LiDAR-Thermal HUSKY UGV Platform

2023 Summer UROP
Sanghyun Hahn

HUSKY & PC

HUSKY UGV

Developer: Clearpath Robotics
Dimensions: 990 x 670 x 390 mm
Max Payload : 75kg
Max Speed : 1.0m/s

TINO 2 PCI-CI170C

CPU: 7th Gen Intel® i3
Chipset: Intel® Q170
Dimensions: 268 x 180 x 110 mm
Operation Voltage: 12V, 7A

Sensors

Ouster OS1-128 LiDAR

Max Range : 200m

Vertical Resolution : 128 channels

Horizontal Resolution : 1024 channels

Operation Voltage : 24V

Data Rate : 20Hz

TELEDYNE FLIR A65

Operation Voltage : 12V

Data Rate : 10Hz

3dm-gx5-25 IMU

Data Rate : 100Hz

Powered by USB-A

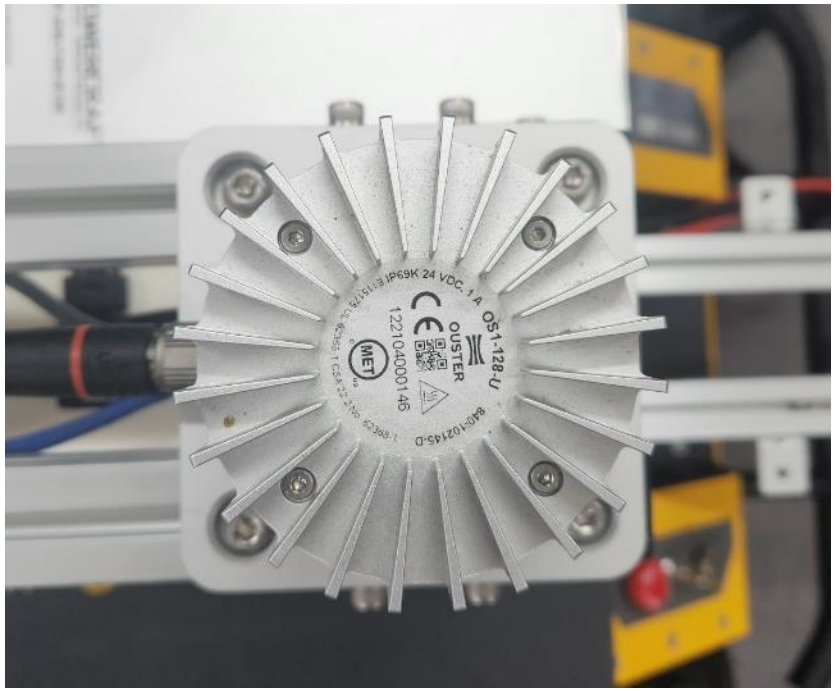
센서 설치

10mm x 10mm Aluminum Profile

