



Case study

Turku University of Applied Sciences creates successful teleoperation solution on Nokia RXRM platform

- A new element for collaborative industrial metaverse, building on Nokia's RXRM technology
- Improves remote operations in mobile environments such as the maritime industry
- Users from different locations can work in the same virtual space simultaneously, gaining significant efficiencies



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Our research group known as Futuristic Interactive Technologies (FIT) has established itself as an internationally recognized expert in virtual training and industrial metaverse technology. This expertise is evidenced by several national and international awards. The research group works at the FIT Turku Competence Center, where a wide selection of the latest interactive technologies in the field are available, from XR glasses to laser scanners and mobile robotics.

We are pleased to have the opportunity to develop the unique application on Nokia's Real-time eXtended Reality Multimedia (RXRM) solution platform. Our cooperation with Nokia has been seamless at every step of the process. Moving forward we will continue to have the opportunity to further develop our own industrial metaverse environments by simultaneously leveraging the best features of the metaverse platform, Nokia's RXRM technology and the Unity physics engine.”

Dr. Mika Luimula
Research Group Leader

Futuristic Interactive Technologies
Turku University of Applied Sciences

Turku University of Applied Sciences (UAS) is a Finnish higher education institution of 13,000 experts, researchers, students, faculty members and teaching professionals. Turku UAS creates solutions for a better tomorrow – both regionally and globally. Turku UAS graduates are practice-oriented professionals with top competencies.

As a significant regional actor, Turku UAS has close ties to businesses and municipalities in South-Western Finland. Turku UAS is the fourth largest technical university in Finland. Students are sought-after experts, with 99 % employment within five years of graduating.

With a high level of expertise in external R&D funding opportunities, Turku UAS executes nearly 200 R&D projects on a yearly basis. Turku UAS has over 30 research groups that work to improve the welfare of the region. Strong regional, national and international partner networks support the development work of Turku UAS.





Point cloud visualization on top of 360° video stream an interesting research topic in maritime industry as a part of Necoverse project.

Objective

Enhancing ship energy efficiency across its lifecycle using an industrial metaverse environment

One of the Turku UAS research projects is called Necoverse, Next Generation Training, Design and Operation. The objective of this Business Finland funded research is the creation and utilization of metaverse environment in shipbuilding and industrial content – including people, ship, and shipyard.

This specific research project combines knowledge from a fusion of sensor data, advanced user interface design, and the integration of these into the multi-user virtual world.

The focus is to enhance energy efficiency in the shipyard and in the ship from design phase to ship operation and maintenance.

Solution

A remotely controlled mobile robot with 360° live cameras

The teleoperation solution was built on a mobile Omron LD-60 robot, but it can easily be implemented into vessels, drones, or other mobile platforms.

The remote user controls the robot using multimedia information from two 360° live cameras: one on the robot providing 1st person view and the second camera offering 3rd person view of the surrounding environment. The Head-up display (HUD) on top of 360° visualization developed by Turku UAS presents real-time sensor data, such as temperature and humidity, directly in HMD, screen or even mobile devices. The HUD provides the user with all the required data to make efficient decisions.



Results

Nokia RXRM ensures high-quality multimedia streaming with optimized bandwidth

Turku UAS developed this combination of physical and virtual work environments based on Nokia's RXRM technology foundation. Nokia RXRM ensures real-time high-quality multimedia streaming with optimized bandwidth for 360° video and 3D audio, addressing both current and future massive data transfer needs. In the Turku UAS robot application, the RXRM viewport effectively reduces the bandwidth required for 360° multimedia streaming over 95%. This significant bandwidth saving greatly enhances data transfer efficiency in collaborative virtual environments.

Turku UAS recently launched this remote-controlled system at the Imagine The Metaverse event in Finland. The system operated two days between two cities in Finland approximately 160km apart, producing over 1.8 TiB of content and only about 82 GiB uplink bandwidth. Impressively the 360° videos streamed without any stuttering throughout the event.

