Training and support system in the cloud for search and rescue missions

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GPU TECHNOLOGY CONFERENCE

ICARUS

ICARUS Unmanned Search and Rescue

IMM

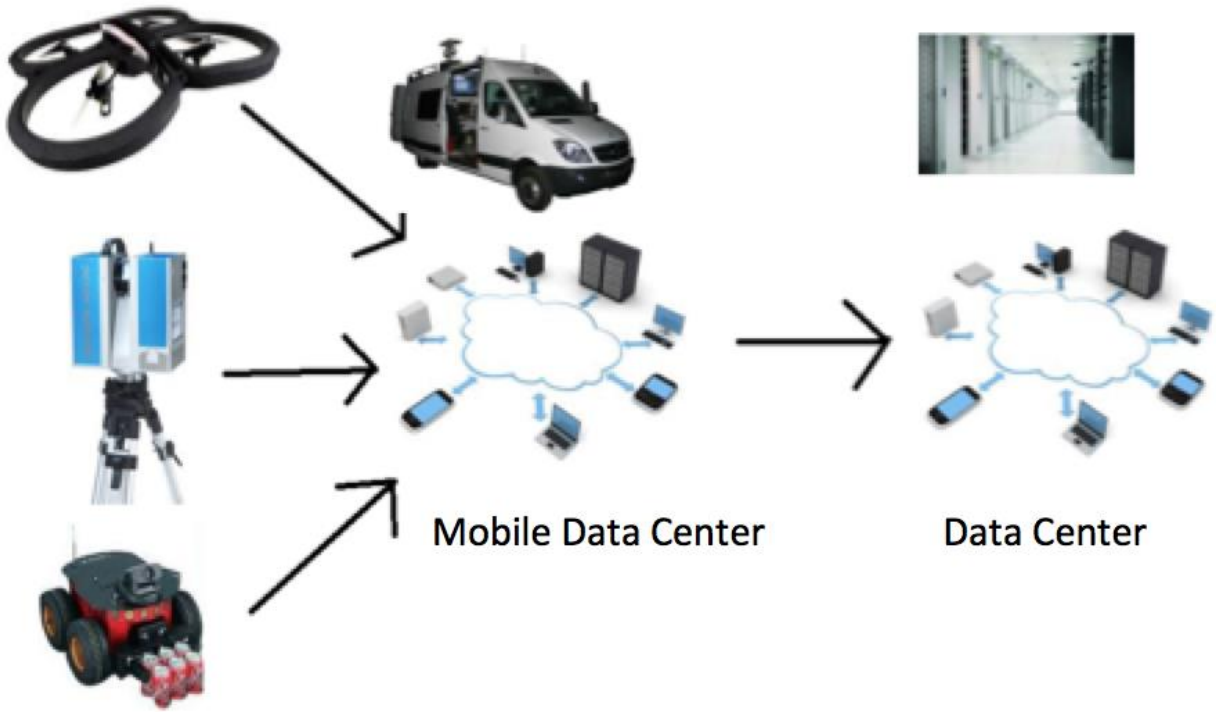
Objectives

1. Development of a light sensor capable of detecting human beings
2. Development of cooperative UXV
3. Heterogeneous robot collaboration
4. Self-organizing cognitive wireless communication network
5. Integration of Unmanned Search And Rescue tools in the C4I
6. Development of a **training and support system**