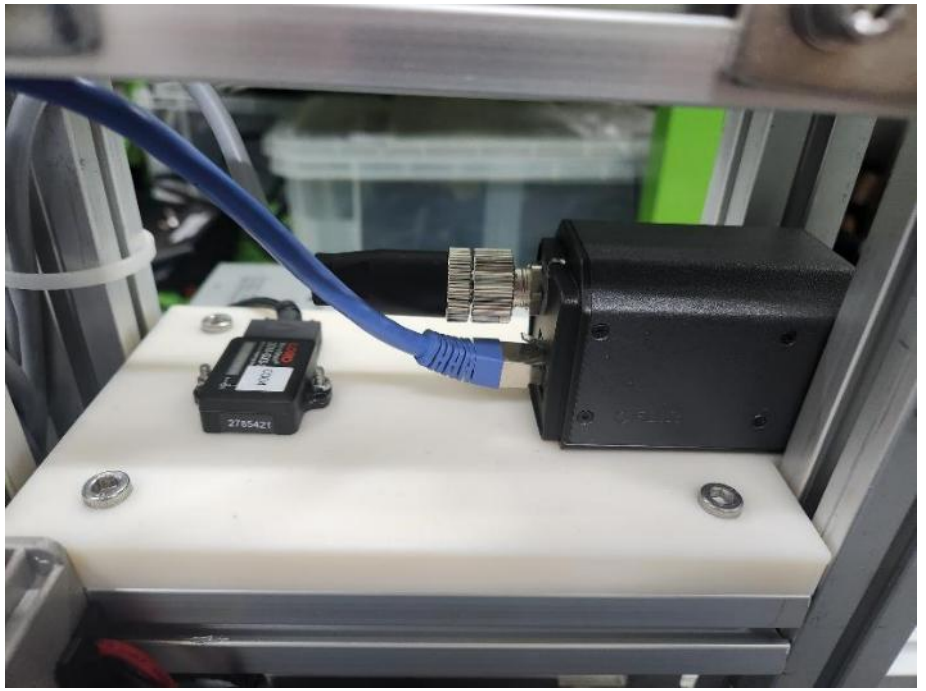
L x W x H = 160 x 80 x 250

IMU & FLIR at H = 130mm

센서 설치

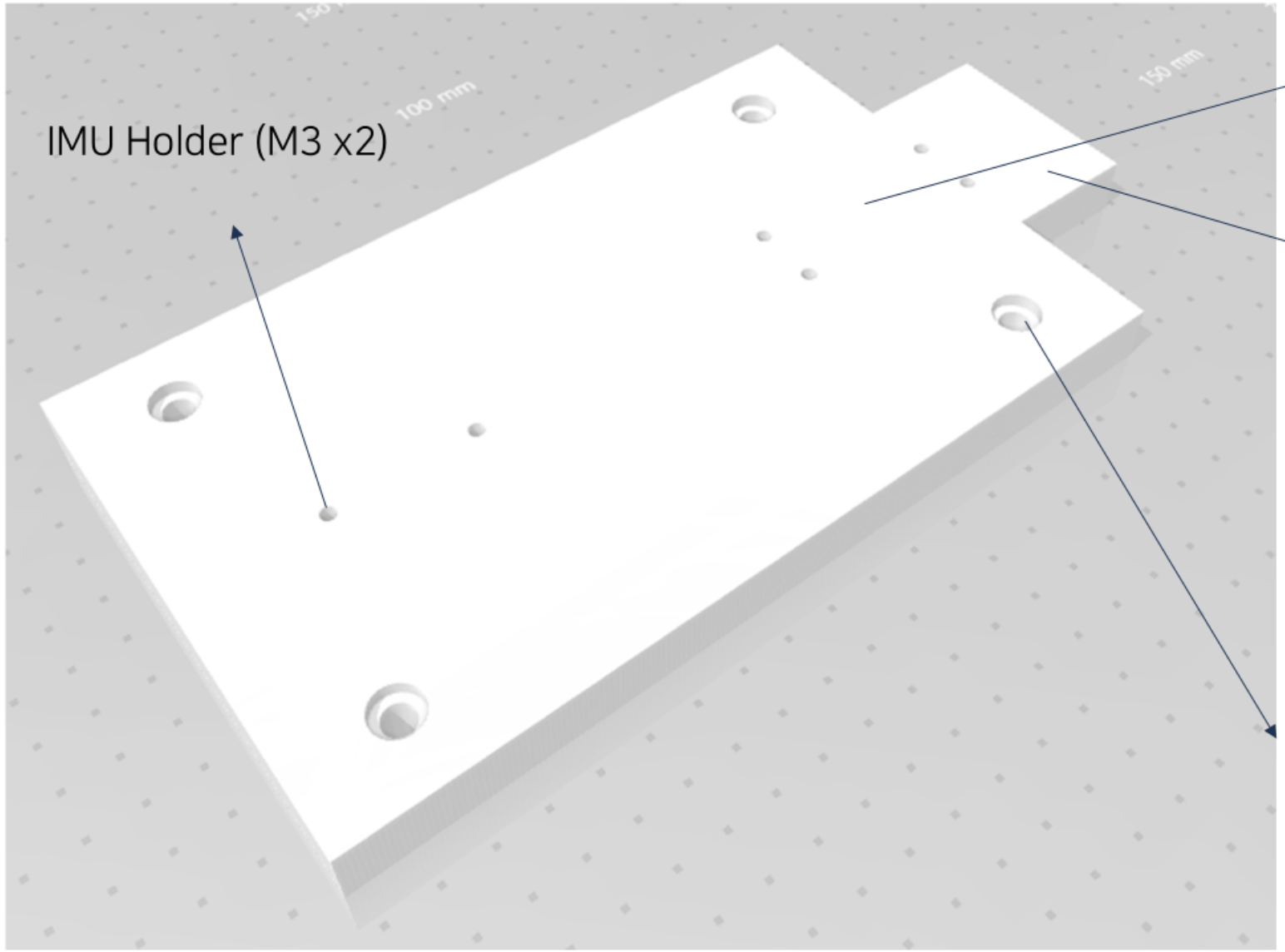


LiDAR is directly attached to the frame

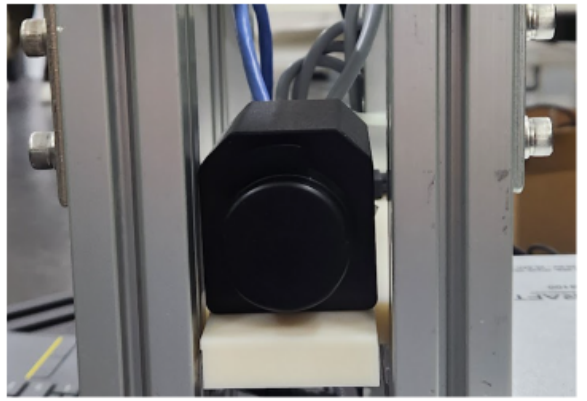


IMU, FLIR is attached to a mount

Camera Mount



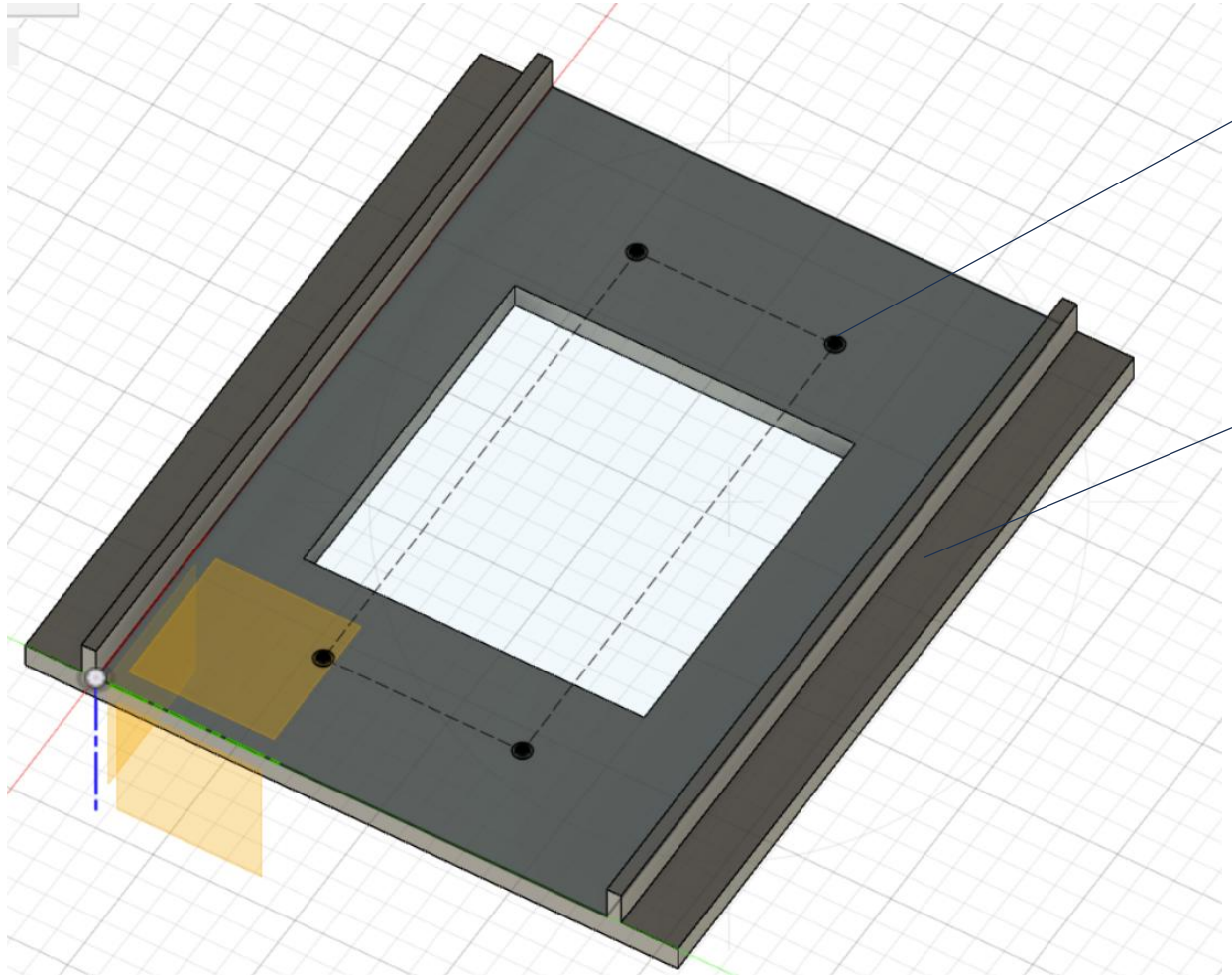
FLIR Holder (M3 x4)



