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Change-Aware Updating of Knowledge Graphs for Operator Training

Master's Thesis

Detection, representation, and propagation of engineering-data changes in knowledge graphs for scenario generation.

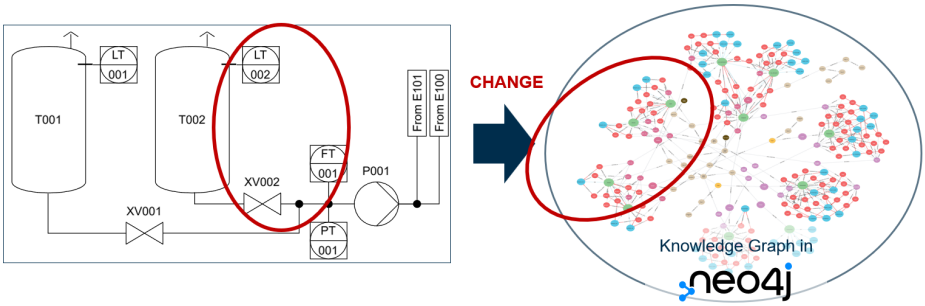
Motivation

Process plants are repeatedly modified throughout their lifecycle, for example due to maintenance, modernization, repairs, product changes, or changes in the control system. Operator Training Simulators allow control operators to practice different scenarios to prepare them for possibly hazardous situations, for example when equipment breaks down unexpectedly. However, if the plant changes but the training scenarios are not updated accordingly, operators may practice outdated situations that no longer correspond to the real plant. This limits the validity and usefulness of the training.

Goals

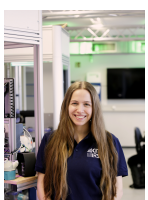
Within an ongoing PhD project, a knowledge-graph-based assistance system for scenario generation is being developed. Existing work derives plant-specific scenario information, including equipment topology, control actions, and component-related fault conditions, from engineering data. This Master's thesis shall investigate how changes in engineering data can be captured within this knowledge graph and propagated to derived fault conditions and scenario descriptions.

- Research on change management, versioning, and evolution of knowledge graphs
- Develop a concept to detect, represent, and classify changes between versions of a knowledge graph representing plant-specific scenario information.
- Analyze how changes in engineering information affect derived information, such as fault conditions and scenario descriptions.
- Implement and demonstrate the approach using representative example changes.



Interest and Useful Prior Knowledge

- Interest in knowledge representation and abstract modeling of complex systems in the context of process plants
- Programming experience and enthusiasm for software development
- Experience with knowledge graphs, e.g., labeled property graphs or Neo4j



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Thesis: Master's Thesis
Available starting: now
Tags: *Knowledge Graph, Operator Training, Change Management*