



KEY FACTS

Acronym: IMOCO4.E

Full name: Intelligent Motion Control under Industry4.E

Coordinating institution: Sioux Technologies B.V.

Project coordinator: Arend-Jan Beltman

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Start date: 1st September 2021

Duration: 36 months

Consortium: 46 Partners from 13 countries

This issue provides a grasp of the main project developments during *July 2022 – October 2022*. It also provides facts on the results achieved, as well as links to the latest dissemination activities.

During the past 3 months, the consortium continued developing the IMOCO4.E concept and methodologies, with extremely promising results. These results extensively presented at the 2nd Consortium Meeting in Riga, Latvia on September 20 – 22nd, 2022 where the 46 partners had the chance to meet for the first time F2F. We are also proud to announce that within this first and very fruitful F2F meeting, IMOCO4.E coordinator, released the [1st promotional video of the project!!](#)

IMOCO4.E Highlights

WHAT HAS BEEN DONE?

In WP2 two out of the three tasks have been completed. The remaining task T2.3 will define the IMOCO4.E reference architecture. We have collected sketches of the green-field and brown-field motion control system architectures from all the involved use-case and pilot owners. These sketches placed particular emphasis on the implementation of AI and digital twinning.

During this reporting period, the WP2 team have translated these sketches into a generic framework in which IMOCO4.E technology building blocks can be integrated. Based on this generic framework, use-case and pilot owners will be requested once again to draft their foreseen system architectures, according to the framework we will provide. In the next months, the final deliverable of WP2 D2.4 “General specification and design of IMOCO4.E reference framework” will be completed, which will collect those views.

WP2

ToC

Project Highlights: **P1**

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Dissemination &

Communication: **P3**

Meetings, Publications &

Deliverables: **P4**

What has been done

WP3 finished the work on the initial Layer 1 requirements and delivered D3.1. Now the partners are iterating on this document - the work on the final requirements and specifications (D3.2) has begun. In the T3.2 partners continued developments on 6 different sensors and on the reference guidelines for these sensors. Most of the sensors now have a clear contribution to specific building blocks and applications (use-cases, pilots, demos). In this period, consistent one-page descriptions were compiled about the novel sensors, including sensor pictures, parameters, and applications. Those descriptions can be used and disseminated as informative flyers. T3.3 continued the development of 8 solutions for SoC, FPGA, and multi-many core platforms, and T3.4 continued developments of 9 AI-based modules. As in T3.2, these tasks also have mostly connected involved solutions, partners, building blocks and applications. The highlight of T3.5 is that a laboratory testbed for testing the novel servo drives has been finalized and already described in a paper.

WP3

WP4

Partners in WP4 are working flat out as all tasks of the work package are already running. In Task 4.1, control technologies to be developed and their corresponding requirements have been defined and reported in the deliverable D4.1, released in M11. Partners are developing technologies within tasks 4.2 to 4.6 to fulfil the defined requirements. Task 4.2 has provided a state-of-the-art in the field of XiL methodology for control system design based in Digital Twins and has collected current XiL strategies adopted by IMOCO4.E partners. Partners involved in Tasks 4.3 and 4.4 are deeply working in the development

and implementation of smart control algorithms, that will form IMOCO4.E Building Block 5. Some highlights within these tasks are the development and implementation of an adaptive impedance control algorithm industrial robot manipulators, a machine learning based compliant control of robots, and a repetitive control approach for lift systems. Task 4.5, linked with IMOCO4.E Building Block 10 and dealing with path planning, route optimization, and decision making (collision avoidance) of mobile robots is also fully working on technical developments, focused in three of IMOCO4.E's Pilots and Demos. Finally, partners in Task 4.6 are working in different multi-core edge platforms as well as required development framework that includes vision and Artificial Intelligence workload. WP4 partners have already provided the first scientific publications and, indeed, a specific workshop at the IEEE ETFA conference was organized in September 2022 with participation of WP4 partners.

In the period between M9 and M14, WP5 partners have been actively preparing requirements and specifications for digital twins and their components. The important event was the 12M consortia meeting in Riga where most partners met in person. WP5 leader presented the status of this work package and its tasks. A separate discussion slot was dedicated to the digital twin's concept, its components, and clarification of slight overlaps between some tasks. There are mainly three building blocks linked with WP5.

These are BB6 on algorithms for monitoring, predictive maintenance, and commissioning, BB8 on AI-based components, and BB9, dealing with cyber security and data management. Their connections with the tasks have been identified. BB9 was particularly analyzed in detail during several teleconferences due to the importance of proper communication between the components. The noticeable achievement in this period was the finalization and submission of deliverable D5.1.

