

## PROJECT DETAILS

Project Title:

**Trust-Aware Agentic Digital Twins for Resilient Advanced Manufacturing.**

Project Summary:

This project aims to develop an intelligent Digital Twin (DT) framework for resilient and human-centric manufacturing systems. Manufacturing systems demand automation beyond efficiency by integrating human oversight, trust, and resilience against emerging threats. However, existing DT solutions for manufacturing remain descriptive and lack adaptive reasoning and formal validation capabilities. This research will integrate deterministic behavioural modelling leveraging knowledge graph semantics and Agentic AI reasoning grounded in large language models (LLMs) to develop Digital Twins enabling verifiable models to detect cyber-physical inconsistencies and provide explainable decision making. The outcome will be trusted DT enabling resilient and secure manufacturing systems.

Preferred Applicant Skillset:

The preferred HDR applicant should have a strong foundation in artificial intelligence, cybersecurity, computer science, or related engineering disciplines. Demonstrated knowledge of machine learning, LLMs, knowledge graphs, and agentic AI architectures is highly desirable. Experience with deterministic rule-based modelling and state-based system modelling will be advantageous for digital twin development. The candidate should possess strong analytical reasoning, experimental design capability, and quantitative evaluation skills, alongside the ability to conduct rigorous validation and produce high-quality scientific research outputs within interdisciplinary research teams.

Internship Opportunity:

The selected candidate will have the opportunity to work in close collaboration with industry partners operating smart manufacturing facilities. The candidate will actively engage with an established research team working on an advanced manufacturing testbed and benefit from structured mentorship and collaborative learning. The internship will address real-world challenges in advanced manufacturing, including cyber-physical vulnerabilities, operational disruptions, workforce trust, and sustainability pressures. Through the PhD project, the candidate will contribute to integrating deterministic Digital Twins with Agentic AI, translating advanced research into practical solutions that enhance operational continuity and secure intelligent automation.

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