



ARTWORK

Helping workers to build customised products more efficiently

Utilising digital twins of factory workers and equipment, smart instruction generation and a worker feedback system, the ITEA project ARTWORK (smART and connected WORKer) will develop a real-time assistance system to connect workers to the production line and enable automatic, context-based derivation of process instructions.

Addressing the challenge

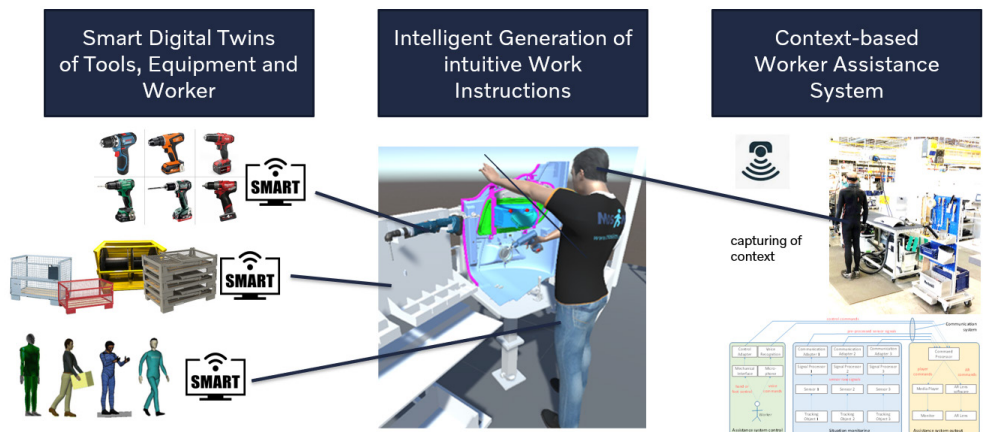
In European plants, many employees work with their hands on complex, individualised products. A flexible production system is required to deal with numerous variants, but model creation and feedback remain mostly manual and the simulation and evaluation of variants is costly and time-consuming. The most flexible resources are the workers, yet IoT is mainly focused on equipment automation. Although sensors for capturing tools or parts of workplace exist, there is no integrated toolchain focusing on manual assembly workplaces.

Proposed solutions

To achieve this, ARTWORK will develop a real-time, context-aware assistance system for workers, including engineers and line operators. First, the simulation of manual workstations will be enabled by combining digital twins for tools and equipment with digital twins of workers. The integration of real sensor data will allow real-time simulation of digital twins for advanced monitoring and adjustment of instructions in response to behaviour. A targeted digital twin database will be the foundation for evaluation and integration at other companies. Second, smart instruction generation will be derived using an automatic reasoning engine and a set of ground knowledge on processes, tools and task sequences that cannot be directly reasoned from product structure and geometry. This includes online decision support tools for engineers to perform dynamic assembly line balancing

across stations and workflow planning for operator roles within stations. Also, tools for team leaders to perform manning of the operator roles in stations, and for line managers to handle late-stage changes in product sequencing needed due to missing preconditions (e.g.,

improvements on the state of the art, including a 30% reduction in instruction preparation time when changing stations and a 10-20% improvement in the tracking and localisation accuracy of vision-based technology. For workers, the bi-directional system will allow them to utilise their expertise to optimise instructions and processes during assembly and assist them in recovering from an incorrect task order without human consultation. This creates trust in the system and a more enjoyable work environment while targeting a >50%