Align the profile to the FLIR Camera
→Secure wide FOV as possible

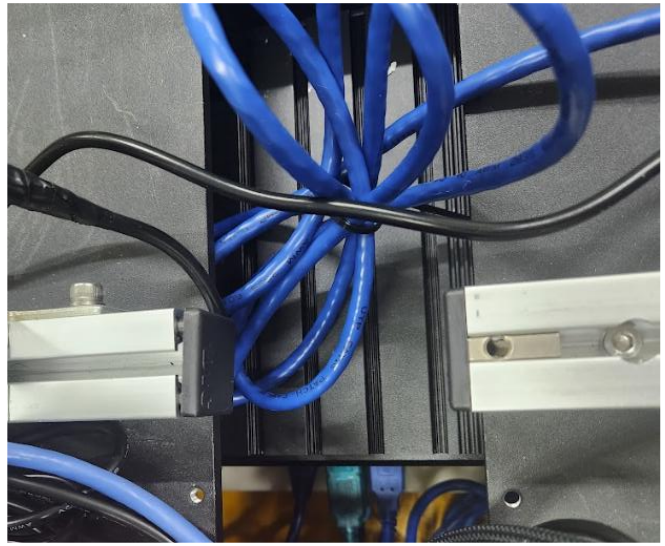
Fixed to Frame(M6 x4)

PC Mount



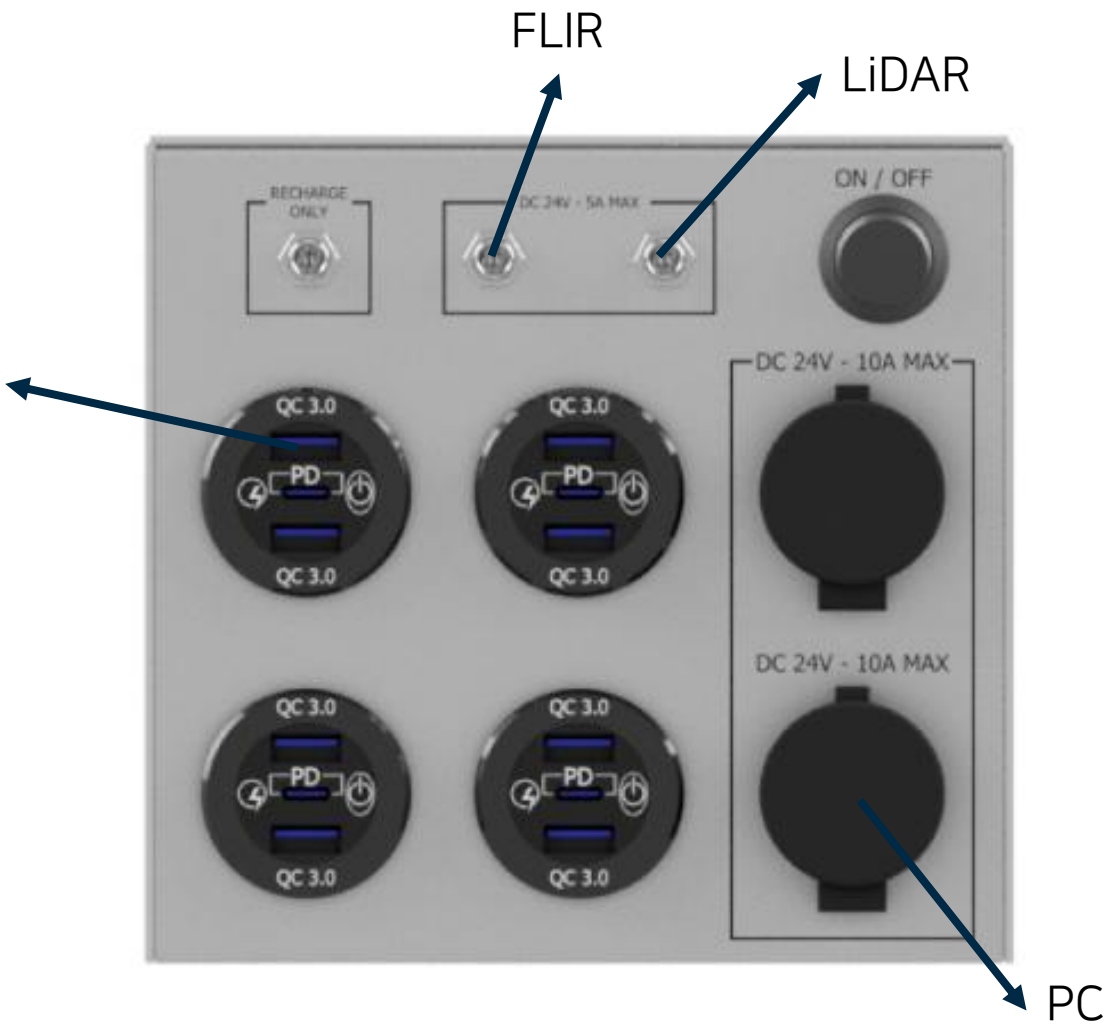
Fixed to Mini PC(M3 x 4)

