



Project Progress in Quarter 2/2022

Currently, the consortium is working on the integration of the core technologies into the FELICE system for the phase I milestone in September. The project has made progress in all work packages towards the projects objective. Especially in the technical work packages WP 3 to WP7 there has been plenty of progress to enable a first phase integration. This involves e.g. the finalization and shipment of the robot- and workstation prototypes, as well as continuous work on the intelligent execution system (orchestrator) and FIWARE communication infrastructure.

Upcoming: Plenary/ Integration meeting at CRF

The consortium will meet for a plenary integration meeting between the 11th and the 15th of July in Melfi, Italy.

During the five days, the developed prototype technologies will come physically together for integration tests. The technology status will be tested for all 7 demonstration cases (see [Newsletter 2](#)). Furthermore, the partners will present the status and the ongoing work in the work-packages and developed key-technologies.

Meetings



Bimonthly technical meetings have been held to coordinate the progress across the work packages.



Meetings coordinating the Integration and Demonstrations of Phase 1

[See newsletter](#)

News

The project duration was extended by 3 months to end of September 2024. All deliverables will be - shifted by 3 months.

Ergonomic approaches in FELICE

The objectives of the Project include the improvement of physical and cognitive ergonomics through intelligent production technologies, interaction methods and interfaces. Including Adaptive Workstations, Speech and Gesture Control capabilities and camera-based ergonomic evaluations.

Physical strain detection in industrial environments

In the FELICE project, the ability to assess the risk of physical strain of the workers during their work activities is crucial. One non-intrusive and cost efficient approach uses passive camera systems. With these, the body posture can be assessed as a key indicator for the prevention of musculoskeletal disorders. However, some challenges need to be addressed.

One challenge using this approach is the recognition of the body postures. Neural Networks can be used to generate and analyse 2D or 3D skeletal data in real-time given an input video of human actions. The identified postures can be used for ergonomic assessment tools i.e. the MURI risk analysis approach.

Integration of posture recognition technology in the FELICE use case is planned from early July onward by the consortium member and research center *Foundation for Research and Technology-Hellas* (FORTH).

A preliminary study co-funded by FELICE and carried out in the sustAGE project successfully deployed this technology and combines the vision-based, non-invasive recognition of work postures also used in FELICE with time-synchronized worker physiological, heart-rate-based measurements. The aim of this technology is to assess risk indicators, train better predictive models for worker physical fatigue and ultimately support relevant decisions for improving occupational safety and well-being in industrial environments.

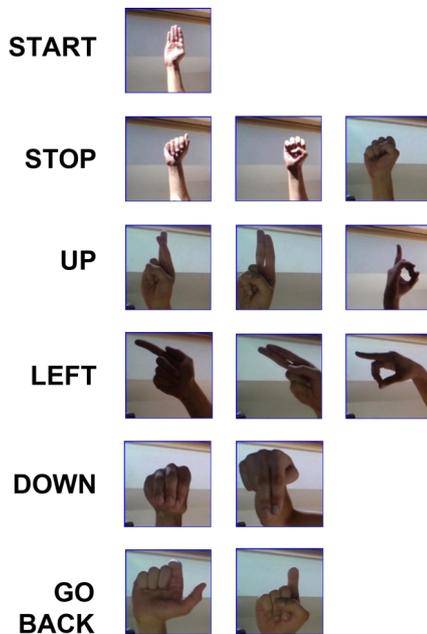
[Click here for the study publication](#)



Papoutsakis, K.; Papadopoulos, G.; Maniadakis, M.; Papadopoulos, T.; Lourakis, M.; Pateraki, M.; Varlamis, I. Detection of Physical Strain and Fatigue in Industrial Environments Using Visual and Non-Visual Low-Cost Sensors. *Technologies* **2022**, *10*, 42. <https://doi.org/10.3390/technologies10020042>

Ergonomic approaches in FELICE

The objectives of the Project include the improvement of physical and cognitive ergonomics through intelligent production technologies, interaction methods and interfaces. Including Adaptive Workstations, Speech and Gesture Control capabilities and camera-based ergonomic evaluations.



Speech and gesture control

Speech commands and gesture recognition allow the robot and adaptive workstations involved in the FELICE project to operate safely and ergonomically alongside humans.

The team at the University of Salerno (UNISA) is working on the development of algorithms for voice- and gesture-based human-robot interaction. The algorithms designed for voice analysis, optimized to be robust to industrial noisy environments, and for gesture recognition, able to deal with partial occlusions, provide the human operator with an innovative tool to dynamically change the assembly workflow. In particular, the human workers can ask the robot for help in taking or placing tools (such as hammer, screwdriver) or parts to be assembled (e.g. control panel, rearview mirror), or to adapt the height and orientation of the workstation to better satisfy ergonomics needs.

