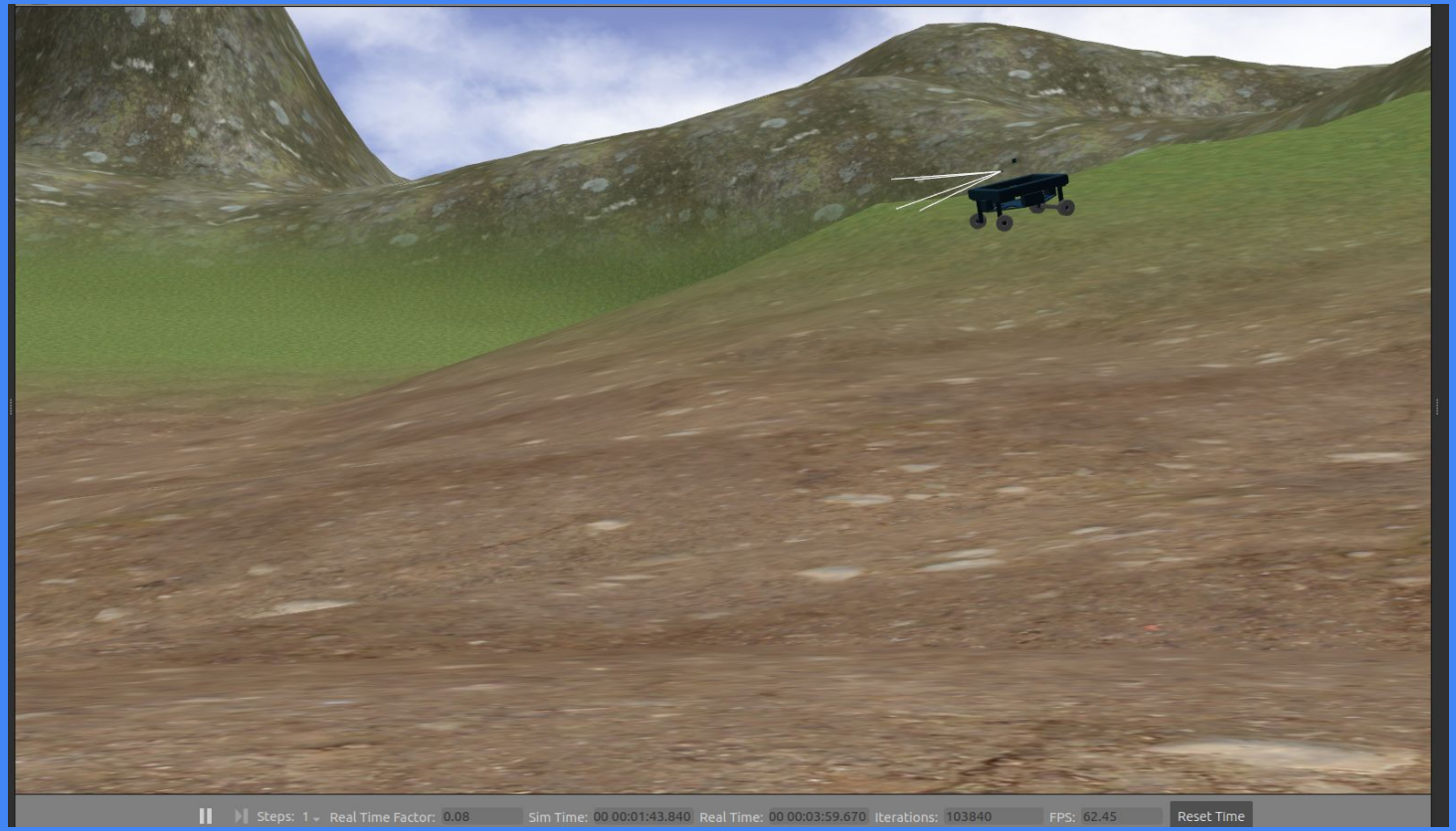
Navigation on Uneven Terrain



Problem Definition

Given a robot decorated with all required sensors, autonomously traverse a uneven field, with minimal overlapping of routes.