Fixed to HUSKY UGV by Duct Tape



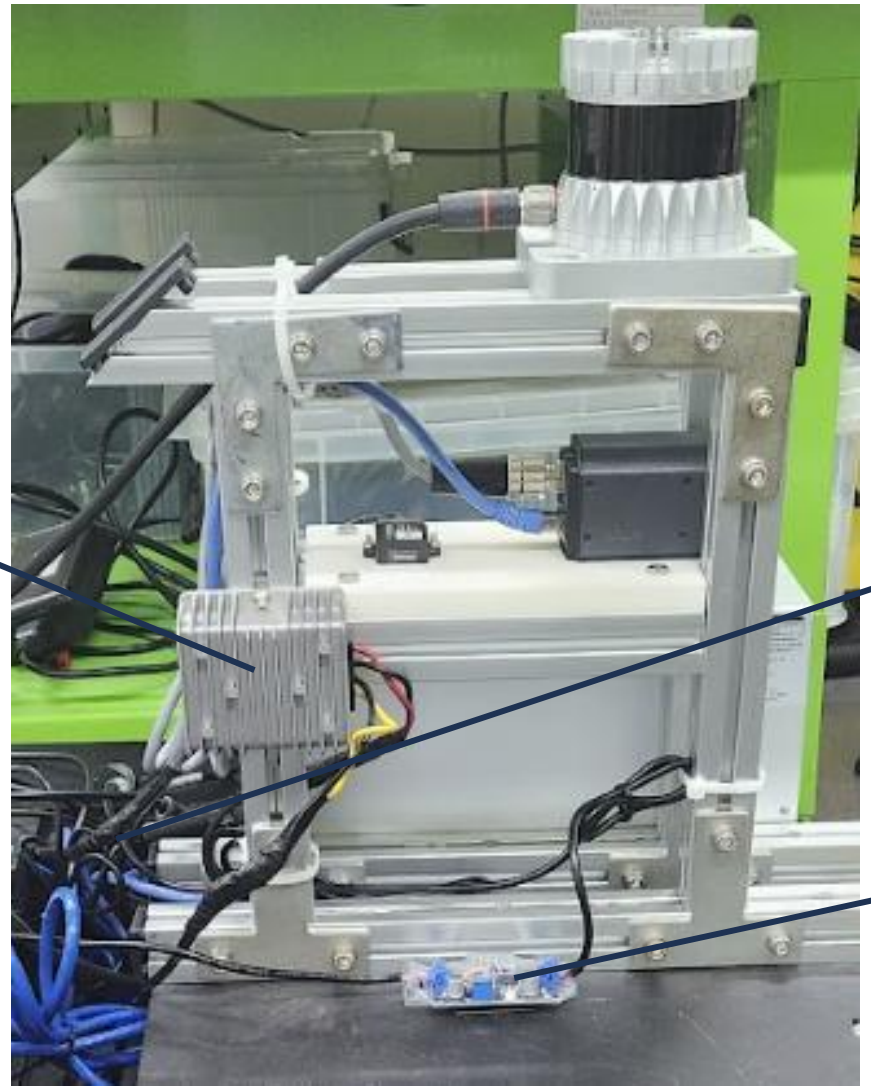
Power Supply

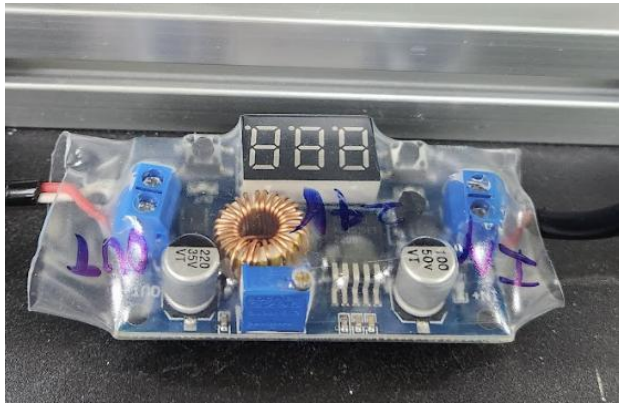
Powercraft DMOP-256LF264-B100



Power

PC power converter
(25~26V -> 12V)