NVIDIA CUDA RESEARCH CENTER

ICARUS Platforms

Training and support system in the cloud



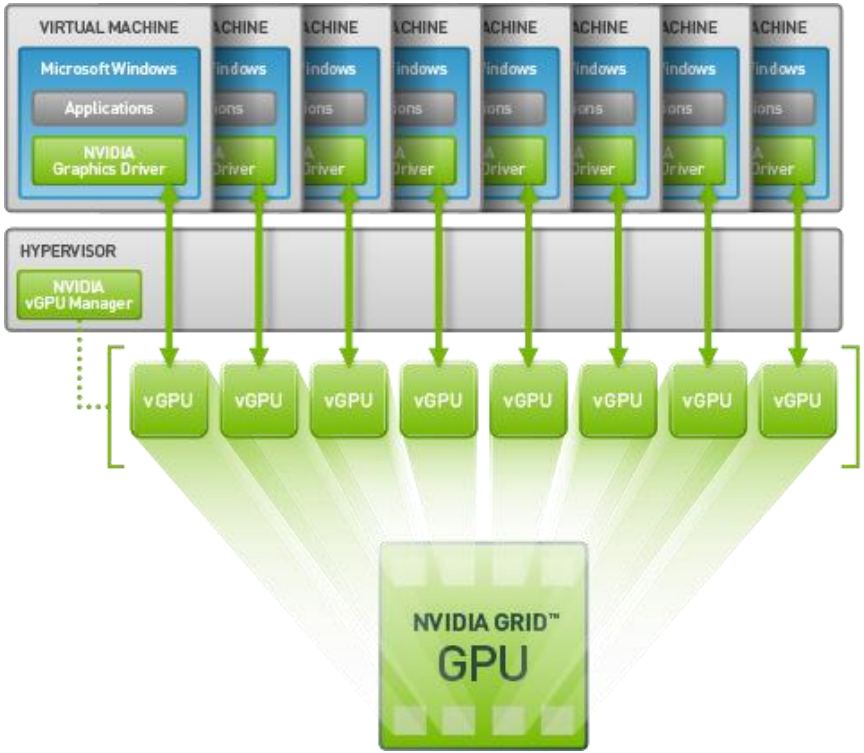
Hardware

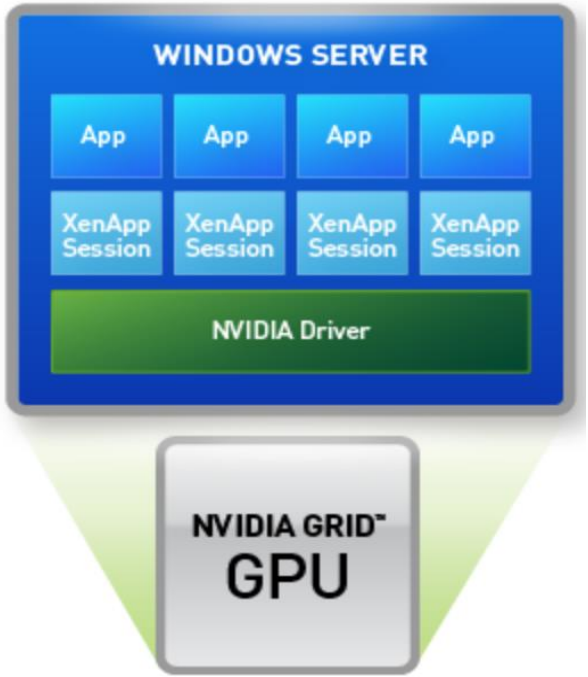
Supermicro RTG-RZ-124OI-NVK2:

- 2 x 2.8GHz Xeon CPU (2 x 10 cores)
- 256 GB RAM
- 1.25 TB SSD
- 2 x NVIDIA GRID K2 card

