



Advantages of multi-user environments in big data visualization and remote control

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Agenda

Multi-user environment versus Metaverse – definitions

Remote control operations

Environment data collection and implementation for theory, practical and certified courses

Multi-user environments for remote control operations

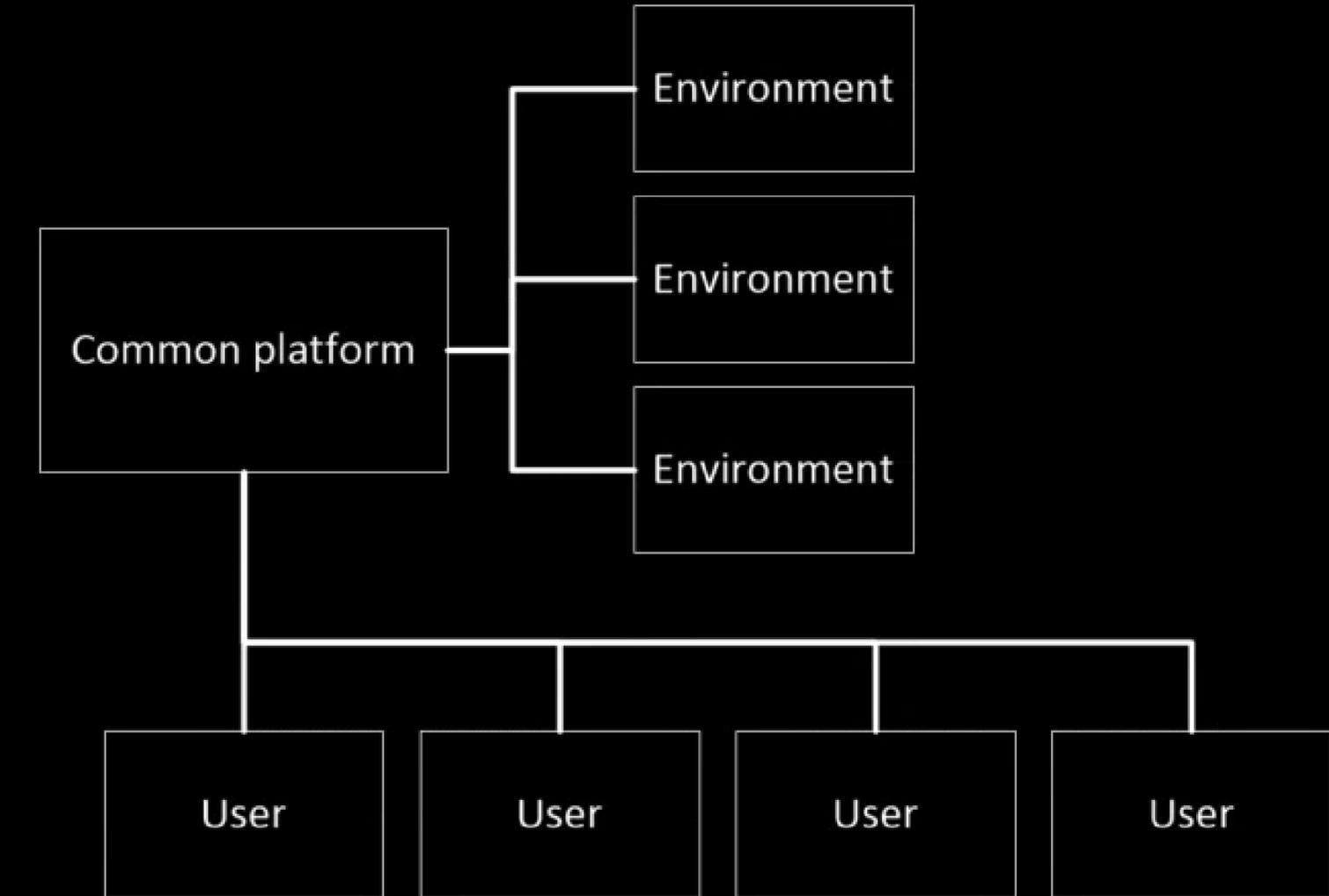
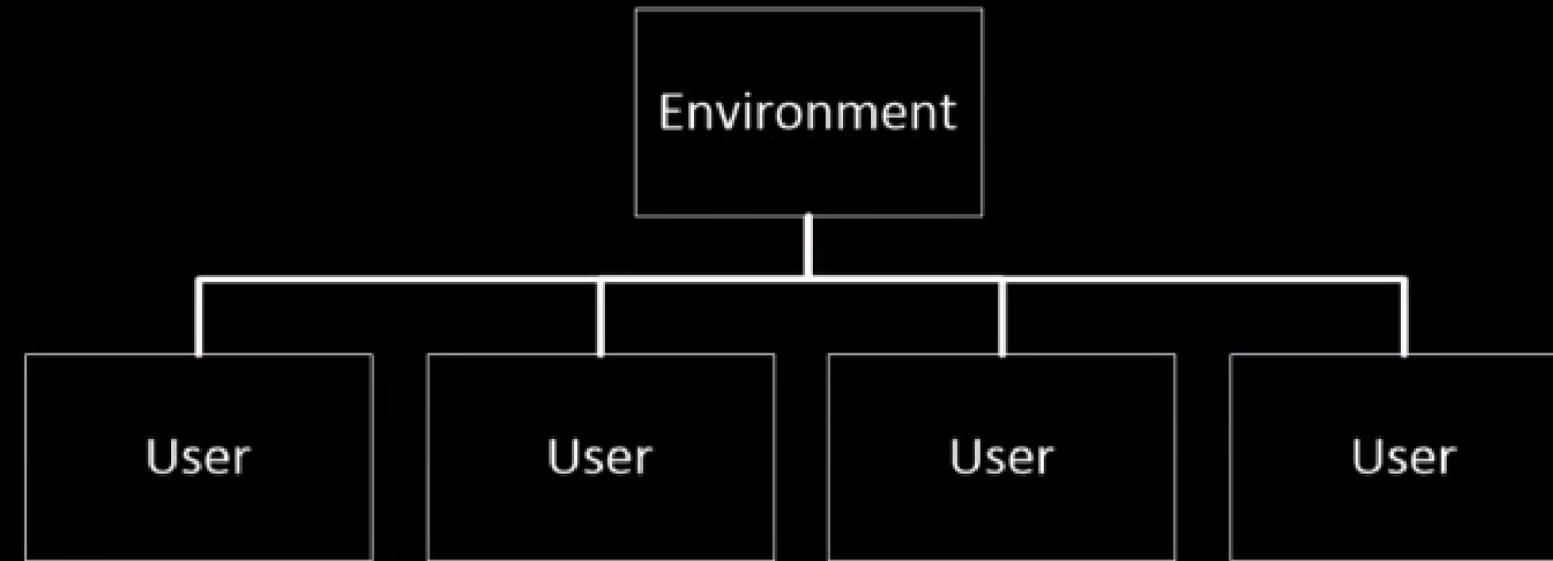
Combinations of sensor data and behavioral data