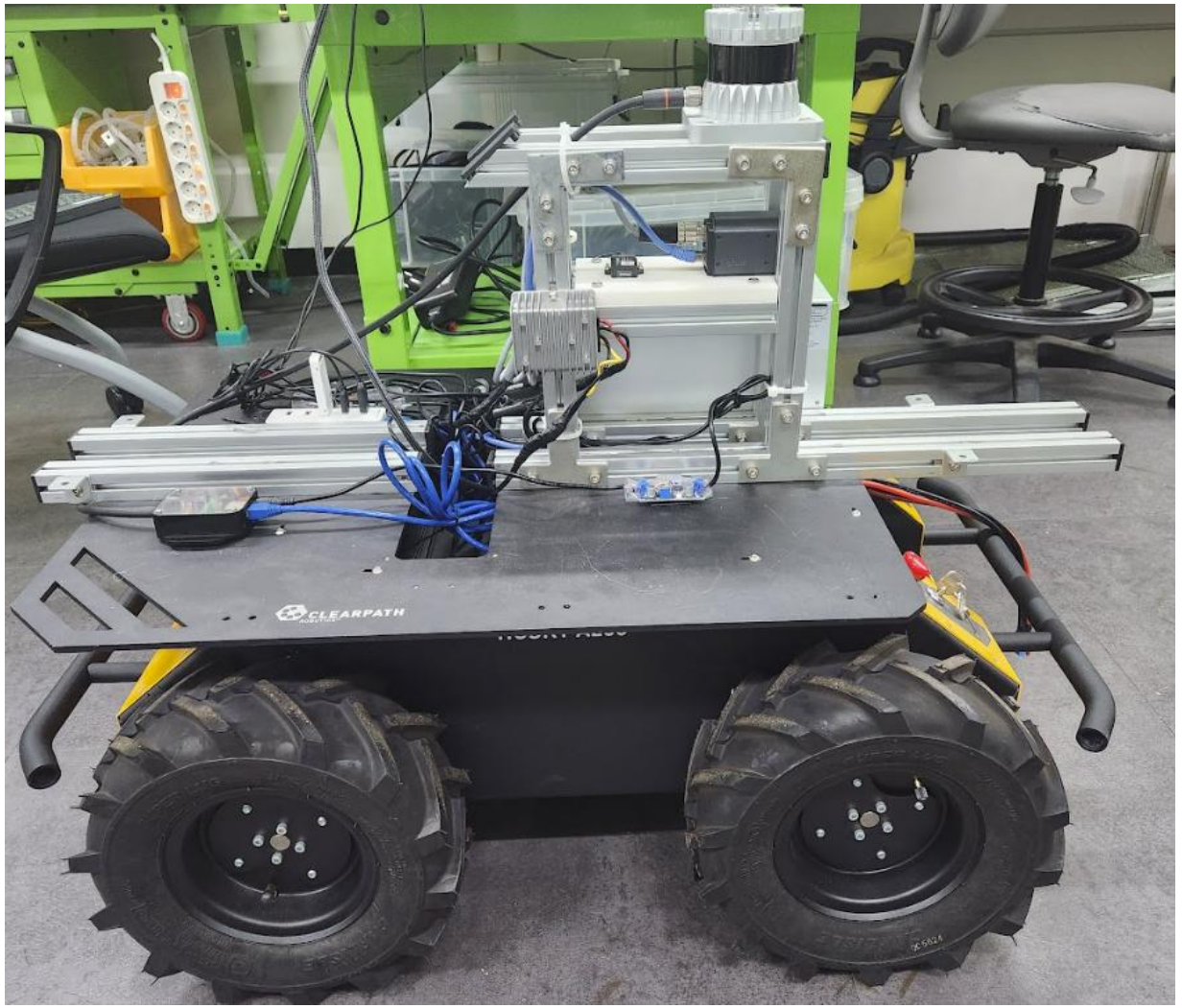




