Combined AI and Data solutions for creation of INSIGHTS

Challenge 2.2
Digital Twin based lifespan analysis tool

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Challenge and Context: Traditional design cycle paradigms in manufacturing have been optimised to their limits, and further gains are expected from cross-stage optimisation through combined AI and Data solutions. Digital information is becoming available in large amounts during different stages of product design, manufacturing, useful life, and recycling. Digital twins enable the collection and comprehensive management of all digital information linked to a unique product asset, exploiting it for added value creation within the same stage at which the data was collected. Leveraging these technologies, the manufacturing industry is on the verge of fully reaching Industry 4.0's digitalization potential, where digital twins play a central role at both the product level and at the production level. Manufacturers are striving to reduce their ecological footprints by minimising energy consumption, material use, and waste. AID4SME is committed to overcoming these challenges for use case owners both inside and outside the consortium.

Use Case and Expected Solution: Inside the consortium, Arçelik operates extruder processes to blend virgin plastic material with plastic scrap. Flaws in the mixing rate can lead to discolouration and cracking, generally caused by high ratios of recycled material. Arçelik seeks a product-production digital twin solution to optimise material mixing ratios based on real-time measurement of visual and mechanical properties of the different plastic source materials. This aims to increase the ratio of recycled plastic, enhancing sustainability while maintaining quality and reducing scrap. Additionally, Arçelik's consumer electronics refurbishing factory, which refurbishes over 50000 products annually, seeks to reduce the amount of refurbished products by combining augmented sensing (cf. challenge 1.1) and a product-production Digital Twin to optimise End-of-Life Product Refurbishment processes by assessing the health and predicting the remaining lifespan of components. For this industrial high-TRL application, within this challenge, the focus will be on a digital twin-based lifespan analysis tool, which enables Arçelik to determine the remaining life of parts and optimise their refurbishment processes. This will increase the repurposing of parts from discarded products as spare parts, adjust warranty periods and pricing for resold products and parts, and enhance overall sustainability of the refurbishment process by minimising waste and facilitating responsible and resourceful management of end-of-life products. Arçelik has foreseen the following activities/Key Performance Indicators (KPIs): (i) 20% reduction in waste from discarded parts; (ii) 15% increase in reused components; (iii) 5% reduction in warranty-related costs due to data-driven lifespan predictions; (iv) 30% improvement in refurbishment throughput; (v) checking the suitability of the spare parts and comparing the measurement results obtained on the part with production tests and modeling for life cycle determination; (vi) identifying returned products and parts with potential for recovery, creating end-to-end traceability and inventory system. This list is not exhaustive but rather indicative. Additional KPIs will be studied and can be integrated to ensure quality outcomes.

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 quality assessment and quality control. The consortium partners will guide and mentor SMEs to deploy a straight-through digitalisation (STD) approach in the challenges. More specifically for this challenge, a Digital Twin-based lifespan analysis tool will be demonstrated at TRL 6 at the high-TRL playground of Arçelik. This tool will determine the remaining life of products and parts, enabling the partner to increase the repurposing of parts from discarded products as spare parts, adjust warranty periods and pricing for resold products and parts, and enhance the overall sustainability of the refurbishment process by minimizing waste and facilitating responsible and resourceful management of end-of-life products.

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