- Obstacle aware, safety first mindset
- Recovery actions should intervene if robot gets in trouble(very likely)

A few beneficial discussion questions

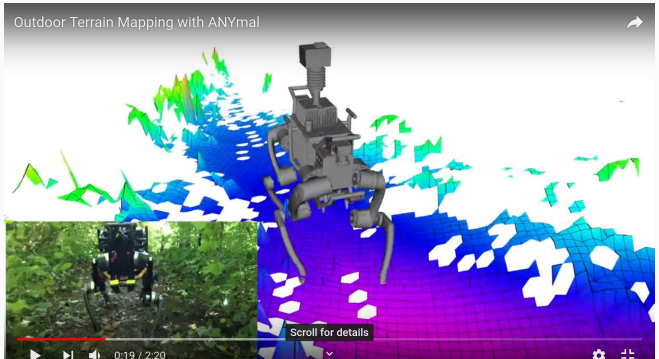
Will 3D global representation of environment help in any way ?

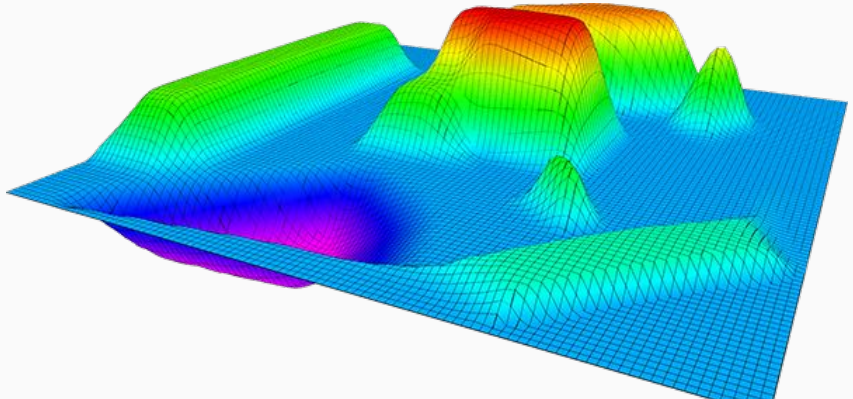
- to reveal possible ads/cons of representing environment in 3D
- Currently navigation2, does not represent the environment in 3D, instead it relies on somewhat old tech costmap_2d
- If we see that 3D representation is worth it, we can collaborate with navigation2, as they are also willing to make a jump from costmap_2d -> grid_map, for the environment representation.
- This could be costly in terms of investment of time(it might take month**s**) .

Will 3D global representation of environment help in any way ?

Possible ADs

- Realistic representation with reliable collision avoidance and path planning
- Surface models that can support a traversability analysis before robot operates
- Possibility of increase in localization accuracy by using something like 3D AMCL





Will 3D global representation of environment help in any way ?

Possible CONs

- Extended computation, which might not bring help
- Pre building the maps might be required, if we were to utilize localization from this.
- Biggest fear is; whether this will worth.

Current considerations for 3D environment representation?

- Grid_map (2.5D actually, but various layers to embed all 3D data, no integrated planner that I know, but they can be converted to costmap_2d easily)
- Mesh_map(triangular meshes, have compatible planners and controllers)
- elevation_mapping (robot-centric or local tasks only, bases on grid_map)