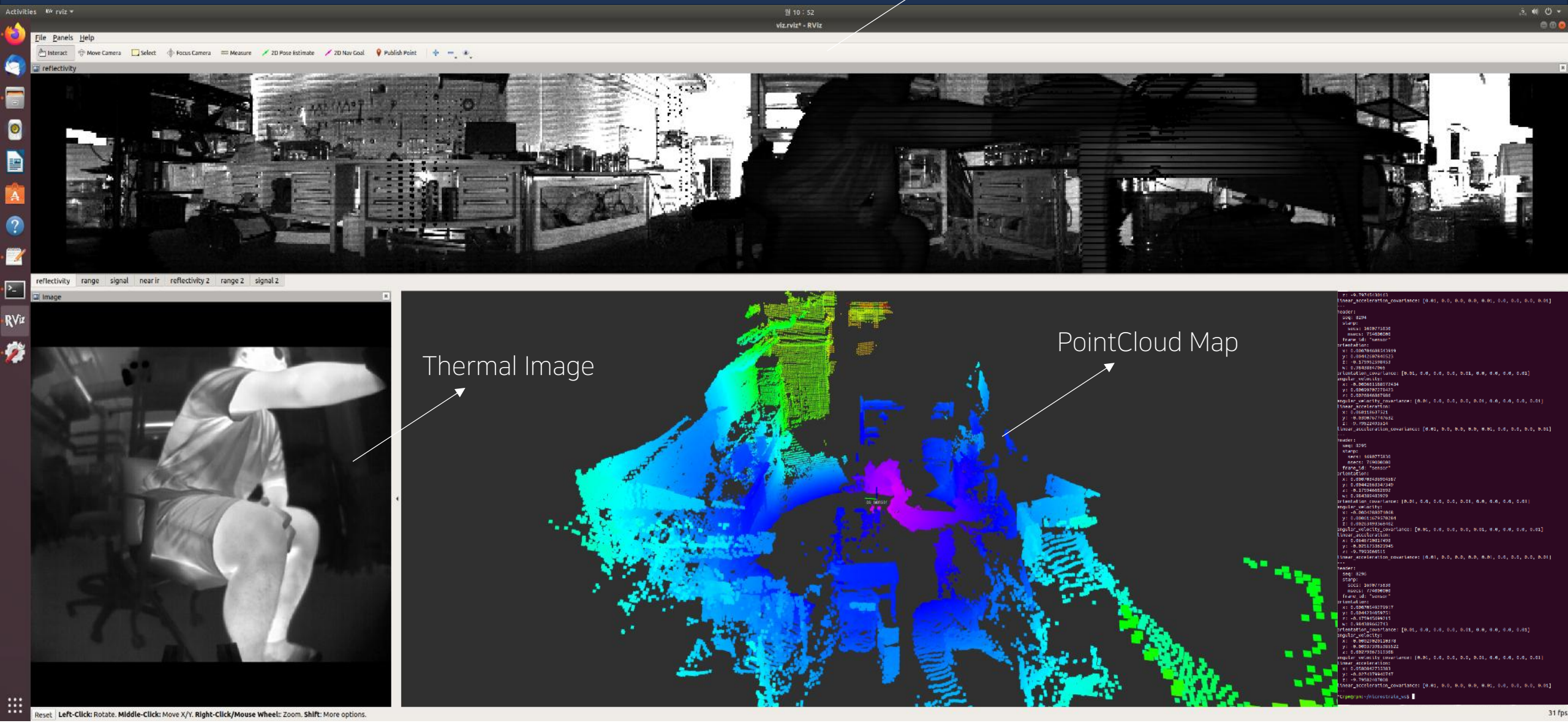
FLIR power converter
(25~26V -> 12V)