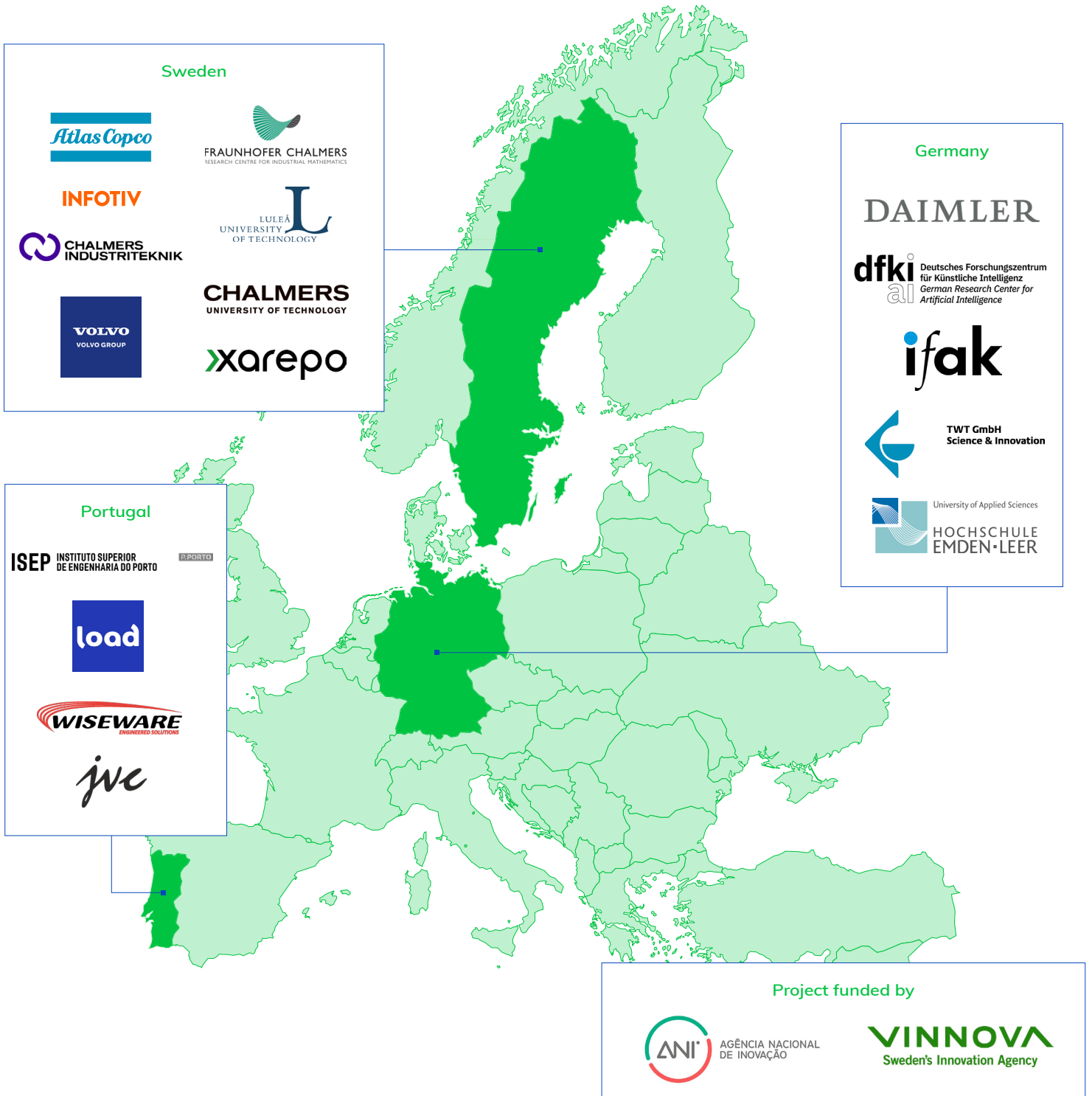


missing critical parts). Finally, a worker feedback system will link the combined product models and production process models with real-time measurement data from sensors. Screens and augmented reality solutions will provide information to workers while user input based on natural speech recognition and gesture recognition will provide a user-friendly interface.

Projected results and impact

When implemented in full, ARTWORK ultimately expects to provide a 10-30% increase in a factory's first-time through. This will be achieved via various

reduction in qualification time. The consortium views open-source software development as the best way to promote their work and the project's results will therefore be integrated into the IT infrastructure and toolchains of end-users using open code. In the longer term, the use of standards and the global drive for lower operating costs will lead third parties to contribute to the toolchain, enabling the creation of a new market of products and services and the integration of ARTWORK into critical production domains that push European industry forward.



Project start
March 2024

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Project website
<https://itea4.org/project/artwork.html>
<https://artworkproject.org/>

Project end
February 2027

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