HPC solution for ICARUS project is based on Server Supermicro RTG-RZ-1240I-NVK2

GPU virtualization

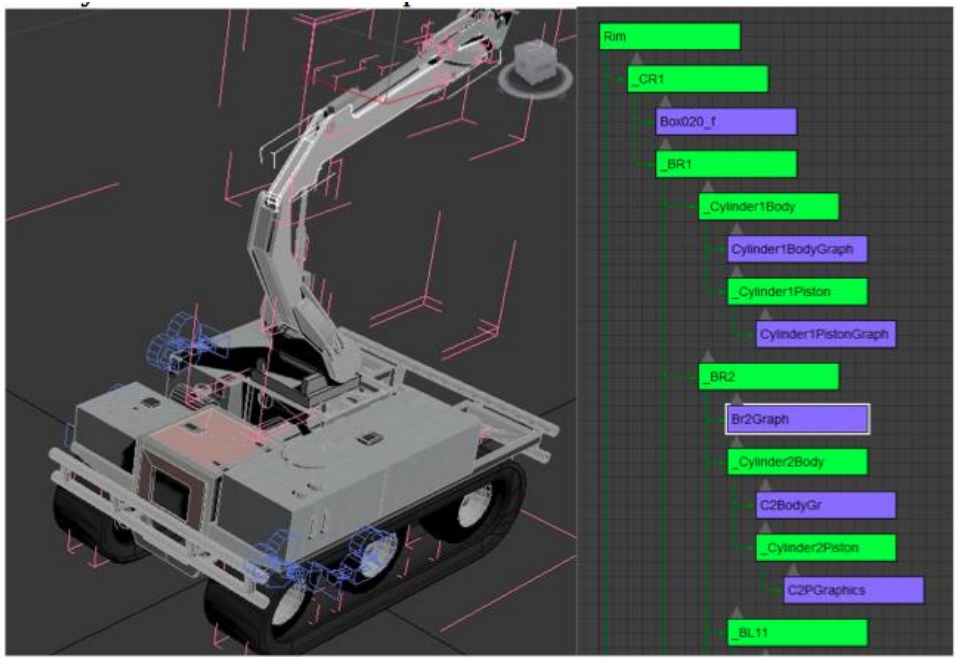


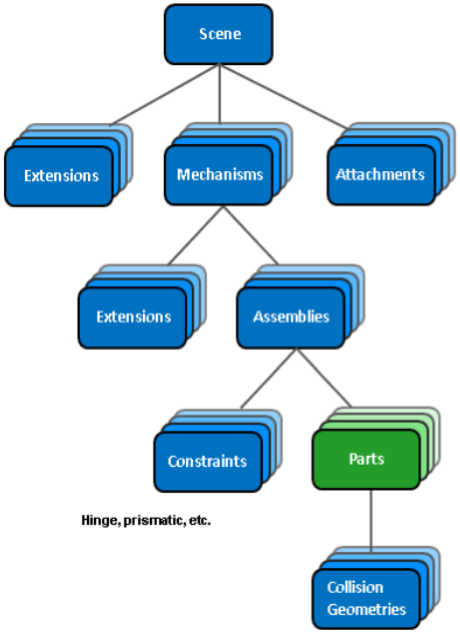


Training in the cloud

- NVIDIA GRID server with installed serious game framework
- Multi robot operator training
- Access over Ethernet to high fidelity robotic simulation

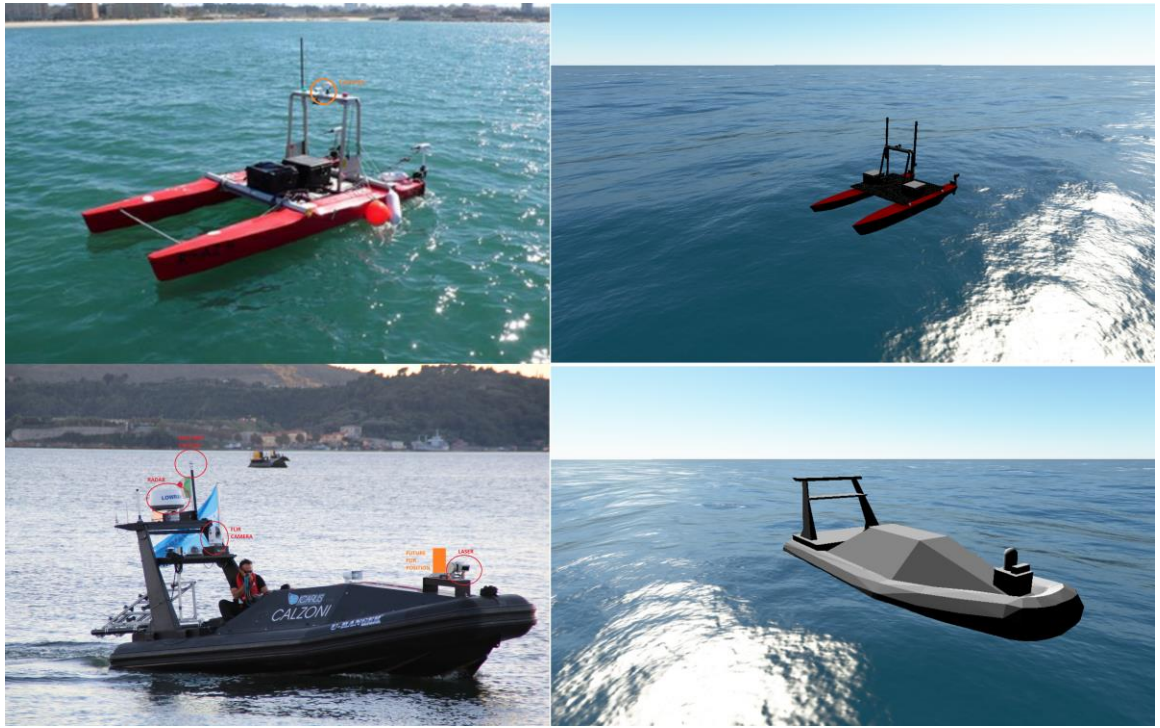
Structure of SAR vehicle and virtual scene