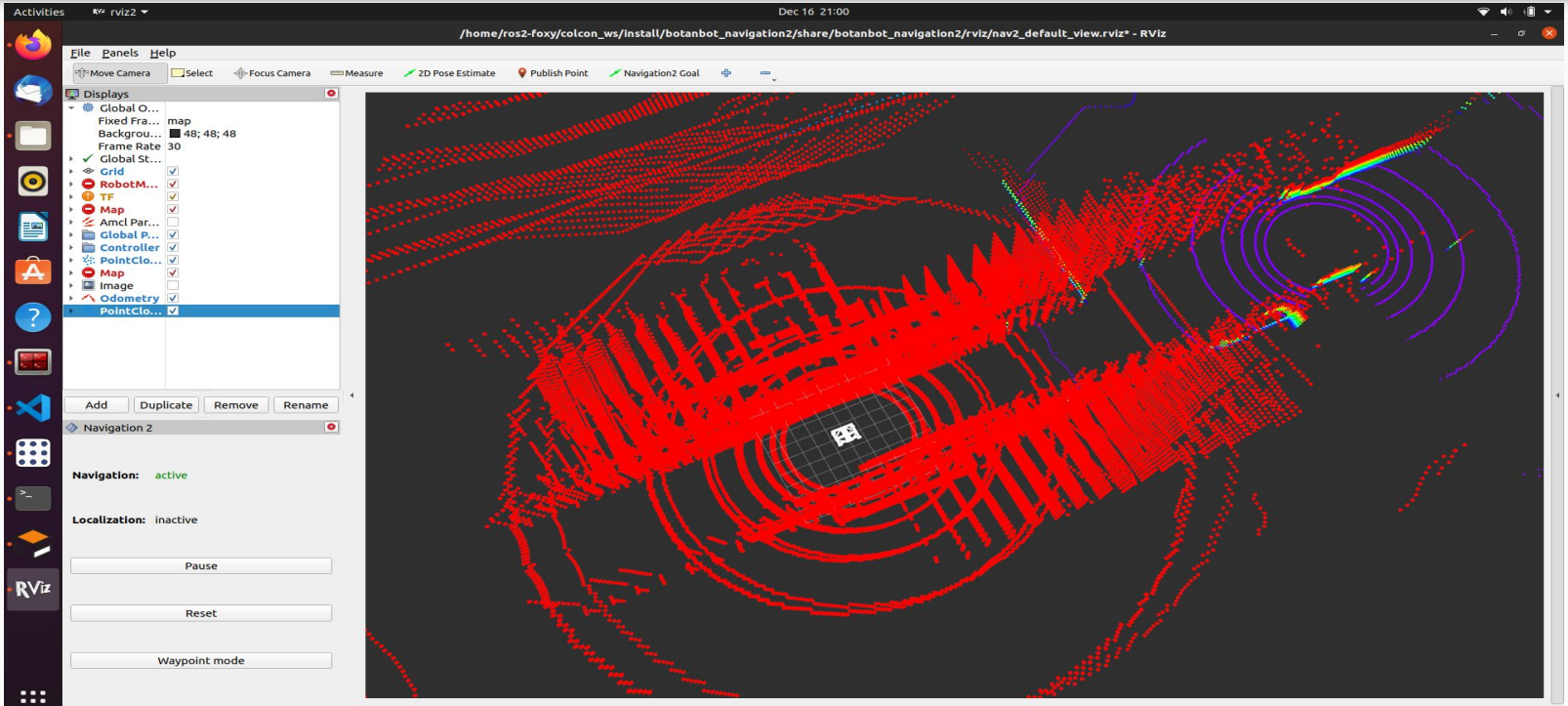
- traversability_mapping(not a serious consideration but nice to keep it here, based on Lego-LOAM)