Multi-user environment versus Metaverse

definitions in context of this presentation

Former is any environment which can host multiple users remotely or locally

Latter is combining several or all multi-user environments into unified seamless platform



Environment data collection and implementation for theory course

Tasks and exercises are given by cues in virtual environment

With common platform, data of each task and exercise attempt is collected in the backend system. The course can run 24/7 and internationally

Common platform can provide access to several environments and training scenarios: user progress can be followed and reviewed for audit

Statistics of the exercise environment are provided for course supervisors in real time if required



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- Move
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- Interact
- Sprint
- Push to Talk
- Teleport
- Show/Hide Course
- Release Item

Environment data collection and implementation for practical course

Tasks and exercises are done in virtual environment, supervised by certified trainer or neural network

Monitoring of each task and exercise attempt is collected in the backend system. Attempts can be fully reconstructed in virtual environment

Course trainer can move freely in the environment, gaining any required perspective of the attempts

Trainer and trainee can communicate in real time. Trainer can also switch to trainee's view at any moment when required.



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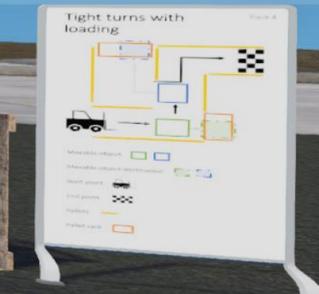
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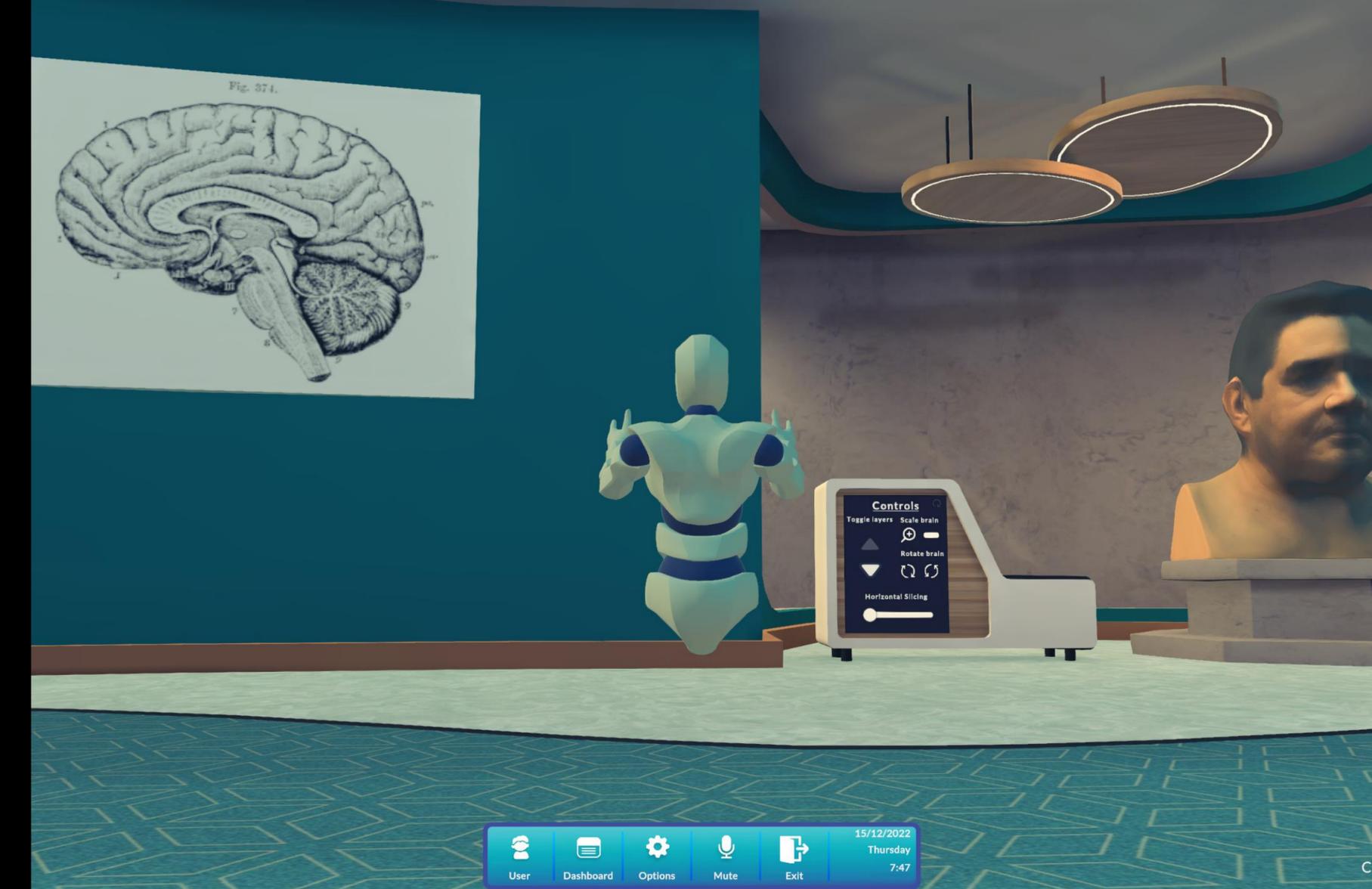
Environment data collection and implementation for certified course

