connected everything.

Novel Digital Twins for Compliance Debts in Smart Manufacturing

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Industry Partner:

Uptime Institute®

Colloborators also include a number of leading scientists from China, USA and Australia.

The project

This a novel investigation into "Compliance Debts" in smart manufacturing - a technical debt phenomenon, characterised by the gap between what levels of compliance can be achieved under uncertainty, with the available resources and information, and the hypothesised "ideal" compliance level. Compliance in smart manufacturing refers to the industry's responsibility to operate in agreement with established laws, regulations, standards, and specifications. Managing compliance is ultimately an investment activity under uncertainty for value creation and debt avoidance. It is a daunting engineering challenge to ensure optimality and assurance for compliance in the presence of uncertainty, and some engineers often take suboptimal and/or "quick and dirty" compliance engineering decisions and choices to meet urgent demands (e.g., a deadline; budget), compromising quality and compliance. Such compromises are viewed as "debts".

What the project will demonstrate

The project envisages a novel paradigm shift towards a utility-based and debt-aware engineering for compliance. The paradigm shifts leverages *digital twins* which provide industries with immense chances for complex utility- and debt- driven computations, including real-time optimization, sampling, dynamic and online search and/or info-symbiotic simulations and what–if analysis for compliance. The combination can provide new opportunities for efficient, highly scalable and real-time

> *"The project's goal is to provide manufacturing industries with sophisticated debt-aware data analytic and decision support tools for diagnostics and prognostics analysis for compliance and self-assurance as moving targets."*

intelligent prognostics and diagnostics value as well as debt-aware analysis and decision making for complex scenarios that go beyond the classical ones considering the ripple impact of violations. This can consequently inform its beneficiaries with more optimal and unconventional strategies for compliance, providing the basis of debt and value driven stress testing and interactive/intelligent visualization.

The project will look at cases from digital remanufacturing, provided by the AUTOREMAN project at the Autonomous Manufacturing Lab, University of Birmingham and Uptime Institute, London, a leading cloud standard and certification international body.

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