if(!decided_to_3D_env_representatiom){ jump last_slide; }

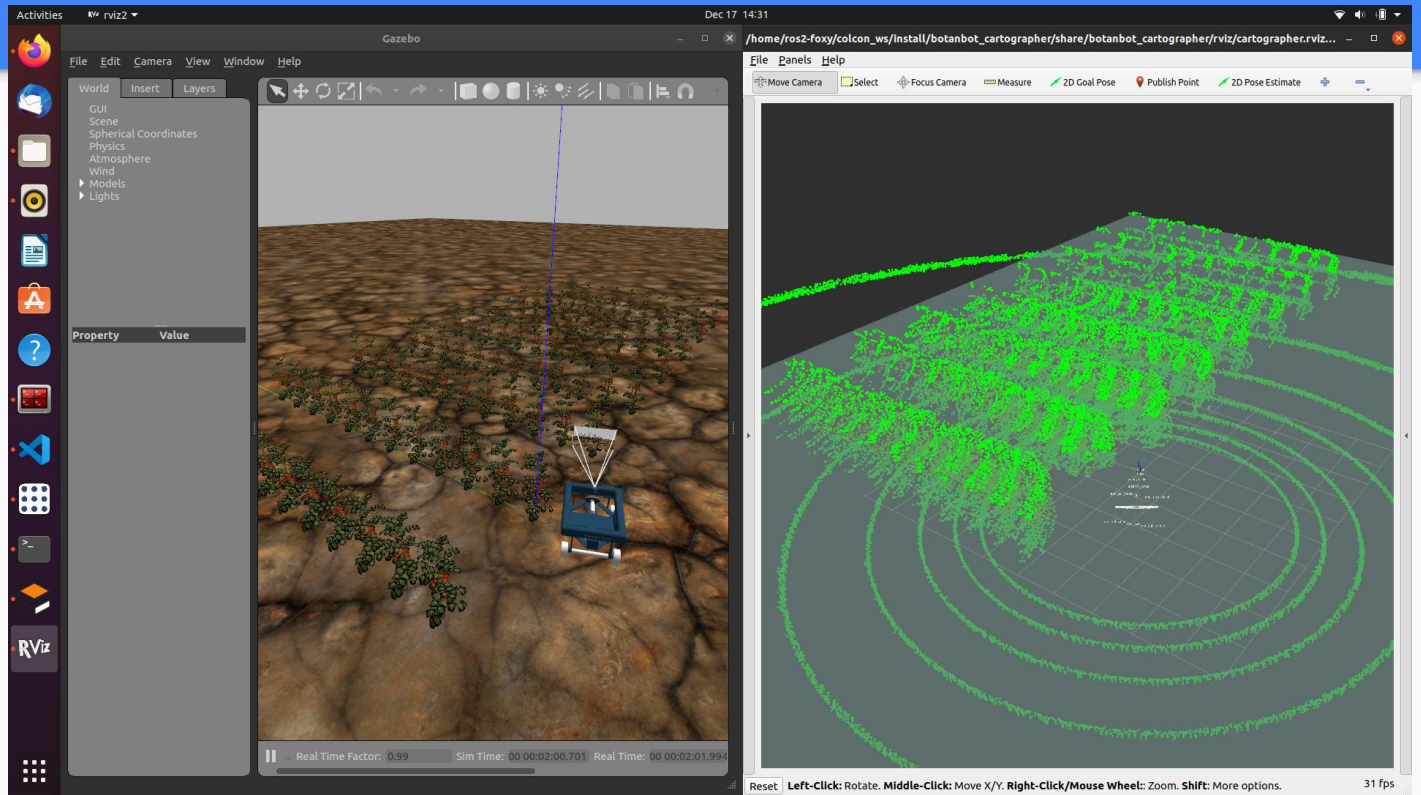
SLAM packages;

- LIO-SAM(**lidar-inertial odometry, loop-closure+**)
- Cartogrpaher(allows pure localization)
- Octomap(Not really SLAM, assumes that map->odom->base_link is already there).