Common platform provides identity, authenticity and authority services. The certificate candidate can be validated to be who he claims to be.

Certified environments are open for access only after identity has been confirmed.

Platform provides collection of data for certification based on required metrics.

Built-in monitoring of the environment can provide immediate feedback on required events



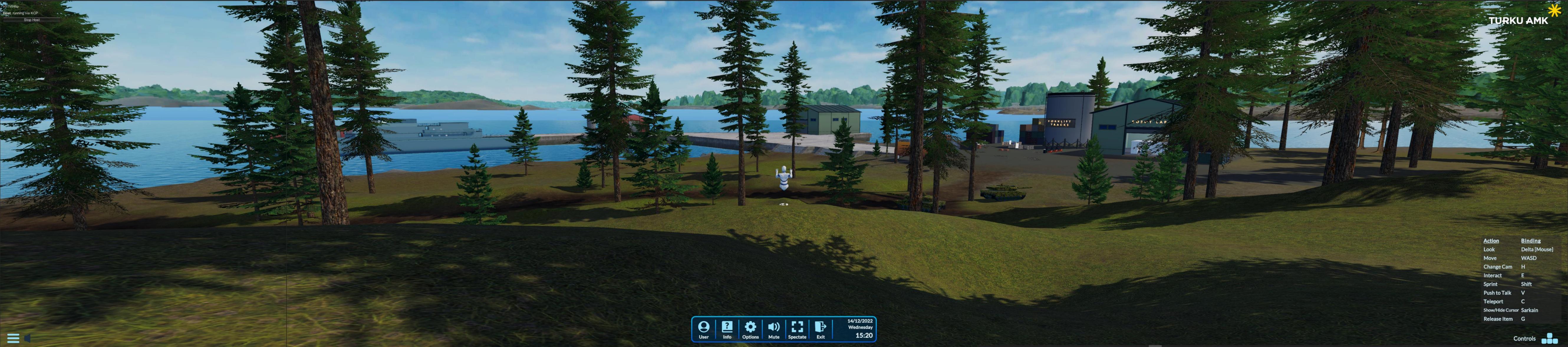
Combination of sensor data and behavioral data

In addition to the physics operations, the virtual environment can observe user's operations in fine detail: eye-tracking, finger-tracking, hand-tracking, health sensors.

Data of eye-tracking is collected at 200hz frequency per eye in the state-of-the-art headsets. Massive amount of data from various sources is a challenge.

Combined with physics operations, the environment state as well as user's state and actions can be reproduced.