Nokia RXRM effectively reduced the bandwidth required for stutter-free 360° multimedia streaming over

95%

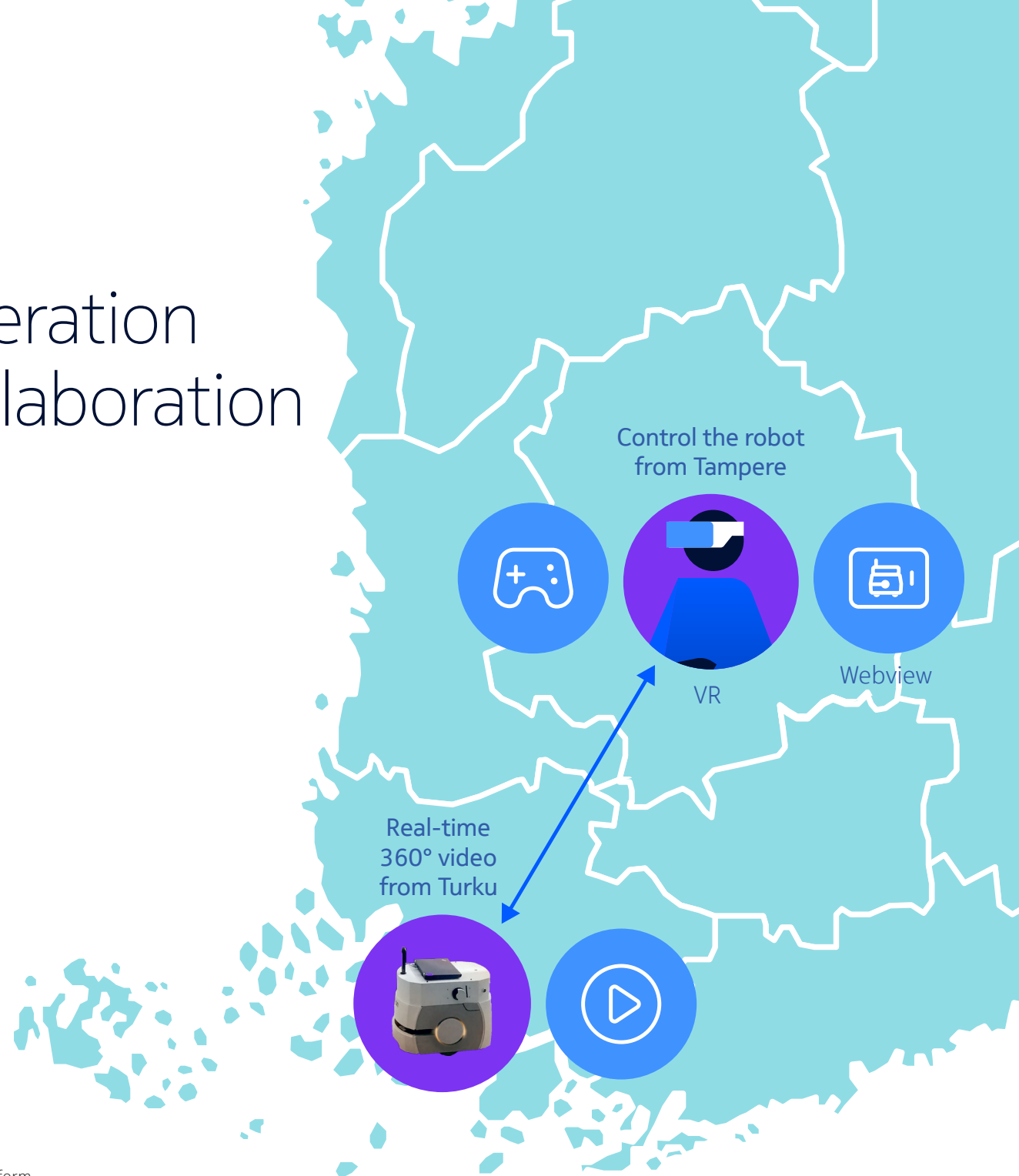
The system produced over **1.8 TiB of high-quality content** yet used only **82 GiB uplink bandwidth.**

Results

Real-time teleoperation and seamless collaboration

Nokia RXRM enables users from different locations or organizations to collaborate seamlessly. The high-quality real-time 360° multimedia stream creates a realistic environment around the robots, vessels, drones or other moving objects enabling truly real-time remote operations. All users are immersed in the same environment, connecting to the same camera streams but each user has an individual viewport providing personalized field of view. Additionally, the use of wide LED walls, as utilized by Turku UAS, enable visualization for larger groups, making it ideal for training settings.

Mobile real-time teleoperation offers vast application possibilities and is key for achieving significant efficiencies across various industries.



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NOKIA

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At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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