THEIA^{XR} NEWSLETTER

ISSUE No. 1

WELCOME TO THEIA^{XR}

Welcome to the first issue of the THEIA^{XR} Newsletter, where we will present you the project, the use cases, and the advancements of the first 6 project months.

THEIA^{XR} is a research project funded by the European Commission that targets to "make the invisible visible" respectively the "unperceivable perceivable" for human operators of mobile off-highway machinery. THEIA^{XR} will:

… integrate real end-users, public/non-users, and real-life data from dedicated industrial environments.

… provide XR interaction concepts and design principles that facilitate human friendly and intuitive design of XR interactions.

… make extended reality technologies applicable to state-of-the-art operating environments (cabin-based, and tele-operational).

… deploy a transdisciplinary co-design methodology to design and develop multimodal XR information presentation and interaction.

The results will be demonstrated and validated in three use cases in the off-highway domain, targeting snow grooming, logistics, and construction scenarios.

THEIA^{XR} PROJECT CONSORTIUM AND USE CASES

PROJECT PARTNERS

The THEIA^{XR} consortium consists of 11 partners spread over Europe including large enterprises, SMEs, universities, and a research institute specialized in Extended Reality technologies, human-machine interaction, and social aspects of human behaviour with mobile machinery.

TTControl's roles in the project are the coordination of the overall project, the development of the control architecture for deploying and hosting mixed reality technologies directly into the off-highway mobile machinery and the dissemination and exploitation activities within the project. TTTech is supporting as affiliated entity in all activities.

In THEIA^{XR}, the team from Graz University of Technology, from the Institute for Computer Graphics and Vision (ICG), focuses on basic research activities in AR/MR/VR and environmental sensing and will develop new enabling technologies to support the individual use cases with adequate solutions.

Technische Universität Dresden is leading the work package focusing on Cyber-Physical Human-Machine Interaction, the construction use case as well as the Dissemination and Communication work package.

The Hochschule der Medien (HdM) Stuttgart Institute of Applied Research (IAF) and the Information Experience Design Research Group (IXD) of IAF is leading a new transdisciplinary co-design process in THEIA^{XR} involving users and operators of off-highway machinery in the design methodologies and decision-making processes.

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Uni.lu's 3 faculties and 3 interdisciplinary centres focus jointly on 3 key research areas: Digital Transformation, Medicine, and Health, and Sustainable and Societal Development. Within the THEIA^{XR} project, UL focuses on the privacy topic of the used data coming from the use case participants.

VTT has exploited VR for already 30 years and AR for 15 years and done more than 100 company cases. Within THEIA^{XR}, VTT focuses on developing and deploying XR applications for improving human-machine interaction, mainly targeting the remote operation of harbor cranes.

Creanex Oy, is a Finnish high technology company specializing in advanced simulator solutions for mobile work machinery. The SME will contribute with off-highway simulator environments for the dedicated use cases to test the developed solutions with Hardware-in-the-Loop approaches.

The company Haption is a high-tech SME based in France, founded in 2001. Haption contributes its knowledge on force-feedback and research how this feedback can be used to improve the human-machine interaction in the off-highway domain.

Besides other business units, Prinoth AG is the first choice worldwide for snow groomers that deliver perfect results. In THEIA^{XR}, Prinoth is leading the snow grooming use case and will also oversee the integration process in the use cases.

Kalmar offers a wide range of cargo handling solutions and services to ports, terminals, distribution centres and to heavy industry. Kalmar is leading the logistic use case as well as the requirements analysis of the project.

USE CASES

Three different application domains have been selected that pose various challenging tasks and environments for the human operator controlling the machinery. All machines within the use cases are high-tech machines, requiring much experience controlling them and the continuous attention of the operator.

SNOWGROOMING

A snowgroomer needs to be operated in all conditions, even during whiteout zero view or the environment.
Sensors and visualization assistances support the operator in driving and controlling the machine.

LOGISTICS

Reach stackers, representing the logistics use case, are handling heavy items, and are operated remotely. Thus. it is necessary to provide the human operator with an ideal perception of the task at hand and the context, that might vary from task to task.

CONSTRUCTION

Operators in construction need to handle heavy excavators and similar machines safely. Mixed-reality technologies will aid the human operator in controlling the machine and efficiently navigating in the operating environment.

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MEETINGS AND EVENTS

JANUARY 2023: KICK-OFF MEETING

Figure 1: THEIA^{XR} Kick-Off Participants

In January of 2023 the THEIA^{XR} project coordinator TTControl hosted the event in Vienna. The project partners got together for a 2-days kick-off meeting to start the activities and plan the coming six months. It was a perfect starting point for various online meetings and ongoing fruitful discussions and exchange.

