

A Framework to Support Failure Cause Identification in Manufacturing Systems through Generalization of Past FMEAs

Inspection and maintenance of manufacturing systems require experts who are familiar with the system's structure and potential defects that may occur. It is a concern in the Japanese manufacturing industry that the shortage of experts makes identifying the defect causes and maintenance activities difficult in the future. A practical approach to compensate for the lack of engineering skill is to refer to the past failure analysis that experts have conducted to identify the causes of failures and repair them.

In this study, we proposed a framework for reasoning possible causes of failures in manufacturing systems based on the past FMEAs (Failure Mode and Effect Analyses) analyzed for various manufacturing systems. The framework generalizes past FMEA descriptions using a combination of classes and properties in the domain ontology of manufacturing systems. The framework searches the possible causes of given failure from the generalized FMEA descriptions through the narrowing down process to consider the possible cause that satisfies the process in the target manufacturing system represented by the partial-order model generated from SysML diagrams. The comparison between the causes inferred by the proposed framework and by skilled experts for three typical failures in the manufacturing system and the interview with them about the plausibility of the inference results showed that more than 73 % of outputs were valid failure causes.

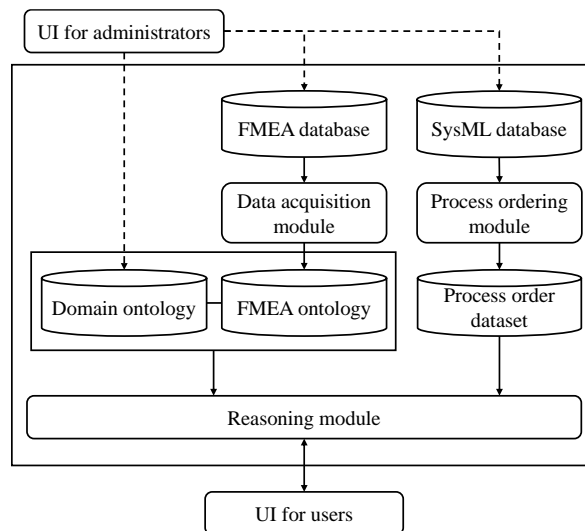


Fig 1. Examples of visualization of the basis for skill discrimination by CAM.

Keywords: Fault Cause Identification, FMEA, Ontology

References

- [1] Okazaki, Sho, Shirafuji, Shouhei, Yasui, Toshinori, & Ota, Jun. (2023). A framework to support failure cause identification in manufacturing systems through generalization of past FMEAs, Proceedings of the 2023 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM), June 28-30, 2023. Seattle, Washington, USA, pp. 858-865.