Report on ERF2023 workshop #50 - 10th Workshop on Hybrid Production Systems - Part 2

WS # 50

10th Workshop on Hybrid Production Systems - Part 2

Organisers:

Name	e-mail	Gender (he/him, she/her, they/them)	Organisation name	Organisation Type (Academic, RTO, Large Industry, SME)	euRobotics member? Yes/No
Sotiris Makris	makris@lms.mech.upatras.gr	Male	LMS, University of Patras, Greece	Academic	Yes
George Michalos	michalos@lms.mech.upatras.gr	Male	LMS, University of Patras, Greece	Academic	Yes
Ramez Awad	ramez.awad@ipa.fraunhofer.de	Male	Fraunhofer-IPA	RTO	Yes
Iñaki Maurtua	inaki.maurtua@tekniker.es	Male	TEKNIKER	RTO	Yes

Speakers/Panellists (please complete, ideally with First Name, Surname(s), Gender (he/him, she/her, they/them), Organisation name, Organisation Type (Academic, RTO, Large Industry, SME)

1. *Dr. George Michalos – Male- LMS-University of Patras – Academic*
2. *Dr. Sharath Chandra Akkaladevi – Male - Profactor GmbH – RTO*
3. *Dr. Nabil Belbachir – Male - NORCE – RTO*
4. *Nikos Dimitropoulos – Male - LMS-University of Patras – Academic*
5. *Oliver Avram – Male - SUPSI – Academic*
6. *Apostolis Papavasileiou – Male - LMS-University of Patras – Academic*
7. *Alfio Minissale – Male – COMAU - Large Industry*
8. *Michael Suppa – Male - Roboception – SME*
9. *Alberto Landini – Male – STAM - RTO*
10. *Daniel Martin – Male – PILZ - SME*

Key questions to be discussed and answered by the WS

- What are the latest technologies developed in the HPS, focusing on:
  i) AI enabled Human Robot Collaobration
  ii) Seasmless Human Robot Collaboration
- Which are the main challenges that the above technologies could address?
- What are the barriers that prevent the researchers/developers to apply those technologies and overcome the challenges?

WS description

This was the 2nd part of the HPS workshop and did consist of two additional sessions. In the third session, a series of 5-minutes, targeted presentations on AI for HRC was be made, creating a panel of 5 presenters that interacted with the audience for 20-minutes. In the fourth session, a short presentation was made by LMS, focusing on seamless HRC, followed by a panel composed of industrial partners (COMAU, PILZ, ROBOCEPTION, STAM) that would interact with the audience for 20-minutes. To prevent inhomogeneity and delays, a common presentation was created with slides from all the presenters targeting a key technology, a main challenge and the barriers faced. In the end of each session, the audience was engaged in an open dialogue with the panel speakers using interactive tools (including both academic and industrial people) to identify the milestones achieved so far and the key challenges to be addressed in the next years.

Highlights from the workshop (max 400 words)

Note: Describe the key highlights or major points of interest that emerged from the workshop and the discussions. In particular note anything that altered your perspective or thinking on the topic and note anything that may be of interest to the wider robotics community.

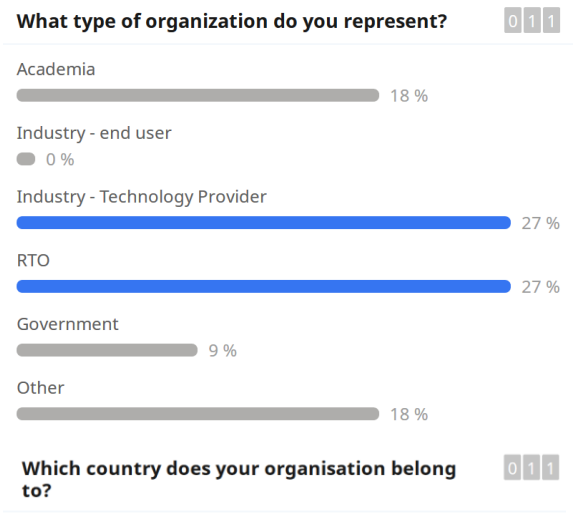
Session 3:

