

## CHARM PROJECT DEVELOPS IOT SOLUTIONS FOR HARSH INDUSTRIAL ENVIRONMENTS

The CHARM ECSEL JU project aims to develop industrial IoT solutions with an improved tolerance towards harsh industrial surroundings. Digitalisation of the European manufacturing industries is the key to their continuous renewal and competitiveness. Harsh environmental conditions in manufacturing processes and end user environment may slow down the opportunities brought by IoT (Internet of Things) and AI (Artificial Intelligence). The CHARM project is set to solve this challenge.



Figure 1: The top left picture represents an automation line of a paper mill from Valmet. The picture is courtesy from Valmet. The bottom left picture shows autonomous equipments, a 21 tonnes Loader Toro LH621i dumping into a dumper Toro TH661i. The picture is courtesy from Sandvik. The right picture shows a robotic manipulator used for mechanized ultrasonic inspection conducted on VVER 1000 secondary circuit piping test assembly with realistic defects. The picture is courtesy from ÚJV Řež labs.



This project has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 876362. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Finland, Austria, Belgium, Czechia, Germany, Italy, Latvia, Netherlands, Poland, Switzerland.

CHARM (Challenging environments tolerant Smart systems for IoT) is an extensive three-year project with 37 partners from 10 European countries and a total budget of 29 M€. It is co-financed via ECSEL Joint Undertaking, EU Horizon 2020, national funding agencies of the participating countries and the consortium partners. The partners come from Austria, Belgium, Czech Republic, Finland, Germany, Italy, Latvia, the Netherlands, Poland and Switzerland.

Launched in June 2020, the CHARM project will develop condition monitoring, predictive maintenance, automation, real-time manufacturing control and optimisation and virtual prototyping system demonstrators and test them in industrial settings. The ECS (Electronics, Components and Systems) technologies must be designed to withstand combinations of severe thermal, mechanical, and chemical stress present during the manufacturing processes used in the industry. Solutions will be demonstrated for six use cases that cover condition monitoring, predictive maintenance, and real-time quality assurance.

The CHARM use case leaders come from six different manufacturing sectors covering mining (Sandvik Mining and Construction Oy, FI), paper mills (Valmet Technologies Inc., FI), machining (Tornos SA, CH), solar panel manufacturing (Applied Materials Italia SRL, IT), nuclear power plant maintenance and decommissioning (ÚJV Řež, a. s., CZ) and professional digital printing (Canon Production Printing Netherlands B.V.). The project consortium consists of 11 small and mid-sized enterprises, 14 large enterprises and 12 research and technology organisations. They represent the industrial value chain from simulations, sensors and components to packaging, integration and reliability as well as connectivity, cloud and cyber security solutions.

The project will develop sensors for e.g. gas detection, high temperature and pressure, as well as advanced vision systems for real-time quality control and autonomous equipment for industrial applications. Electronics component packaging technologies beyond state-of-the-art will be used to ensure that the sensors are able to withstand the harsh conditions. The IoT systems will also include new solutions for wireless power transfer, connectivity and cybersecurity.

Valmet, the leading global developer and supplier of technologies, automation and services for the pulp, paper and energy industries, acts as the project coordinator for CHARM. "We are excited to participate in this European network to develop IoT capabilities for value-adding customer solutions," says **Heikki Kettunen**, Senior Manager R&D at Valmet. Spinverse, the Nordic innovation consulting company, coordinated the project proposal and consortium building and has been selected by the partners to support in project planning and management as well as in administration and facilitation as the project progresses.

Tampere University is one of the academic partners in CHARM. Professor Jose Luis Martinez Lastra from the Faculty of Engineering and Natural Sciences emphasises the significant impact of providing seamless integration within the IoT networks set by the industrial partners in order to facilitate the digitization of their current, and future businesses.



This project has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 876362. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Finland, Austria, Belgium, Czechia, Germany, Italy, Latvia, Netherlands, Poland, Switzerland.



TAU will participate in CHARM by supporting 3 of the Use Cases: Paper Mills, Mining and Nuclear Power Plant Maintenance and Decommissioning. "In particular our work will deal with the integration of novel sensor systems in extremely harsh environments: for monitoring air quality and paper mill equipment conditions, autonomous navigation, and robotic manipulation" Professor Lastra said. In addition, Professor Tchamov will contribute in the design of the low-level hardware in order to create a comprehensive multi-data source IoT platform for harsh conditions.

Professor Lastra leads Tampere University's FAST-Lab whose research areas include automation, industrial informatics, industrial cyber-physical systems, robotics and artificial intelligence.

**Contact Person:**

*Jose Luis Martinez Lastra*

Email: [jose.martinezlastra@tuni.fi](mailto:jose.martinezlastra@tuni.fi)

Phone: +358407794748

*Anne Korhonen*

Email: [anne.m.korhonen@tuni.fi](mailto:anne.m.korhonen@tuni.fi)

Phone: +358503002500

**Main Researcher:**

*Maria Ines Robles*

Email: [mariaines.robles@tuni.fi](mailto:mariaines.robles@tuni.fi)

Phone: +358 447893848

**Consortium project partners:**

Project coordinator: Valmet Technologies Inc.

aixACCT Systems, Applied Materials Italia, AT&S Austria Technologie & Systemtechnik, Beneq, Besi Austria GmbH, Besi Netherlands B.V., Canon Production Printing Netherlands B.V., Consorzio Nazionale Interuniversitario per la Nanoelettronica, CSEM Centre Suisse d'Electronique et de Microtechnique, Delft University of Technology, E+E Elektronik Ges.m.b.H., Fraunhofer Institute for Reliability and Microintegration IZM, Imec Netherlands, InnoSenT GmbH, ŁUKASIEWICZ - Instytut Technologii Elektronowej, Lapland University of Applied Sciences, Luna Geber Engineering, Materials Center Leoben Forschung GmbH (MCL), NOME, Pac Tech Packaging Technologies GmbH, Qplox Engineering, Quantavis, Reden, Riga Technical University, SAF Tehnika, Sandvik, SmartMotion, SSH Communications, Sylvac SA, Tampere University, Technische Universität Chemnitz, TIPb, Tornos SA, ÚJV Řež, a. s., University of West Bohemia, Würth Elektronik

**About ECSEL JU**



This project has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 876362. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Finland, Austria, Belgium, Czechia, Germany, Italy, Latvia, Netherlands, Poland, Switzerland.



*The "Electronic Components and Systems for European Leadership" (ECSEL) is a Joint Undertaking established in June 2014 by the European Union Council Regulation No 561/2014. The ECSEL Joint Undertaking – the Public-Private Partnership for Electronic Components and Systems – funds Research, Development and Innovation projects for world-class expertise in these key enabling technologies, essential for Europe's competitive leadership in the era of the digital economy. Through the ECSEL JU, the European industry, SMEs and Research and Technology Organisations are supported and co-financed by 30 ECSEL Participating States and the European Union. A total of approximately 346 M€ European and national grants have been awarded to proposals with total eligible costs of about 748 M€ arising from the ECSEL JU, making another step forward in the 5 B€ programme to be supported by ECSEL JU.*

<https://ec.europa.eu/digital-single-market/en/ecsel>



This project has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 876362. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Finland, Austria, Belgium, Czechia, Germany, Italy, Latvia, Netherlands, Poland, Switzerland.