WP5

WP6

WP6 started with collecting tools and methodologies helping to design and optimize solutions based on IMOCO4.E framework. Initial HW and SW catalogue showed that there are lots of tangible results which could be used to get our applications to the next performance level and ready for multi-layer digital twinning. We are working on methods

which allow to check in consistent way fulfillment of requirements gathered mainly in WP2. We are in close relation with all other work technical packages in order to get soon to the first iteration of all building blocks and first 'V' of our iterative 'W' approach.

In WP7, 9 partners worked on their specific pilot or demonstrator. In the pilots and demonstrators there are connections to other WP's, to Building blocks and for most of the pilots and demonstrators there are collaborations with other partners. In September the first both deliverables were completed and submitted. In task 7.1 and deliverable 7.1 the pilots are described and in deliverable 7.2 and task 7.2 the demonstrators. In the Riga meeting each partner explained the status of their pilot or demo.



Dissemination & Communication

IMOCO4.E values the importance of networking, exchanging ideas and knowledge with other similar EU projects. The consortium has managed to generate discussions with H2020 TIBCO, METIS and MADEin4 aiming at the co-organization of special sessions as well as boosting joint dissemination activities.

Liaison activities are in progress

During the reference period, the partners intensively disseminated the project results by spreading knowledge and creating good networking opportunities with industrial and scientific peers. The IMOCO4.E partners have focused to widen up the network of scientific experts of the project and transferred valuable scientific results by participating in multiple online and physical conferences and workshops. Visibility of the project and transferability of the project outcomes has been promoted through the update of the [promotional material](#) (released a new poster, Newsletter) and by regular dissemination to the public through social media channels. Within the WP8 activities and in order to foster the visibility of the project, they also released the 1st promotional video that it is an animated project intro video.

During the past 3 months and in the context of WP8 activities, IMOCO4.E participated in the several events, such as:

IMOCO4.E partners attended IFAC ACE 2022 event in Hamburg, Germany during July 24th-27th. (Representative partner: UWB). More details [here](#)



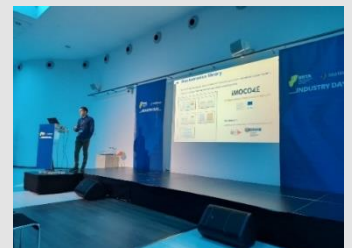
IMOCO4.E partners at the MEMS Imaging Sensors Summit at the World Trade Center, Grenoble-France to engage and empower tech leaders and innovators with IMOCO4.E's vision of the future of smart industry in Europe. (Representative partner: SEMI). More details [here](#)



IMOCO4.E partners attended ETFA 2022 conference in Stuttgart, Germany during September 6th - 9th 2022. (Representative partners: UWB, TUE, UNIBS and Tekniker). More details [here](#)



On the 25th of October of 2022, IMOCO4.E partners participated in the Mathworks Industry Day, jointly organized by MathWorks and the Basque Research and Technology Alliance (BRTA). (Representative partner: TEKNIKER). More details [here](#)



In addition, IMOCO4.E partners plan to participate in:

- Semicon Europa, 15-18 Nov 2022, Munich, Germany – [Event Link](#)
- EF ECS Event, 24-25 Nov 2022, Amsterdam – [Event Link](#)

Special Podcast Sessions

Coming Soon!!

Although the outreach activities continue with weekly posts on social media platforms (LinkedIn and Twitter), the IMOCO4.E team plans to increase knowledge and visibility of the project by raising awareness of the benefits of the IMOCO4.E platform on specific use cases and demonstrators via special podcast sessions and prerecorded videos!

Consortium Meetings, Publications & Submitted Deliverables

46 IMOCO4.E partners met for the first time f2f at the 2nd Consortium Meeting in Riga, Latvia in September 20 – 22nd, 2022. In this 2nd Consortium meeting partners reviewed and discussed the project status, the performed work and examined the crucial action points to be executed for the next six months. Consortium will prepare the 3rd Consortium meeting, which will be held in Bilbao, Spain on March 2023 and the 1st Review Meeting on 15th of November 2022.

IMOCO4.E Publications

The IMOCO4.E project also tries to have an active performance via conference paper publication by presenting the research work carried out in the frame of the project. The list of upcoming presented articles is shown below:

- “Optimized GPU-accelerated feature extraction for ORB-SLAM systems”, IPDPS Conference
- “Embracing GPU Kernels Management in XXX1Scheduling Middleware”, IPDPS Conference
- “Vision-based perception for fast multi-scale object positioning”, DATE conference 2023

Submitted Deliverables

- D3.1 – “Perception and instrumentation Layer requirements and specifications (first iteration)”
- D4.1 – “Requirements for advanced motion control (first iteration)”
- D5.1 – “Integral (system level) requirements for valuable twinning methods (first iteration)”
- D7.1 – “Definition of the pilots”
- D7.2 – “Definition of demonstrators”
- D6.1 – “Guideline of IMOCO4.E methodology and toolchains”

iMOCO4.E



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