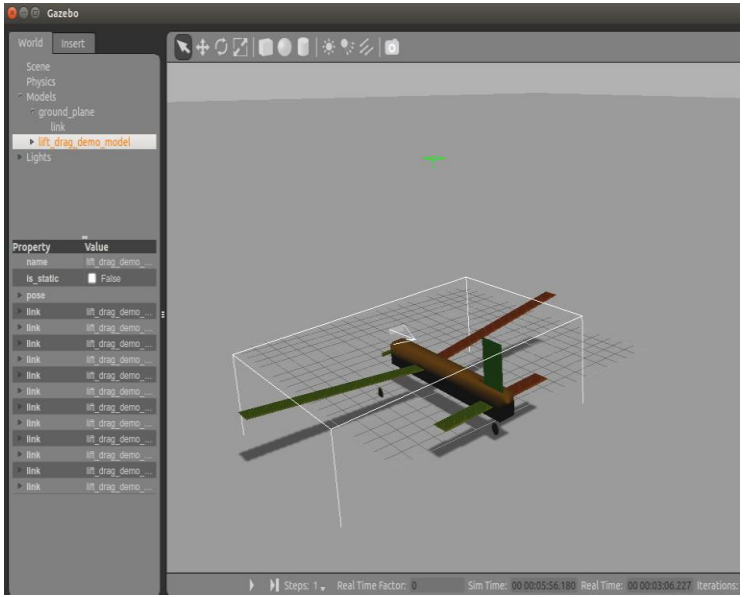


Physics simulation based on VORTEX.

