge dispersed across different stakeholders in production [4]. This knowledge graph has been currently constructed based on the combination of two sources, namely Failure Mode and Effect Analysis (FMEA)[1] data and the VDI 3682 [2], a rule formulation for describing Product, Process, and Resources (PPR). OPC Unified Architecture (OPC UA) [3] is an architecture commonly implemented into machines in the manufacturing industry. The OPC UA has developed standardized data models for over 60 types of industrial machines in which model machine data can be read and written.

In this project, we aim to extend our currently developed ontology (graph model) of the FMEA and VDI 3682 as part of our constructed knowledge graph with the schema from the OPC UA. That is the process will still be defined by the FMEA, but the resources described in the process will be extended by the vast knowledge of the OPC UA model. The implementation should then be one-step in our graph creation pipeline.

We offer this topic in cooperation of TU Wien / QSE and the Austrian Center for Digital Production (CDP, www.acdp.at).

Expertise:

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

- Good skills in English language
- Experience or interest in knowledge graphs and/or the semantic web
- Querying language SPARQL and/or Cypher
- Programming experience in Python and or Java

Reading Material:

- Sebastian Kropatschek, Thorsten Steuer, Elmar Kiesling, Kristof Meixner, Iman Ayatollahi, Patrik Sommer, Stefan Biffel, "Analysis of Quality Issues in Production With Multi-view Coordination Assets," in IFAC MIM, 2022. DOI: <https://doi.org/10.1016/j.ifacol.2022.10.178>

- Felix Rinker, Sebastian Kropatschek, Thorsten Steuer, Elmar Kiesling, Kristof Meixner, Patrik Sommer, Arndt Lüder, Dietmar Winkler, Stefan Biffli, "Efficient FMEA Re-Validation: Multi-view Model Integration in Agile Production Systems Engineering" . DOI: <https://doi.org/10.34726/2362>
- S. Kropatschek et al., "Towards the Representation of Cross-Domain Quality Knowledge for Efficient Data Analytics," 2021 26th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA), 2021, pp. 01-04, DOI: <http://doi.org/10.1109/ETFA45728.2021.9613406>.
- Knowledge graph book: <https://kgbook.org/>

References:

- [1] Failure Mode and Effects Analysis, https://en.wikipedia.org/wiki/Failure_mode_and_effects_analysis
- [2] VDI 3682: Formalised process descriptions; Concept and graphic representation <https://www.vdi.de/richtlinien/details/vdivde-3682-blatt-1-formalisierte-prozessbeschreibungen-konzept-und-grafische-darstellung>
- [3] OPCua: <https://opcfoundation.org/about/opc-technologies/opc-ua/>
- [4] Our existing FPI (FMEA-PPR) Ontology: <https://acd.p.at/onto/fpi>