



DOE-FIU Cooperative Agreement Annual Research Review – FIU Year 2

Autonomous Surveillance of Nuclear Facilities and Repositories

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Autonomous Surveillance of Nuclear Facilities and Repositories

Overall Needs:

- Assistance in Deactivation and Decommissioning (D&D) activities

Objectives:

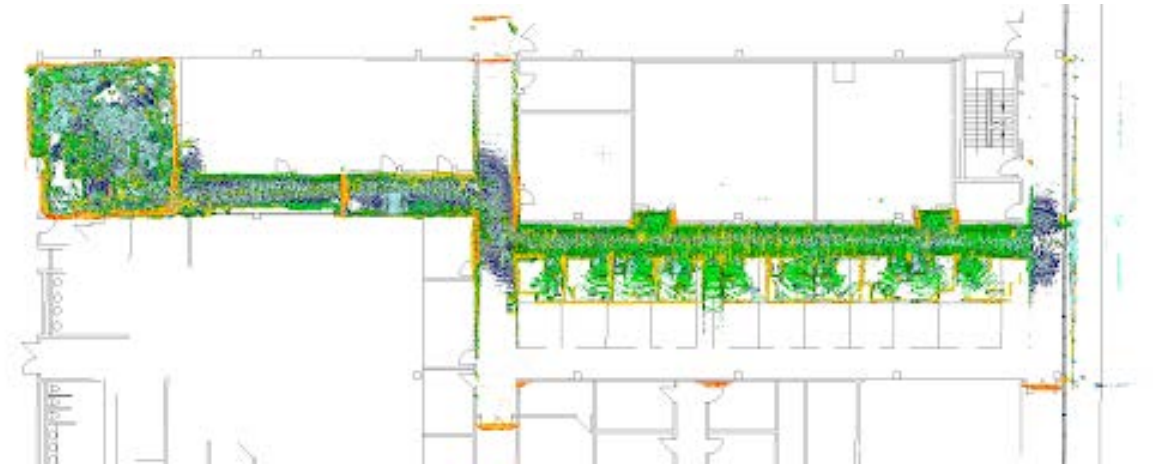
- Develop autonomous robot platforms to perform surveillance tasks at DOE sites
- Evaluate state-of-the-art algorithms and sensors in autonomous robots
- Create continuous stochastic models to predict the overall radiation field by simultaneously fusing data from non-destructive gamma measurements, surrounding images, and three-dimensional LiDAR mapping



Autonomous Surveillance of Nuclear Facilities and Repositories

FIU Year 2 Highlights:

- Large-scale mapping achieved by fusing Iterative Closest Point (ICP) odometry with IMU data
- Furthered ROS 2 migration by gaining better fluency with the middleware and transitioning robot software to it
- Integrated state-machines into robot systems



3D lidar map overlaid on floorplan showcasing accuracy of mapping capabilities



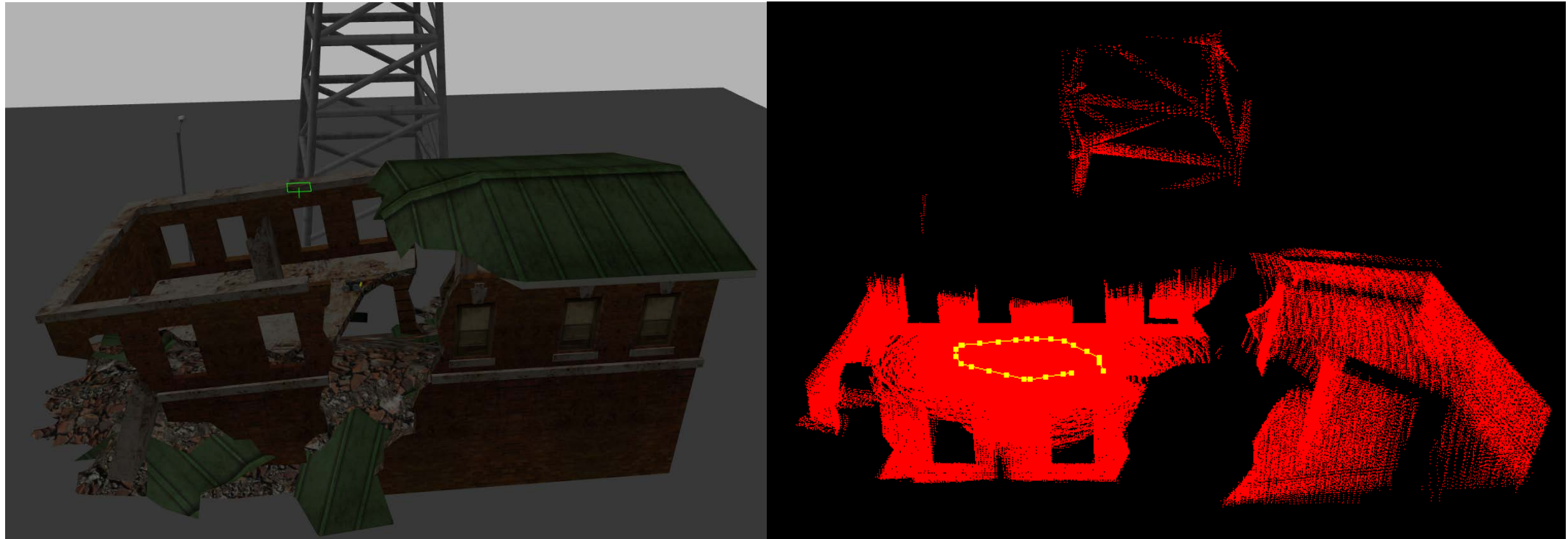
3D map constructed autonomously (left) and manually (middle and right) using mobile robot



