Sustainable Artificial Intelligence

Project Idea	**AI-driven frugal, trustworthy and pervasive learning for sustainable, energy-efficient optimisation of manufacturing and process industries across networked cyber-physical systems, from edge devices to factory-scale digital twins.**
Organization name, town and country	Centre Tecnològic de Telecomunicacions de Catalunya, Castelldefefels (Barcelona), Spain
Addressed topic(s)	HORIZON-CL4-2026-02-DIGITAL-EMERGING-51-two-stage – AI improved advanced manufacturing and production processes in factories (RIA) HORIZON-CL4-2026-02-DIGITAL-EMERGING-53-two-stage – Innovative AI methods and technologies for the process industries (RIA)

Centre Tecnològic de Telecomunicacions de Catalunya

The Centre Tecnològic de Telecomunicacions de Catalunya (CTTC) is a non-profit research institution based in Castelldefels (Barcelona), created by the Government of Catalonia and focused on cutting-edge research in telecommunications and geomatics. Within CTTC, the Sustainable Artificial Intelligence (SAI) research unit develops frugal, energy-aware and trustworthy AI methods for distributed cyber-physical systems, leveraging experimental platforms such as SUPERCOM and IoTWORLD to design decentralized, explainable and resource-efficient learning solutions for applications ranging from industrial IoT and smart mobility to environmental digital twins.

Frugal and Trustworthy Edge AI for Sustainable Factories

- The project proposes a frugal, trustworthy AI “nervous system” for factories and process industries, where edge devices, machines and digital twins collaboratively learn to optimise energy use, throughput and product quality under strict resource constraints.
- It will:
  - Develop distributed and federated learning methods that run on heterogeneous shop-floor devices, with continual adaptation and robustness to faulty or adversarial data.
  - Exploit physics-informed and data-centric AI models to embed prior process knowledge, enabling accurate predictions and control with less data and computation.
  - Integrate these models into end-to-end AIoT and digital-twin pipelines, from sensor data collection to deployment and monitoring on platforms such as SUPERCOM and IoTWORLD.
- We expect the project to succeed because CTTC’s SAI unit already combines expertise in distributed learning, energy-aware optimisation and brain-inspired computing with mature experimental testbeds for cyber-physical systems, allowing rapid prototyping and validation in realistic industrial scenarios together with manufacturing and process-industry partners.

Key competences and partners sought

- We seek industrial and research partners with strong competences in:
  - Advanced manufacturing and process-industry operations, including access to pilot lines or full-scale production environments for AI experimentation and validation.
  - Industrial automation, control and robotics, with expertise in integrating AI into PLC/SCADA, MES and edge-computing infrastructures.
  - Domain modelling and digital twins for factories or process plants, including multi-physics simulation and real-time data integration.
  - Industrial IoT sensing platforms and connectivity (5G/6G, TSN, OPC UA, etc.) enabling secure data collection from heterogeneous machines.
  - Standardisation, safety, regulation and ethics in industrial AI, including certification of trustworthy, human-in-the-loop AI systems.

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