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Remote control operations

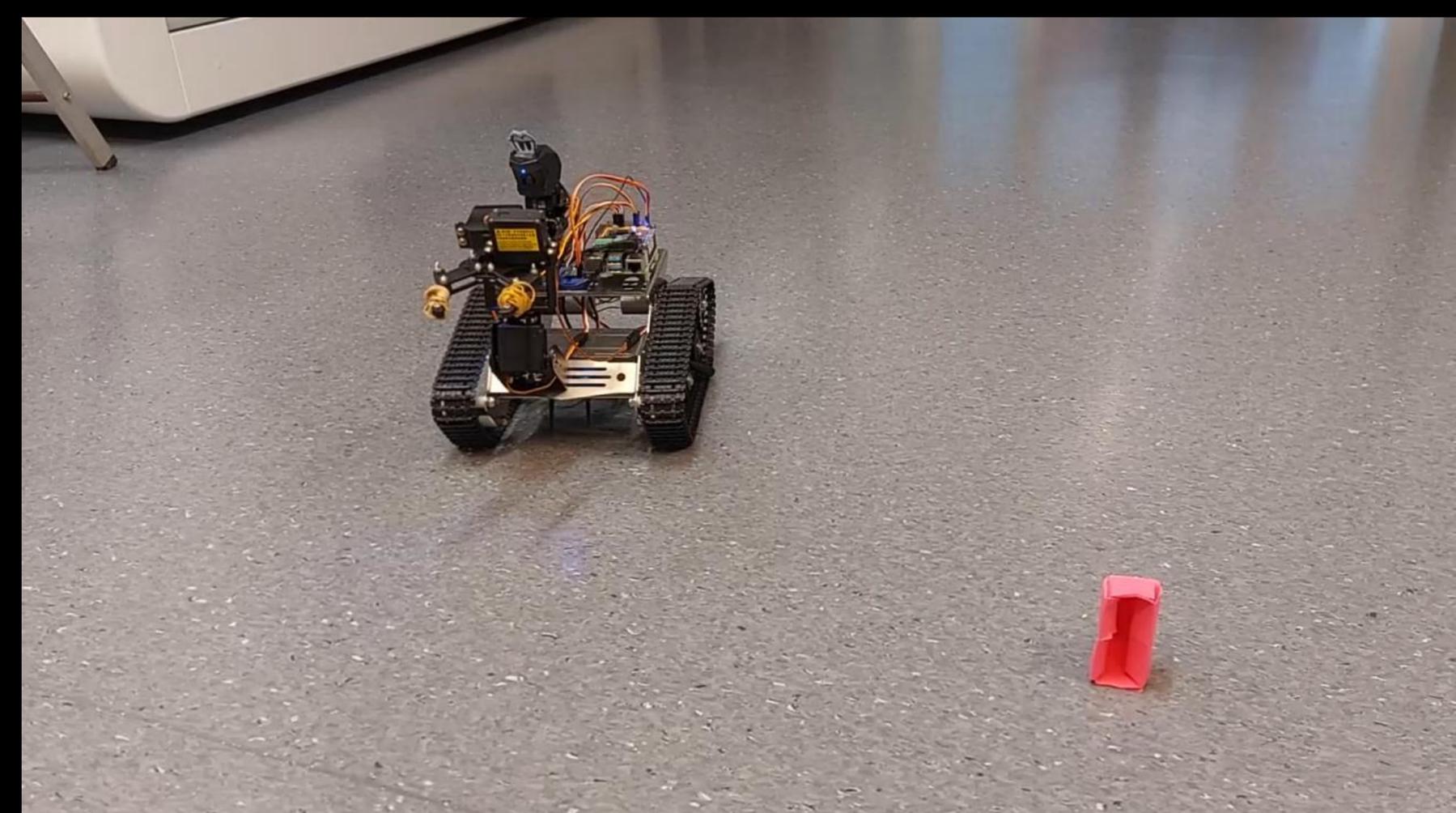
Digital twin controlled in virtual environment, reflected into real world operation and actual machine movements

Data flows

Human operator -> controller command -> network transmit -> machine receiver -> machine operation

Machine sensor -> machine sender -> network transmit -> controller receiver -> user interface -> human operator

Network delays and sensor data flow synchronization





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Multi-user environment for remote control operations

Environment has triggers for remote control positions

Users can move in virtual environment quickly to remotely operate machinery in multiple physical locations even internationally

Users can demonstrate and manipulate environment objects together for collaboration and learning