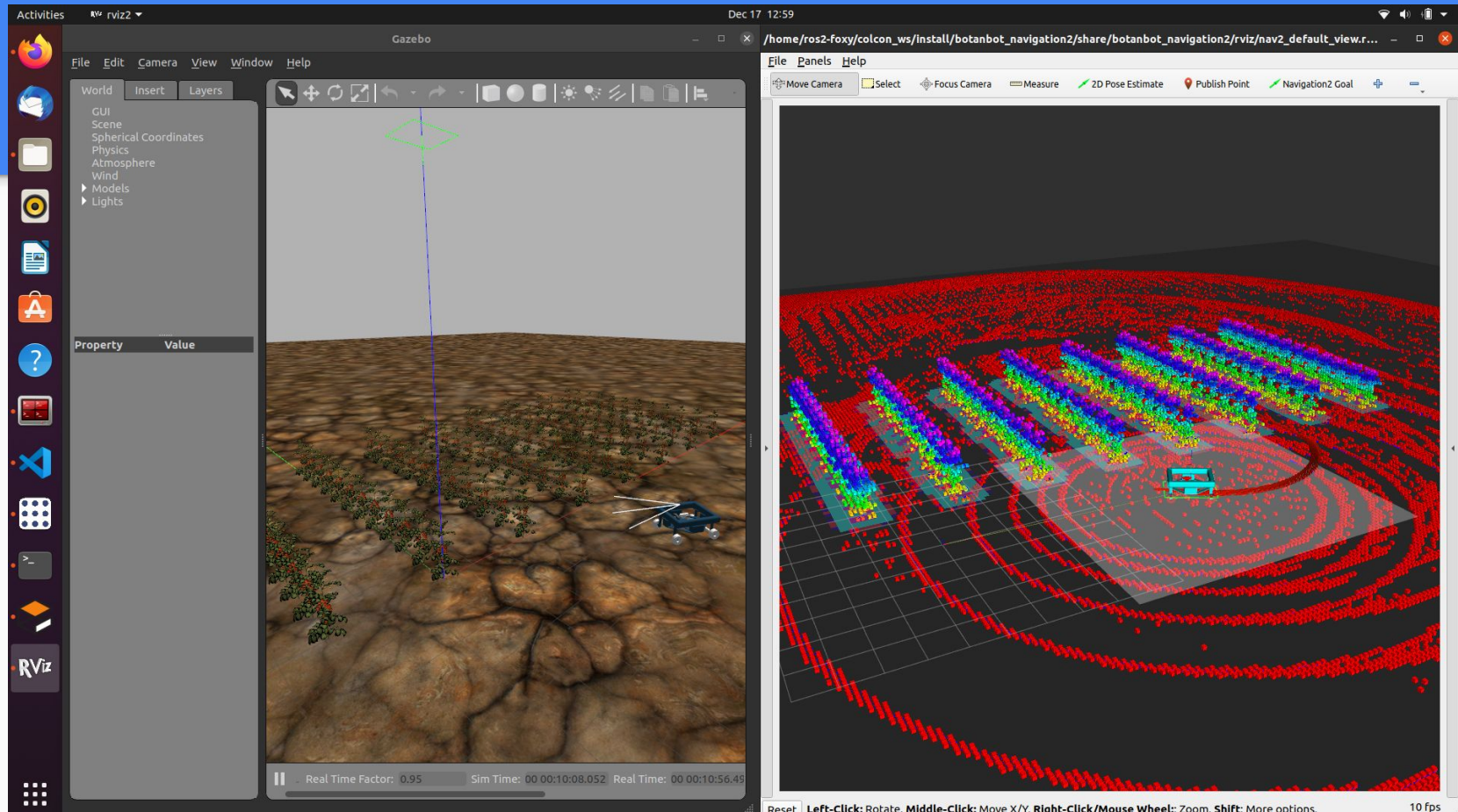
LIO-SAM(PROBLEM)



CARTOGRAPHER(PROBLEM)



OCTOMAP(OK)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File Panels Help
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
Publish Point
Navigation2 Goal
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
10 fps

NEXT STEPS

- Make cartogrpaher and LIO-SAM work and build 3D .pcd maps
- Use this .pcd map to test grid_map
- Do research on how planners and controllers work with grid_maps

Thanks!