TEACHING NEWSLETTER

NO 7

FEBRUARY 2023

TEACHING is an EU-funded project that designs a computing platform and the associated software toolkit supporting the development and deployment of autonomous, adaptive, and dependable CPSoS applications, allowing them to exploit sustainable human feedback to drive, optimize and personalize the provisioning of their services.

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

During the reference project period, TEACHING has improved and implemented main technical action items, by finalizing the AI-Toolkit functionalities and documentation; while this AI-Toolkit contains base classes and utilities that can be used to instantiate AI nodes. The partners have successfully delivered a 3-day functional safety course with the EuroSPI community. Signinficant improvements have been establised in our use cases (eg. Avionics), while we integrating technology bricks from work packages into demonstrable pilots.

Furthermore, TEACHING partners have demonstrated their achievable technical results, and presented the key achievements of the project (dissemination analytics, exploitation milestones, etc.), in our Technical Review meeting, on 5th of October 2022. The meeting was full of fruitful discussions, and we received feedback from our Project Officer and the Reviewers from the European Commission. Moreover, TEACHING's 1st Online Stakeholders' Workshop was successfully held online on mid-October, with title of *"Discover the future of CPSoS applications"*, which has attracted more than 30 participants. You could read more here.

TEACHING HIGHLIGHTS M33 – M36

WHAT HAS BEEN DONE?

The work focused on the demonstration of the TEACHING Platform and the deployment of the Automotive application. The TEACHING Platform architecture follows a microservice-based architecture pattern. Using a message broker, it allows the dynamic definition of data workflows that may run in any platform that supports a Docker container. The workflows can be deployed across multiple platforms. The key idea is that the application developers should be able to use an abstract language to describe the data workflows that they want to deploy, and the system should be able to implement that. In this

context, a TEACHING Application is essentially modelled as a data workflow that is meant to close the feedback loop. Such a workflow may contain AI-based components which add further challenges to the task. The demo for the Automotive TEACHING Application can be found here. Furthermore, the Avionics TEACHING application demo design was approved, and its implementation started.

In the scope of WP2, the tools for supporting offloading of computationally demanding streaming computations on integrated GPUs are available and ready-to-be used by the rest of the project Tasks/WPs. The activities of T2.2 are going in the direction to refine the developed tools by introducing further performance and usability optimizations during the most intensive experimental activities that will be conducted in the next months. Moreover, by the end of the reporting period, CNR has successfully delivered D2.3 which was about "Final release of the computing and communication platform". This deliverable documents how we defined and implemented HPC2I as a Continuum enabling platform by leveraging industry standards and complementing them with new tools and techniques to ease the integration of heterogeneous devices. The HPC2I design provides a virtual infrastructure where communication and computation are mostly decoupled, allowing them to be optimized separately. Within the submission of this deliverable, TEACHING reaches successfully Milestone 5 of WP2, where final TEACHING platform has assembled and integrated with complete functionalities. However, some of the features and results from WP2 were described in D2.3, have been exploited in the integration activities and thus also reported in concurrent deliverable D1.3; which successfully also submitted by the end of this reporting period, from the partner HUA.

The activities of Work Package 3, of the TEACHING project, has focused on the successfully linking and delivery of a three day functional safety course with the EuroSPI community. TUG updated the PENNE automotive E/E architecture framework for testing cybersecurity attacks and thus enhanced the cyber-security training possibilities. Additionally, a demonstrator vehicle showcasing both AI-based and conventional lane detection algorithms, has been further elaborated and will be focusing on safe handovers between the two concepts.

Standardisation activities related to automotive cyber-security and AI-based systems have further been followed up by AIT and dissemination actions for integration of related workshops in international conferences (SafeComp and DSN) have been undertaken.

