Combined AI and Data solutions for DATA COLLECTION

Challenge 1.1
Augmented sensing solution

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1.1 Augmented sensing solutions

Challenge and Context: Forces, stresses, torques, and power are direct indicators of a system's well-being. However, these quantities are typically expensive, difficult and intrusive to measure. Digital twins approach within AID4SME can help alleviate these hurdles for use cases inside and outside the consortium. Digital twins offer a paradigm shift where computational models of various complexities are merged in a coherent framework and linked to online measurement data available on a physical system. This paradigm allows for a hyper-realistic representation of process behaviour, enabling novel engineering applications and process improvements, such as virtual or augmented sensors. Augmented sensing uses cheap, readily available, non-intrusive, and robust physical sensors to collect data from the real asset component in a digital twin. The desired, yet unknown, quantities are estimated, resulting in a real-time/online virtual sensor fed with real measurement data enriched with physical insights.

Use Case and Expected Solution: Within the consortium, Arçelik requires an augmented sensing solution for its refrigerator production facility, which undergoes approximately 120 mold changes per month. Each change necessitates manual, iterative adjustments, causing about 60 tons of polyurethane waste and about 60 minutes of facility downtime per mold change. This results in approximately 5 million euros in annual costs due to production capacity loss. The solution will enable accurate monitoring of forces, stresses, or other relevant physical quantities during plastic mold changes in the refrigerator production line. It will provide real-time feedback and predictive insights to reduce manual intervention and iterative adjustments during mold changes, minimize polyurethane waste, and reduce facility downtime. For this industrial high-TRL application, Arçelik has foreseen the following Key Performance Indicators (KPIs): (i) First time-right adjustment of the mold; (ii) Reduce facility downtime by 15%; (iii) Decrease annual waste by 30 tons; (iv) reduction in energy consumption per mold change. These KPIs are initial indicative numbers and may evolve during the execution of the projects.

Besides this high-TRL application, KU Leuven has technology blocks available at TRL 4 and low-TRL playgrounds to develop and test augmented sensing solutions, specifically for mecha(tro)nic system level dynamics, and model-based augmented sensing in electro-thermo-mechanical applications in the manufacturing industry. For application on the low-TRL research lab playgrounds, the focus will be on the technological development of the augmented sensing solution together with the SME.

Call for SME Application Projects: SMEs are invited to propose a use case leveraging their own technology or solving their problems at hand, which will be further elaborated together with the consortium partners. Inspirational examples can be based on system identification, parameter estimation, force estimation, etc. The consortium offers low-TRL research lab playgrounds as well as one high-TRL industrial application (as detailed above). SMEs applying for this challenge should specify which TRL level they would like to target. For the industrial application, three consortium partners will support SMEs in developing an augmented sensing solution to optimize the mold adjustment phase, targeting difficult-to-measure quantities and ensuring a comprehensive understanding of the manufacturing process. The data will be fed to an AI-based digital twin decision support tool, enabling first-time-right adjustment of the mold by the operator.

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