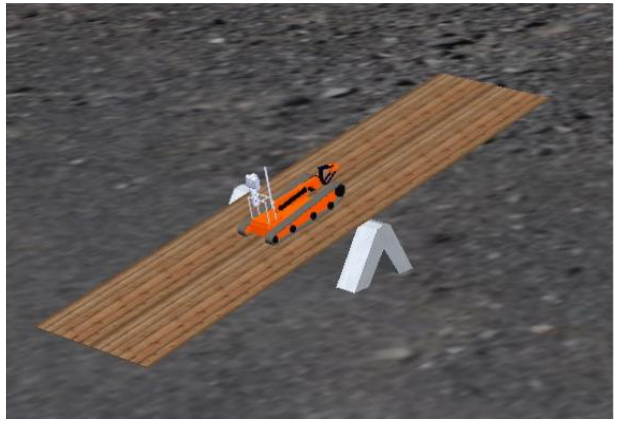
USV simulation

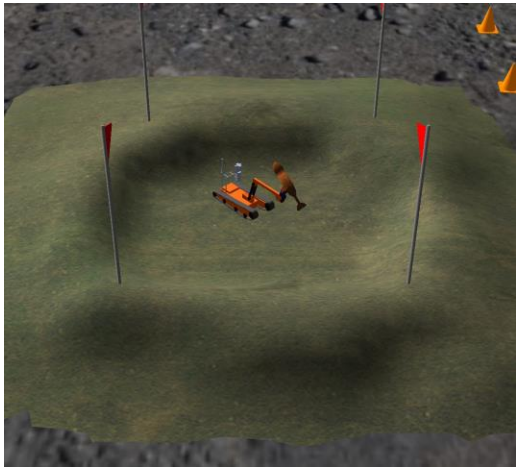


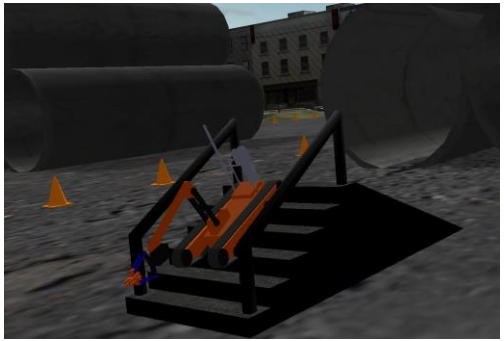
UAV simulation



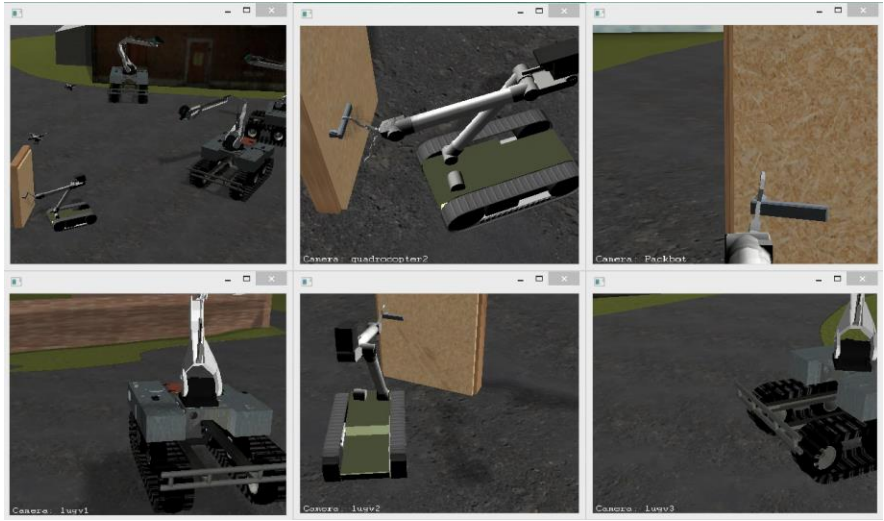
Training missions







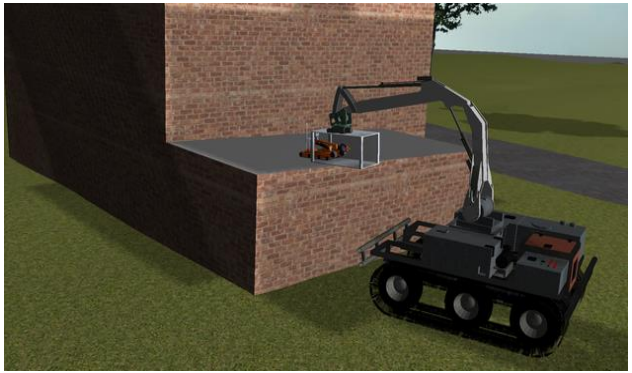
Multi robot operator training

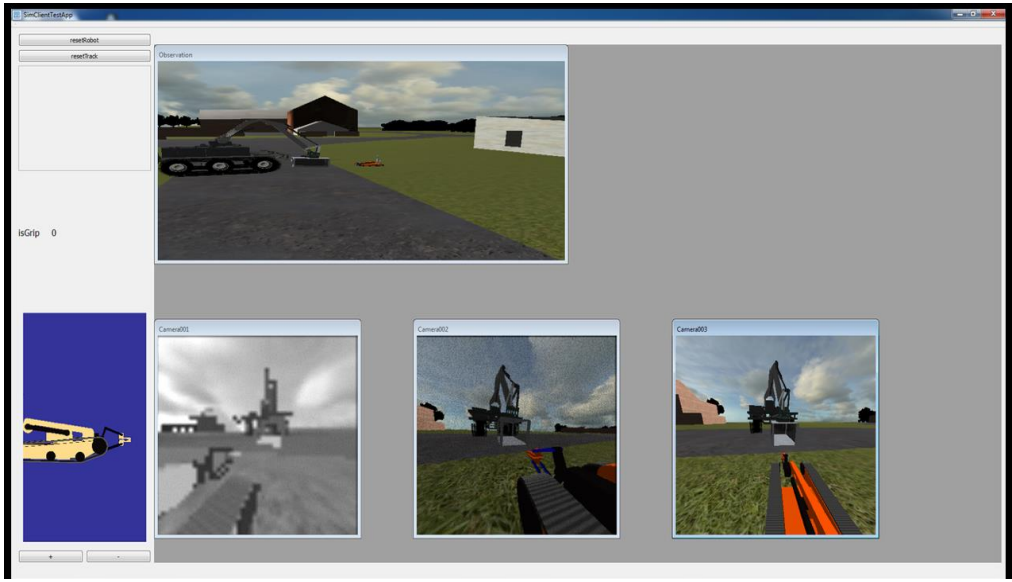


Multiple operators operate in a single scene

Multi robot mission

Scene Overview
Trainer



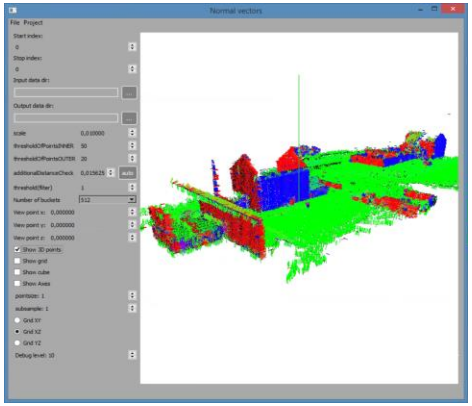


User Views
Different Camera Effects

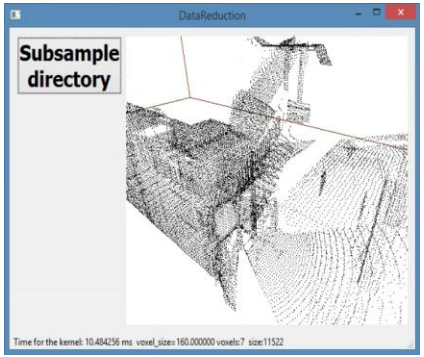
Support system

