
An Ontology-Based Approach to Integrating Digital Product Passport Data into Enterprise Asset Management Systems

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Abstract

Digital Product Passports (DPPs) are a recent European Union (EU) initiative aimed at improving product traceability, transparency, and sustainability to facilitate the circular economy. DPPs contain lifecycle data that have the potential to reduce fragmented data in Enterprise Asset Management (EAM) systems. However, the integration of DPPs presents challenges for existing technical infrastructures, often requiring system development or adaptation. This study presents an ontology-driven integration framework to incorporate DPP data into EAM systems. The research combines literature review, survey and interviews to identify integration challenges and requirements. A modular ontology was developed to formally represent DPP information. Building upon this ontology as the foundational layer, a semantic integration architecture was designed to guide the implementation of a system that uses a triple store and REST APIs to connect the EAM system with DPP data repositories. The resulting DPP ontology was populated with sample data to demonstrate and validate the integration approach. Findings indicate that the proposed integration is well supported for its ability to reduce fragmented data, asset traceability, regulatory compliance while meeting industry requirements. The study provides the first semantic bridge between DPP and EAM systems, enabling organizations to leverage product lifecycle data, for more informed decision-making, while simultaneously laying a foundation for sustainable asset management practices.

Keywords

Digital Product Passport, Enterprise Asset Management, Data Integration, Interoperability, Modular Ontology, Semantic Web, RDF/OWL Knowledge Graph.