Digital tools in decommissioning

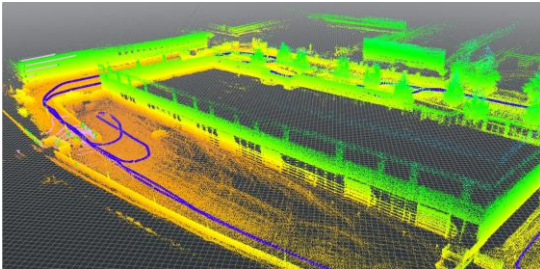## Tatu Harviainen 4.5.2022

VTT

Background – Spatial computing

We create end-to-end solutions for increasing situational awareness based on sensor data collected from the operational environment.

Cross disciplinary research team working on robotics, 3D sensor data collection, data processing, XR visualization and interaction

dECOmm project – Digital decommissioning

Enhancing the efficiency of decommissioning waste logistics by applying advanced methods for gathering and handling information as well as automated documentation, compliant with regulations for radwaste data-keeping and waste acceptance criteria

Digital data collection, processing and visualization

- XR data visualization
- Environment geometry scanning
- Material and radiation scanning
- Autonomous data collection
- Model vs. scan comparison
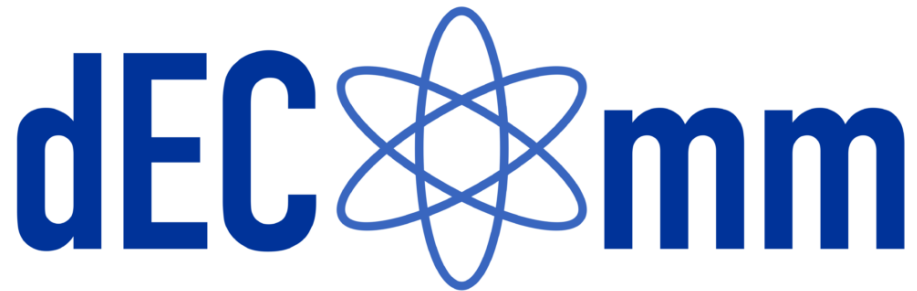
Hands-on experimental approach

Development done by focusing on concrete demonstrators:

- Radiation visualization
- Robot mission planning and execution
- Reality capture and change detection

Radiation visualization demo

- VTT in-house developed radiation simulation tool Serpent used for creating the data
- Enable 3D visualization of the Serpent data with a 3D game engine
- Use augmented reality to visualize the data in the real environment

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Serpent visualization in AR

Robot mission planning and execution demo

- Main goal
  - Demonstrate robot based environment measuring
  - Mission planning and execution in a real environment with a real robot
- Demonstration mission
  - Plan and perform several measurements with several sensors in the chosen demonstration environment
  - VTT new main office building used as a demonstration environment
  - Both contact and contactless sensor measurements demonstrated
- Integration of several solutions

Robot mission planning and execution demo

- Main building blocks
  - **Unity based simulation environment**
    - Mission planning
    - Control of the mission execution
    - Visualization of the measuring results
    - CAD model of the VTT's FutureHub building imported to the Unity
  - **Robot**
    - Mission command interface and operation logic implemented for MIR robot combined with UR robot arm
  - **Hyperspectral sensing**
    - Sensing device mounted on the MIR robot
    - MQTT interface for communicating with the hyperspectral sensing device

Reality capture and change detection demo

- Quadruped Boston Dynamics Spot robot as the autonomous platform
  - More robust platform enabling operation in more challenging environment
    - Stairs, uneven surfaces, doors…
- FiR1 BNCT dismantling as the use case
  - Several data collection runs to track dismantling progress
- Focus on geometry and radiation scanning
- Method development to visualize differences between as-built/demolished and as-planned

Next steps

Next steps

- Data processing method development continues
  - More accurate change detection
  - Mitigate reality capture limitations; varying accuracy, density, occlusions…
- Next data collection runs at FiR1
  - Data collection from various dismantling steps
- Collaboration in data exchange interfaces and larger scale test cases
  - Information assembly as part of the building information model
  - Applying approach in for example large scale free-to-release measurements

Challenges and opportunities

Challenges

- Regulation
- Heterogeneous software environment
- Business models and ecosystem maturing

Opportunities

- Emerging area, many use cases
- Rapidly advancing technical development
- Solutions can be expanded outside decom area