During the reporting period, WP4 activities focused on finalizing the AI-Toolkit functionalities, tutorials, and documentation. Thanks to the joint efforts of all partners involved in the project, we were able to successfully complete this fundamental technology development step and contribute to the planned MS5 project milestone. The AI-Toolkit contains base classes and utilities that can be used to instantiate AI nodes within an articulated computational graph that defines

the information flow and processing of a TEACHING application (Task T4.1). Such AI modules include (but are not limited to) anomaly detection, human-centered personalization, stress detection, federated learning, and others. Furthermore, the work performed in WP4 also proceeded in the tailoring and specialization of the developed learning modules and functionalities towards the validation of the TEACHING platform. This line of activities mainly concerned tasks T4.2 and T4.3, where we advanced in the investigations on the data from the use case setups (both avionics and automotive), refining – in particular – the components for human state monitoring, anomaly detection, cybersecurity, driving personalization and mitigation recommendations in avionics. Finally, we have deepened the analysis and applications of the Safe and Dependable AI functionalities within the AI toolkit (Task T4.4). In this regard, our analysis suggests that there is room in the literature to explore the use of the developed methodology for Usage Level C safety scenarios.

As TEACHING draws to the closure phase, WP5 focuses on integrating technology bricks from other WPs into demonstrable pilots. Generally, that means that SW and FW algorithms are being integrated into the HW platform and the integrated solution is going through the testing phase in both industrial domains. For the avionics use case, the integration activities include improvements in terms of anomaly detection, recommendation system, federated learning aggregation functionality, and interfacing to the vehicle dashboard in a manner that is adapted for human use to maximise the chance of acceptance through possibilities for intuitive usage. Integrating human models, which are resulting from the first driving simulation study into a driving simulation environment is a concern of the automotive pilot. The pilot also relies on the improvement of control functionalities, which are informed by the human model at the input side and are responsible for controlling the driving simulator in desired driving mode. The integrated solution is what the end-users will eventually have a chance to experience. The next step includes testing appropriate technology components in the second driving simulation study.

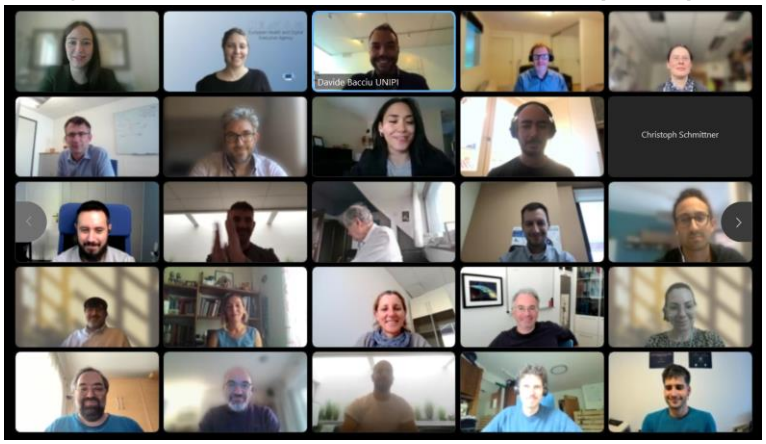
TEACHING Dissemination and Communication

Within the reporting period, the partners have intensively disseminated the project results by spreading knowledge and creating good networking opportunities with industrial and scientific peers. The TEACHING

partners have focused to widen up the network of scientific experts of the project and transferred valuable scientific results by participating in multiple online conferences and workshops. In this regard, partners have successfully organised the 1st Stakeholders' Engagement Workshop which held online on October 18th, 2022, via the Microsoft Teams platform. The workshop titled "Discover the future of CPSoS applications" attracted a total of 41 participants. The concept of "systems of systems" has emerged as an active domain of research in recent years at the interface of various disciplines. So, the main goal was to focus on autonomous, adaptive and dependable CPSoS applications and give the participants the perspective of how these applications can be embedded and implemented within a project. However, the workshop followed up a specific agenda, and the last part of the workshop was an interactive session with the rest of the attendees, while we went through live polls and open discussion. In the purpose of the workshop, partners have created video pitches which are all available in our YouTube channel.

Moreover, TEACHING partners seeking to continuously contributing and supporting communication activities of the project in order to achieve all the dissemination goals. Thus, partners have expanded the project visibility by submitting 7 new publications/journal papers within the aforementioned reporting period.