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FIU Year 2 Highlights:



Gazebo simulation of Jackal robot (left) and resulting SLAM map (right) performed using software framework developed for real-world environment



FIU Year 2 Highlights:

- Paper: “*Radiological Surveillance of Hanford Tank Farm Using an Autonomous Mobile Platform*” was accepted as is for Waste Management 2022 Conference
- Successfully presented work at conference

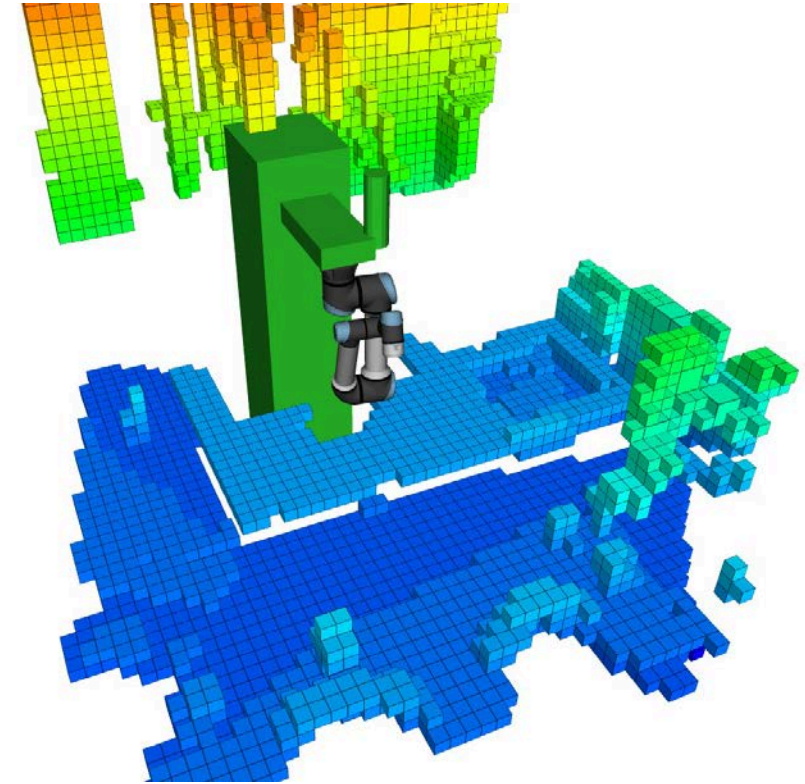
Presenting work at Waste Management Conference 2022



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FIU Year 2 Highlights:

- Worked with UR5e robot using ROS2 middleware
- Added computer vision to robot using Intel Realsense depth camera and Octomap C++ library
- Created mock demonstration of robot arm sampling tank waste



UR5e robot after mapping environment using depth camera and converting into Octomap grid



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FIU Year 2 Highlights:



UR5e system mounted and demonstrating tank waste sampling

Future work

- Develop with a more diverse set of robotic platforms to increase flexibility of surveillance and overcome more obstacles
- Further refine autonomous navigation abilities
- Work on publishing a paper with completed research
- Integrate radiological data into system and test sensors
- Leverage reinforcement learning to overcome advanced obstacles that occur in unstructured environments



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Thank You. Questions?