MARCH 2023: OPERATOR WORKSHOP

Figure 2: On-site Operator Workshop Participants

In March, a selected group of THEIA^{XR} partners participated in the snow grooming use case meeting at partner PRINOTH in Sterzing, Italy.

The main goal was to meet with actual operators of snow groomers and hear their views on how XR technologies could make their day-to-day interaction with the machines easier and more enjoyable. The snow grooming use case will then implement these inputs into a pilot that is hoped to improve human-machine interaction in snow groomers with the help of XR.

The partners also provided insights on the technical aspects of the snow grooming use case and worked towards the first specification, resulting in compelling discussions and ideas.

Figure 3: Operator discussions

Finally, PRINOTH allowed all partners to experience working with snow groomers firsthand by joining the operators during their activities.

JUNE 2023: THEIA^{XR} @XR EXPO

Figure 4: Manuel Kulzer, HdM in discussion with booth visitors

In June, THEIA^{XR} had the first presence at an expo, namely the XR Expo in Stuttgart. Stuttgart Media

University was organizing a booth for the THEIA^{XR} project, and it attracted many visitors who received insights into the project and its advancements.

Figure 5: THEIA^{XR} Stand @XR Expo

JUNE 2023: CONSORTIUM MEETING

Figure 6: Participants of the consortium meeting

As well in June, the project participants got together for the first full consortium meeting after the project kick-off. University of Luxembourg was hosting the very successful meeting:
„I really appreciate the great exchange and open communication we are living in the project. The project has made great progress in all aspects, especially in the use case specifications ", says Martijn Rooker, the THEIA^{XR} project coordinator.
We would like to thank all participants for the open, fruitful and goal-oriented discussions and are looking forward to the next period of the project!

JUNE 2023: IVT Expo and Conference

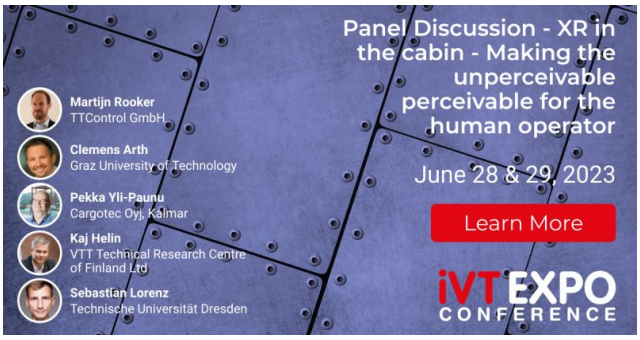

Figure 7: THEIA^{XR} @IVT EXPO & CONFERENCE

Right after the THEIA^{XR} consortium meeting, some project partners were travelling to Cologne to present the project at the @IVT Expo and Conference.

Figure 8: TTControl Expo Stand with THEIA^{XR} roll-up

THEIA^{XR} was represented at the stand of the project coordinator TTControl and was hosting a full session during the conference: "Cab design, Ergonomics, Controls, HMI & Human Factors". The following presentations have been made during this session:

- XR in the cabin – the THEIA^{XR} approach by Martijn Rooker, TTControl
- Accurate Outdoor Augmented Reality - Applications and Challenges by Clemens Arth, TUG

- User Interface Design in industrial applications – Using low effort, medium fidelity prototyping to explore XR modalities by Sebastian Lorenz, TUD
- Exploiting XR in the novel cabin concepts and operator support by Kaj Helin, VTT
- XR use cases in container handling machines by Pekka Yli-Paunu, KALMAR

Figure 9: THEIA^{XR} at the IVT Session "Cab design, Ergonomics, Controls, HMI & Human Factors"

The session was concluded by a vivid panel discussion and interesting exchange with the audience addressing numerous aspects including the social acceptance of different solutions in various scenes.

Figure 10: Project partners after the successful event (f.l.t.r.: Gerald Fritz-Meyer, TTC – Clemens Arth, TUG – Sebastian Lorenz, TUD – Martijn Rooker, TTC – Pekka Yli-Paunu, KAL – Kaj Helin, VTT)

We would like to thank all participants for their efforts in preparing as well as in executing this successful event.

COMING UP

The next phase of the project is very interesting as we will be able to not only present a first XR prototype for remote operation but will also continue with operator workshops at our use case partner's sites. The next consortium meetings are scheduled for end of November / beginning of December 2023 and will be covered by the next edition of our THEIA^{XR} newsletter by beginning of 2024. In the meantime, we are inviting you to follow our advancements on the THEIA^{XR} LinkedIN channel.

THEIA^{XR} has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101092861. Any information of results reflects only the author's view, and the European Commission is not responsible for any use that may be made of the information it contains.