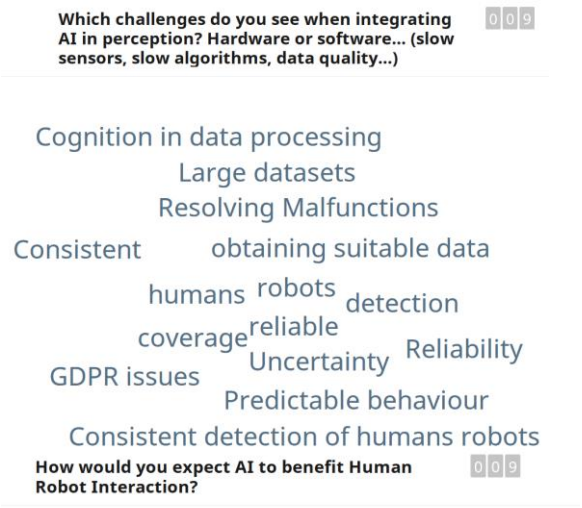
Session 3 tackled the topic of AI for Human Robot Collaboration presenting interesting results from a number of relevant EU funded projects, namely: AI-PRISM, COGNIMAN, CONVERGING, FLUENTLY and ODIN. The results and experiences derived from the projects' outcomes provided the basis for further discussions in a variety of manufacturing sectors such as automotive, aeronautics, white goods, bicycle industry, additive manufacturing, glass fibre production, machining, electronics among others. Special attention has been provided on demonstration of innovative solutions related to the context of collaboration between robots and human operators as well as the utilization of Artificial Intelligence techniques in such solutions. More specifically, technologies related to reconfigurable production systems, digital twin, quality inspection, Augmented Reality, advanced sensing and actuation, robot control, social human-centred collaboration have been presented and evaluated. Session 3 summarized its activities via an interactive panel discussion where the speakers together with the audience had the opportunity to answer in a variety of questions, paving thus the way towards the beneficial introduction and usage of AI in different aspects of manufacturing especially in workspaces where the collaboration of humans with robots is required.

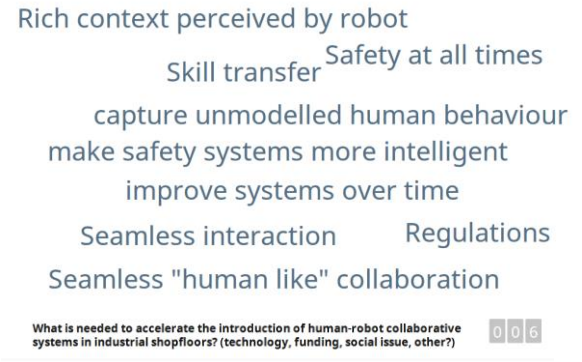
Session 4:

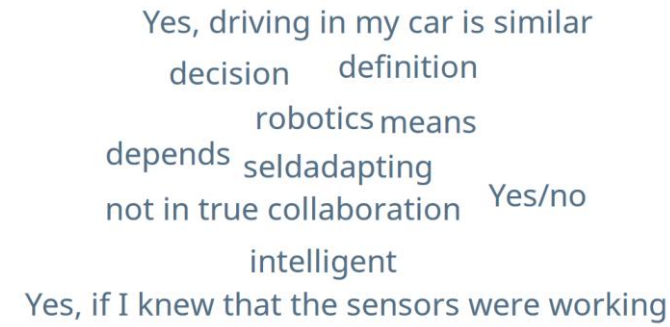
The 4th session of the HPS workshop aimed to present and analyse the technological advancements and enablers towards seamless HRC, providing insights and lessons learnt from recently concluded EU funded projects – success stories (e.g. SHERLOCK, SHAREWORK). Afterwards, a panel consisting of representatives from key EU technology providers related to HRC took place, including industrial robot manufacturers (COMAU), sensing experts (ROBOCEPTION), integrators (STAM) and safety experts (PILZ). An introduction to the topic was done by presenting the evolution of industrial HRC, while the examples of the main enabling technologies were presented, such as high and low payload collaborative robots, exoskeletons, mobile robots, interaction and awareness, AI for perception and cognition as well as design considerations for safe HRC. Three advanced industrial applications were presented, from the renewable energy and automotive sectors, involving high payload collaborative robots undertaking heavy weightlifting and from the contract manufacturing sector involving a low payload collaborative robot undertaking repetitive tasks, demonstrating benefits in terms of weight handled by the operators, production system performance, reduction of errors and ergonomics benefits. During the interactive panel discussion, insights related to the latest technologies developed in the area related to robots (h/w, s/w), sensors, safety and integration aspects was presented, including vision supported flexible production, safety sensors with faster reaction time, simplification of safety certification, new faster cobots, more capable exoskeletons and easy to program solutions. Moreover, the challenges developing such solutions as well as the barriers that prevent their wider adoption were discussed, such as data greediness for AI, robustness of AI solutions, high complexity of the design and integration of HRC, feeling of low performance of collaborative operations due to safety concerns, operator's acceptance and high gap between user's requirements and performance of the current robotic solutions.