Furthermore, TEACHING project gathered its partners on the 5th of October 2022, for the 2nd Technical Review meeting, which has been held online with the participance of all the project members, the Project Officer and the assigned reviewers. The main purpose of the meeting was to present the main results achieved within the past 12 months of the project, from the technical point of view. Also, progresses from the work packages along with the Dissemination and Exploitation plan of the project, have been reported and presented.



Last, within WP6, "Communication, Dissemination, Standardization and Exploitation" by the end the reporting period, in December, partner AIT has successfully submitted the deliverable D6.7, "Overview of AI standardization"; which is linked with T6.4. The intention was to deliver an overview about relevant standardisation activities related to AI (Artificial Intelligence).

Visibility and transferability of the project outcomes has been promoted by regular dissemination to the public through social media channels.

Partners seek to organize further meetings within the dissemination and exploitation activities, such as Hackathon event, or technical workshops, in physically nature in order to achieve an in-person integration meeting and boost our discussion culture by the end of the project (June 2023).

TEACHING Publications

The TEACHING project also had an active performance via journal and conference paper publication by presenting the research work carried out in the frame of the project. The list of the presented articles produced in the reference project period is shown below:

Decaro, Valerio, Bano, Saira, Machumilane, Achilles, Gotta, Alberto, Cassarà, Pietro, Carta, Antonio, Semola, Rudy, Sardianos. Christos, Chronis, Christos, Varlamis, Iraklis, Tserpes, Konstantinos, Lomonaco, Vincenzo, Gallicchio, Claudio, & Bacciu, Davide. (2022). AI-as-a-Service Toolkit for Human-Centered Intelligence in Autonomous Driving.

Davide Bacciu, Patrizio Dazzi and Alberto Gotta "Supporting Privacy Preservation by Distributed and Federated Learning on the Edge", ERCIM News, No 127, 2021

Bano, Saira, Tonellotto, Nicola, Cassarà, Pietro, & Gotta, Alberto. (2022). FedTCS: Federated Learning with Time-based Client Selection to Optimize Edge Resources.

Charalampos Davalas, Dimitrios Michail, Christos Diou, Iraklis Varlamis, & Konstantinos Tserpes. (2022). A Cloud-based Continual Learning System for Road Sign Classification in Autonomous Driving.

Pietro Cassará, Alberto Gotta, & Lorenzo Valerio. (2022). Federated Feature Selection for Cyber-Physical Systems of Systems. IEEE Transactions on Vehicular Technology.

Merlin, Gabriele, Lomonaco, Vincenzo, Cossu, Andrea, Carta, Antonio, & Bacciu, Davide. (2022). Practical Recommendations for Replay-Based Continual Learning Methods.

Sylvain Girbal, Jimmy Le Rhun, Daniel Gracia Pérez, & David Faura. (2022). Safety & Security monitoring convergence at the dawn of Open Hardware. 11th European Congress on Embedded Real Time Software and Systems (ERTS 2022), Toulouse, France.

Bano, Saira, Carlini, Emanuele, Cassara', Pietro, Coppola, Massimo, Dazzi, Patrizio, & Gotta, Alberto. (2022). A Novel Approach to Distributed Model Aggregation Using Apache Kafka.

TEACHING Deliverables

- ➔ D1.3: Report on TEACHING CPSoS integration and on Human Centred Design outcomes; R+DEM, Public, M36, HUA
- ➔ D2.3: Final release of the computing and communication platform; Demonstrator, Public, M36, CNR
- ➔ D6.7: Overview of AI standardization, Report, Public, M36, AIT

TEACHING Consortium

Key Facts

Project Coordinator: Dr. Davide Bacciu
Institution: UNIPI
Email: bacciu@di.unipi.it
Start: 1-1-2020
Duration: 36 months
Participating organisations: 11
Number of countries: 6

Follow us

www.teaching-h2020.eu
TEACHING_H2020
@TEACHING_H2020

Fundings

This project has received funding from the European Union's Horizon 2020 Research and Innovation program under grant agreement No 871385.

EUROPEAN UNION