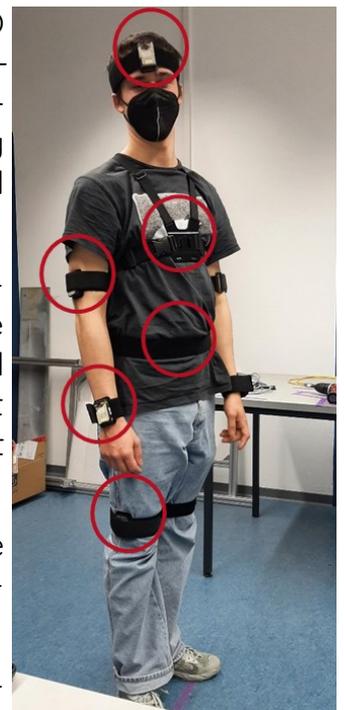
Proof-of-Concept Evaluation of the FELICE Adaptive Workstation design

Following the human-centred design process, according to DIN EN ISO 9241-210, the Adaptive Workstation prototype developed by the *Institute of Ergonomics and Human Factors* (IAD) has been evaluated using the TEA Ergo CAPTIV system, a motion capturing system enabling the measurement of body joint angles e.g. of neck, shoulders and back.

Abstracted typical tasks for a car door assembly like screwing, positioning and tightening of window seals and tightening of clips were carried out on a mock-up of the car door to compare an industrial base configuration and a configuration with the capability to adapt height and/or inclination of the work object. The proof-of-concept study was conducted with 11 male and 6 female subjects.

The test subjects spend significantly less time in high-risk areas of the extension and flexion of the neck and shoulder after tilting or readjusting the height of the door during the work process.

Following these results, the Adaptive Workstation prototype will be integrated into the FELICE system at the campus manufacturing hall at CRF in Melfi, Italy in July to be tested at the car door assembly line at CRF in the future.



[Click here for a video of the Adaptive Workstation prototype](#)

FELICE at the European Robotics Forum (ERF 2022)

Partners involved in the Felice Project took an active part at this year's European Robotics Forum held from 28.06 to 30.06 in Rotterdam, the Netherlands. The ERF is a leading forum for researchers, engineers, managers as well as entrepreneurs, and public funding officers from all over Europe. The main focus is the discussion of challenges induced by the innovations in robotics and robotics-related Artificial Intelligence.

For more information check out the conference website: <https://erf2022.eu/>

FELICE x Robotics4EU



FELICE members had the chance to meet with scientist of the Robotivs4EU project during ERF 2022, which empowers the collaboration of EU projects in the field of robotics. Preliminary insights, results and visions were discussed.

Demonstrator by IML



A live-demonstrator was presented by the Fraunhofer IML at this year's ERF, that shows how a robotic system can be controlled remotely using an open-source software. The Demonstrator was presented as cooperation of the EU projects FELICE and DIH² [click here to see the video](#)

ERF 2022 Workshops

FELICE co-organized four workshops at this year's ERF with one being held by consortium member Profactor which is part of the euRobotics topic group *Sustainability and Environmental aspects*. The workshops covered the challenges regarding sustainability and Robotics and additional topics from robotic applications to sustainable manufacturing of robots.

1. Workshop on Application of Robotics in Sustainability and Environmental aspects

2. Workshop on Industrial Robots and Sustainability

3. Workshop on Robotics for Sustainability - Manufacturing of of Sustainable Robots

4. Workshop on Social Robots: The Duality of Sustainability and Societal Application

Publications

Several scientific publications regarding the technologies of the FELICE system phase I prototype are currently in development or accepted and awaiting publication. A current list can be found on the website or the official FELICE Zenodo channel:

[FELICE publications on the website](#)

[FELICE on ZENODO](#)

Recent Scientific Publications

Akkaladevi S.C. et al. (2021) Programming-Free Approaches for Human-Robot Collaboration in Assembly Tasks. In: Wang L., Wang X.V., Váncza J., Kemény Z. (eds) Advanced Human-Robot Collaboration in Manufacturing. Springer, Cham.

DOI: https://doi.org/10.1007/978-3-030-69178-3_12

Link: https://link.springer.com/chapter/10.1007%2F978-3-030-69178-3_12

M. Lourakis and G. Terzakis, (2021) “A Globally Optimal Method for the PnP Problem with MRP Rotation Parameterization,” 2020 25th International Conference on Pattern Recognition (ICPR)

DOI: <https://doi.org/10.1109/ICPR48806.2021.9412405>

Link: <https://ieeexplore.ieee.org/document/9412405>

Conference Publications

Manolis Lourakis (June, 2022) “Computer vision for safety monitoring and human-robot collaboration in the workplace” at the 6th FITCE Technology Forum in Chania, Greece

ISM: Co organisation of workshop on Human-Robot Collaboration & AI for Sustainable Production

[Click here for more information](#)

Deliverables

Public FELICE deliverables released under the work plan are accessible on our website

[Click here for more information](#)

WP1—Project coordination and management:

D1.2: Data management plan

D1.4: Innovation management plan

WP3—System baseline technologies and enablers:

D3.1: State of the art report

WP9—Dissemination, exploitation and long-term sustainability:

D9.1: Project website and visual identity



FELICE



<https://twitter.com/FeliceH2020>



<https://www.linkedin.com/company/h2020feliceproject/>



Coming soon



<https://www.felice-project.eu/>



This project has received funding from the European Union's Horizon 2020 Research and Innovation program under grant agreement No 101017151.