- HPC in the cloud for large 3D data processing
- Rendering 3D maps over Ethernet
- Gathering data from different robotic sources
- Generating mission plans for mobile robots

Support System – main functionality

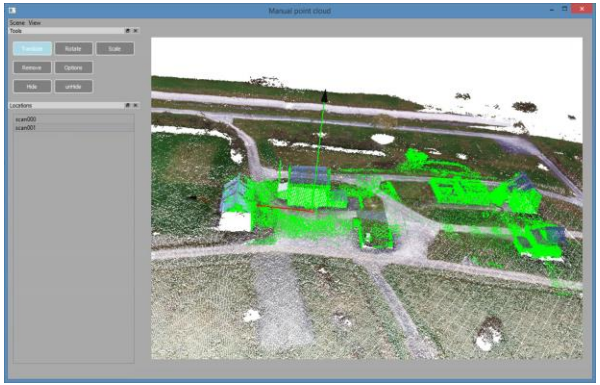


Normal Vectors Computation

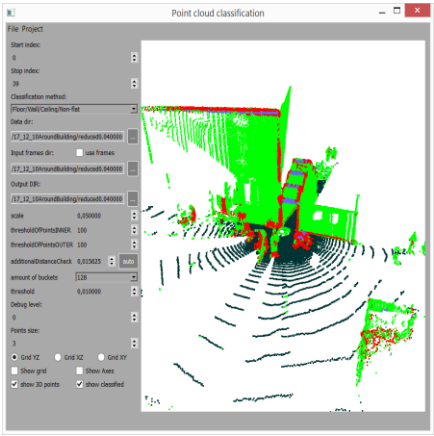


Sub-Sampling

Matching



Semantic Classification



Deployment in the field (trials in Marche-en-Famenne Belgium 2014)

http://www.fp7-icarus.eu/news/icarus-successfully-completes-autonomous-uav-and-ugv-demo-field-tests-marche-en-famenne-belgium

