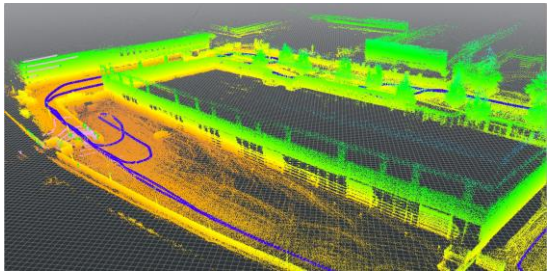
Robot demos in dECOmm

Tatu Harviainen 23.11.2022

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

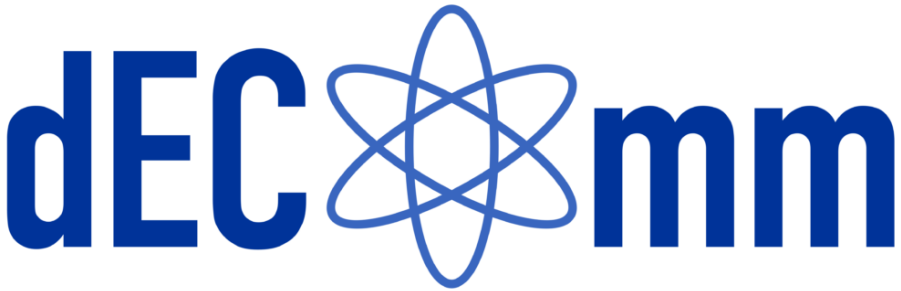


dECOmm project – Digital decommissioning

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



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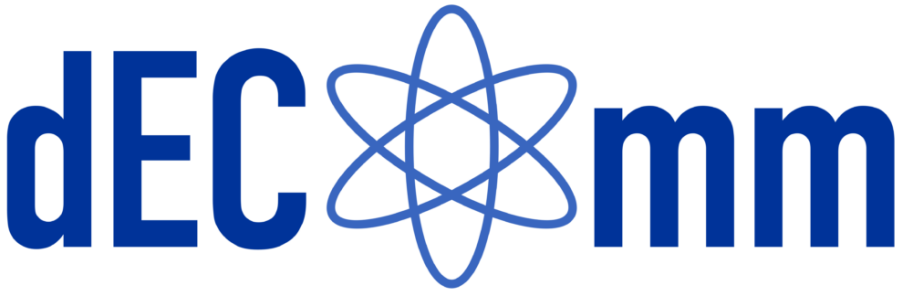


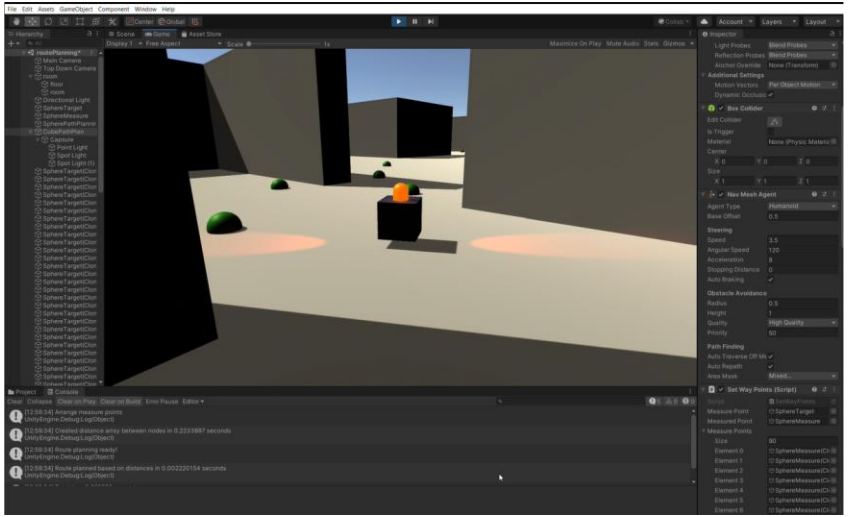
Hands-on experimental approach

Focus on concrete demonstrations using different platforms

- Robot motion planning and optimization with virtual simulation
- Robot mission planning and execution with wheeled MiR robot integrated with UR robot arm
- Reality capture and change detection with quadrupled Boston Dynamics Spot robot

Simulation based robotics development

- Virtual model of the robot and operational environment implemented using 3D development platform
  - Unity 3D
  - Virtual environment created for testing
  - Different robot motion models
  - Path finding
  - Route planning and optimization



Video

- Path finding
- Route planning and optimization

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 head office 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 3D 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 3D
  - **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

Video

- Robot mission planning and execution video

Reality capture and change detection demo

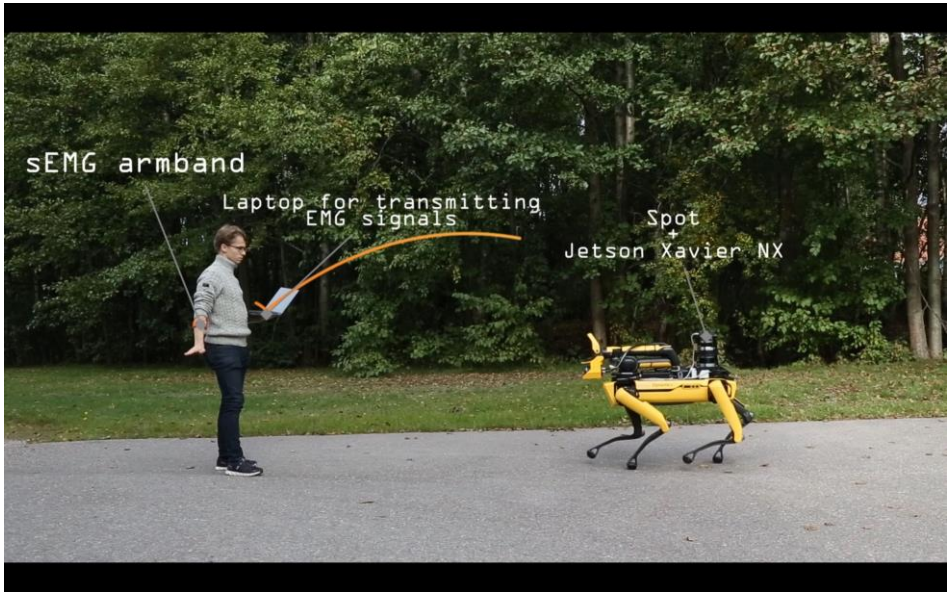
- Quadruped Boston Dynamics Spot robot as the autonomous platform
  - More robust platform enabling operation in more challenging environment
    - Stairs, uneven surfaces, doors…
- FiR1 BNCT dismantling as the use case
  - Several data collection runs to track dismantling progress
- Focus on geometry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

Video

- Spot robot reality capture at FiR1

What’s next, what’s in the future?

- Further development of contamination measurement pilot and comparison against manual process
- Human-robot interface for efficient collaboration
- Data management and streaming
  - Dynamically updated BIM
  - Digital twin
  - Industrial Metaverse



beyond

the obvious

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