Future development paths

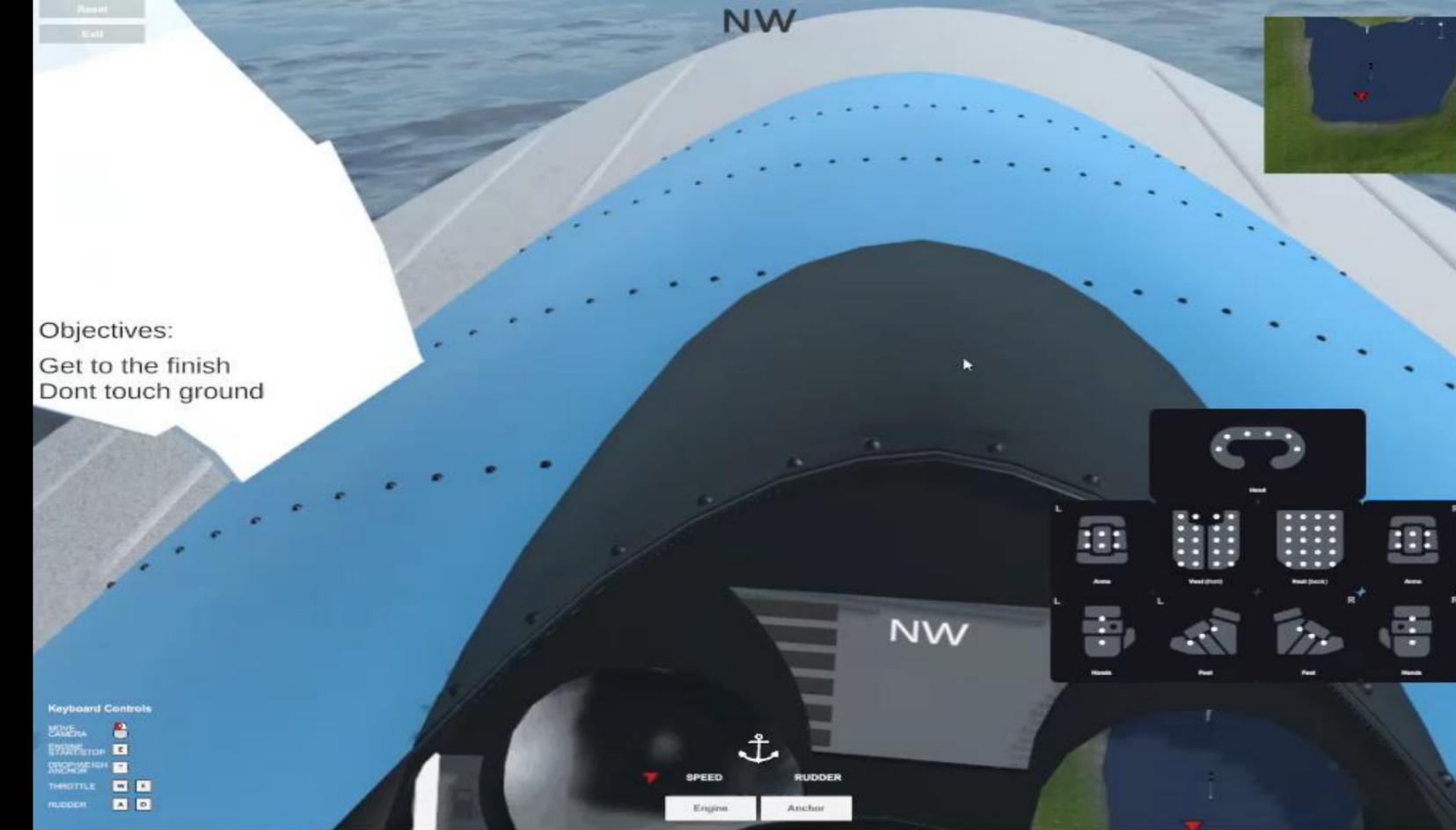
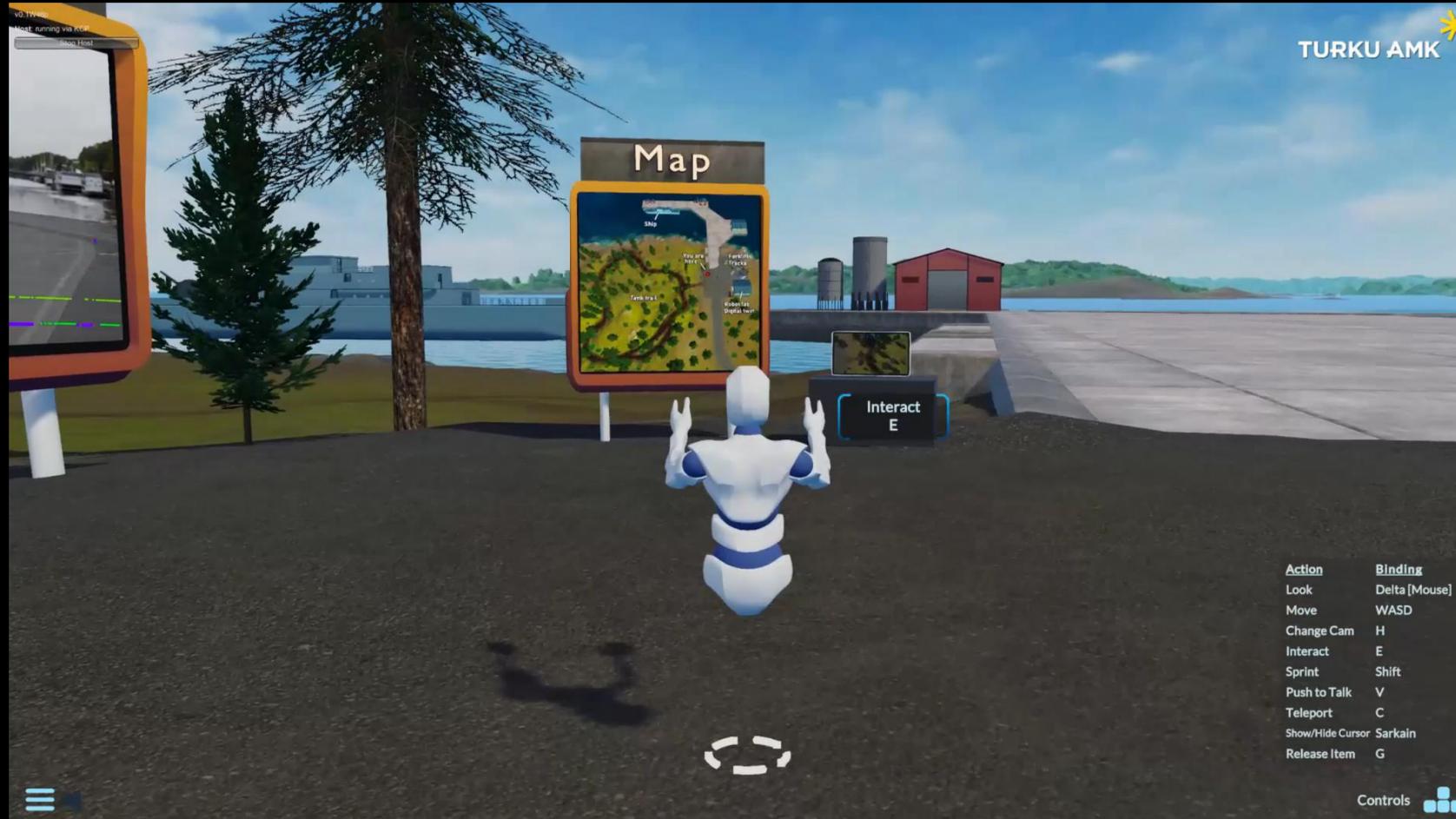
Data (pre)processing at edge devices to achieve smaller data transfer loads and Big Data analytics

Common platform for remote operations without restrictions on physical location

User right, credential and subscription management as well as remote device integration: smart machines can be represented in various ways inside virtual environment

360 video and lidar scanning for augmented static virtual environment

All combined into single platform!



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Thank you!

Questions and discussion

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