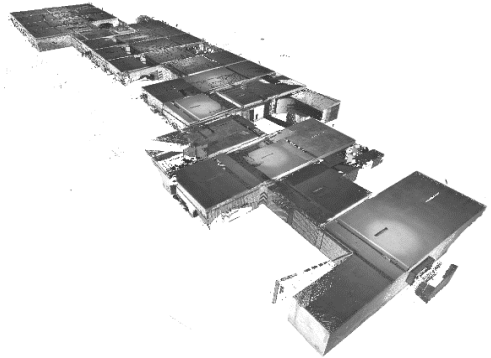
Support system
Data from different robots

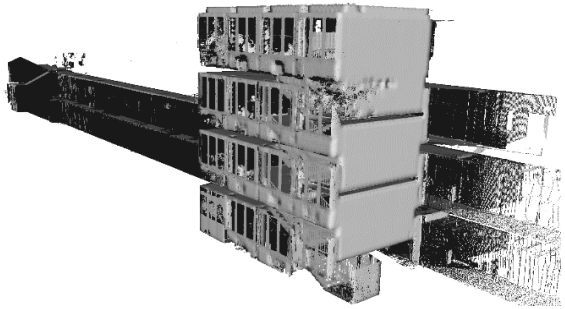
Simulated Crisis Management Center

0.5 Mbit/s per user

Up to 20 users – performance drop after 15

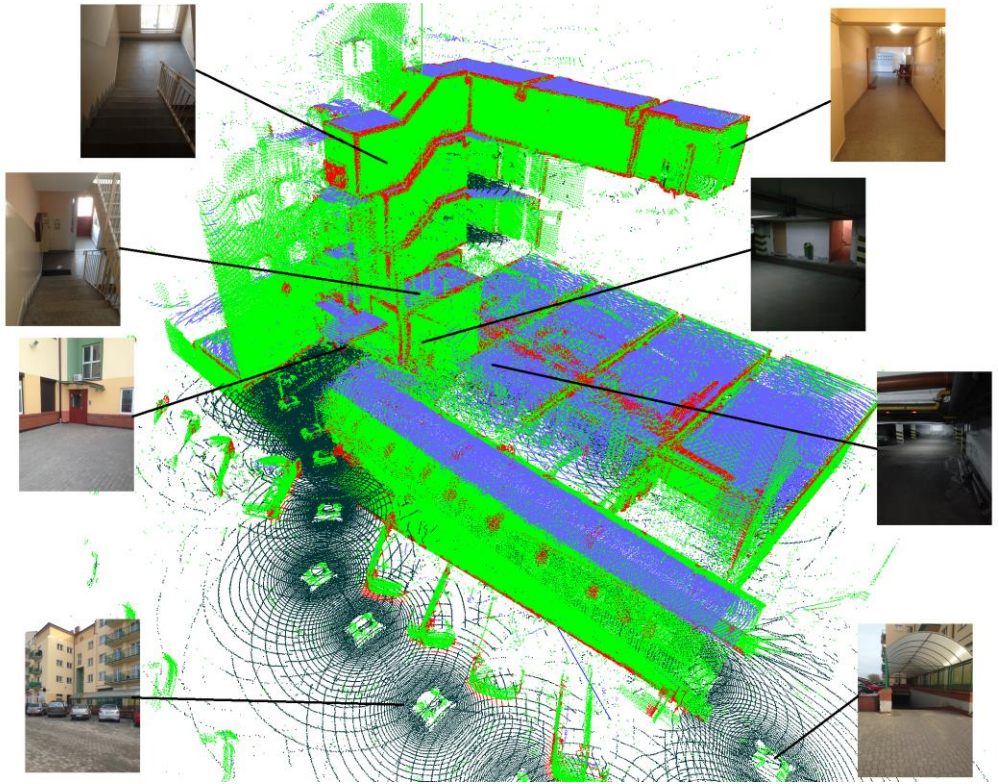
Accurate registering of 3D data from geodetic laser scanner