Feedback in the interactive sessions:









Conclusions and/or next steps (max 300 words)

Note: State what you concluded from the workshop and what the next steps or outcomes from it are. For example; do you plan to hold a follow-up meeting, will this inform grant proposals, can you deliver a newsletter article, did the meeting allow attendees to make new connections, was there a clear overview of the current state of the art, or a vision for the future?

Taking into account the different projects' presentations as well as the audience inputs, the speakers discussed in depth their personal views regarding the future of AI in the topic of human robot collaboration. Based on this, the main challenges that should be addressed in terms of AI in perception were analysed such as the consistent results, the minimization of uncertainty, the collection of suitable data for training, the persistence of large dataset and the potential GDPR issues. In terms of benefiting from AI in Human Robot Collaboration, both the audience and speakers agreed that AI technologies can provide a robust transfer of skills, make safety systems more intelligent, establish a more seamless interaction and perceive a richer context by the robot. In addition, further barriers were discussed in terms of HRC such as the means of certification, the required safety regulations, as well as the cost that in many cases is high for industrial partners to integrate such solutions in full-scale production. Finally, the future steps towards accelerating the introduction of HRC systems in industrial shopfloors have been tackled, highlighting the need for value creation and more real-life industrial demonstrators. Thus, there was a common view on the need towards further collaboration under EU funded projects or clusters such as the Hybrid Production Systems (HPS) where different organizations can participate having a strong impact on the EU industrial and research community.

Last but not least, further interest has also been expressed on presenting further mature results from the EU projects in upcoming ERF workshops, under the umbrella of the HPS cluster.

Thus, the HPS organizers aim to submit their interest to conduct the 11th HPS workshop during ERF2024.

You can add links to websites, videos etc. here:

Previous Workshops:

- ERF2014 - Hybrid Production Systems: https://www.hybrid-production-systems.eu/portofolio/erf/
- ERF2015 - Hybrid Production Systems: https://www.hybrid-production-systems.eu/e/
- ERF2016 - Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2016/
- ERF 2017 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2017/
- ERF 2018 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2018/
- ERF 2019 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2019/
- ERF 2020 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2020/
- ERF 2021 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2021/
- ERF 2022 – Hybrid Production Systems:https://www.hybrid-production-systems.eu/9th-workshop-on-hybrid-production-systems/

Project Websites:

- AI-PRISM: https://aiprism.eu/
- COGNIMAN: https://cogniman.eu/
- CONVERGING: https://www.converging-project.eu/
- FLUENTLY: https://www.fluently-horizonproject.eu/

- ODIN: https://odin-h2020.eu/
- SHERLOCK: https://www.sherlock-project.eu
- SHAREWORK: https://sharework-project.eu/

Workshop website:

- https://www.hybrid-production-systems.eu/erf-2023/

If you are planning future publications or meetings (or would like to organise a more focused event such as a TG driven webinar) please let us know here.

Organize in ERF 2024 the 11th HPS as a follow-up workshop.

If you like the euRobotics' communication team to contact additional people apart from the organisers to discuss collaboration/dissemination in order to maximise the impact of your workshop, please add them here

Name, affiliation and e-mail of additional contact person(s): N/A