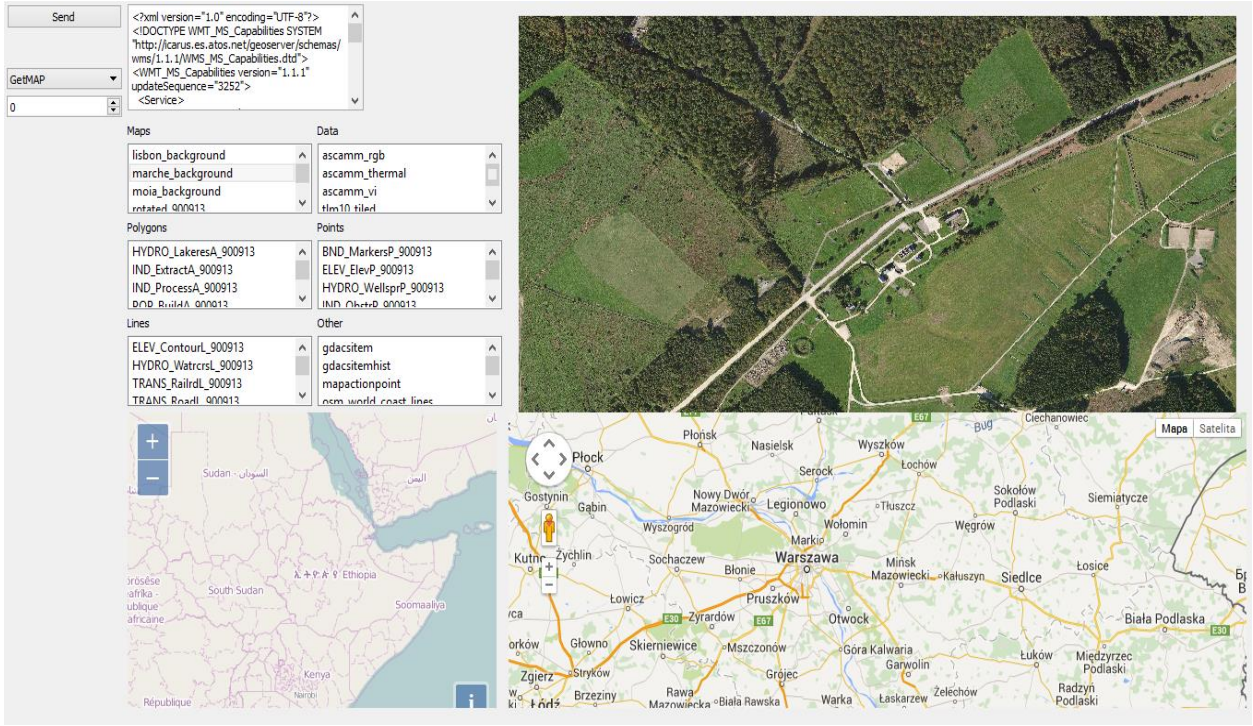


„Towards terrestrial 3D data registration improved by parallel programming and evaluated with geodetic precision.” J. Bedkowski, K. Majek, P. Musialik, A. Adamek, D. Andrzejewski, D. Czekaj, Automation in Construction Volume 47, November 2014, Pages 78-91

Support System – mapping of extreme environments



Support System – access to mapping services



Connection to dedicated GIS server

Conclusion

- Training and Support system based on NVIDIA GRID technology provides new functionality for mobile SAR robotics system
- GPU virtualization enables robust rendering of serious games and 3D maps over Ethernet
- NVIDIA GRID technology enables easy integration with existing Crisis Management Centers

Contact and Acknowledgments

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