LiDAR power converter
(25~26V -> 24V)

System Overview



Outputs


Intensity Map
Thermal Image
PointCloud Map
Activities
rviz
viz.rviz* - RViz
File Panels Help
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
reflectivity
reflectivity range signal near ir reflectivity 2 range 2 signal 2
Image
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click/Mouse Wheel:: Zoom. Shift: More options.
31 fps

Husky

Flysky FS-I6 Drone Controller

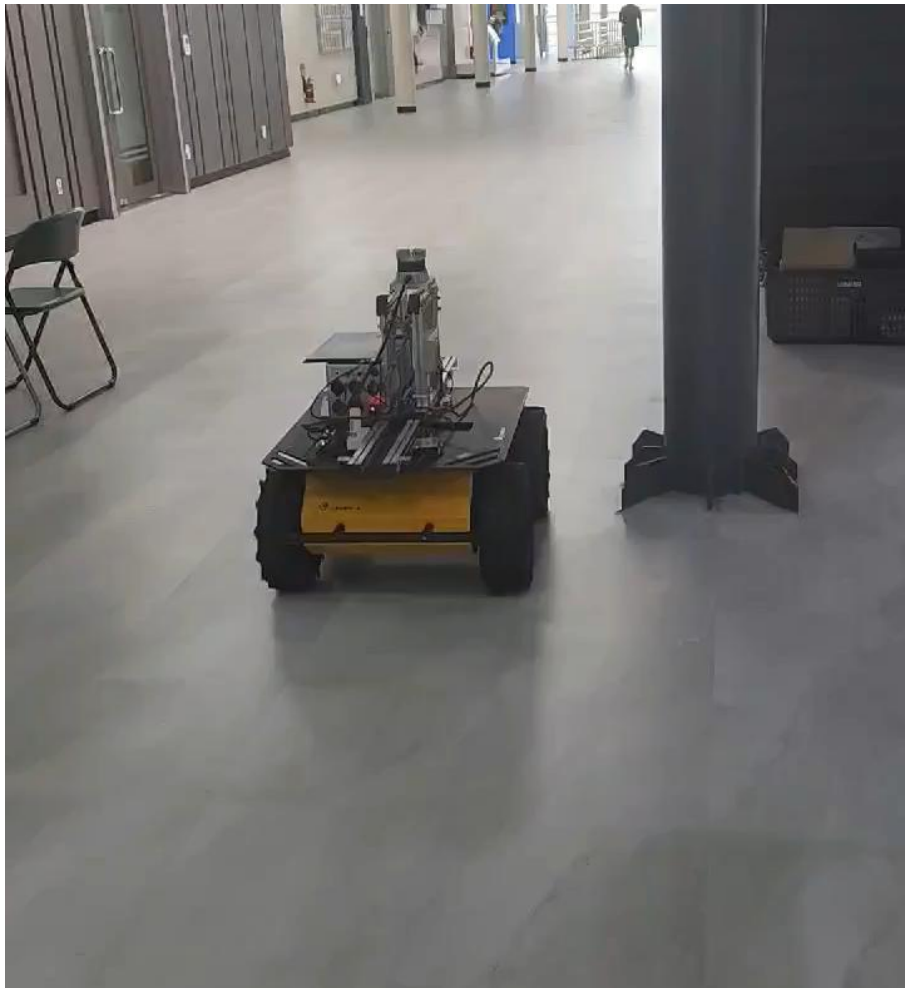
Forward/
Backward

Rotation

Data Collection

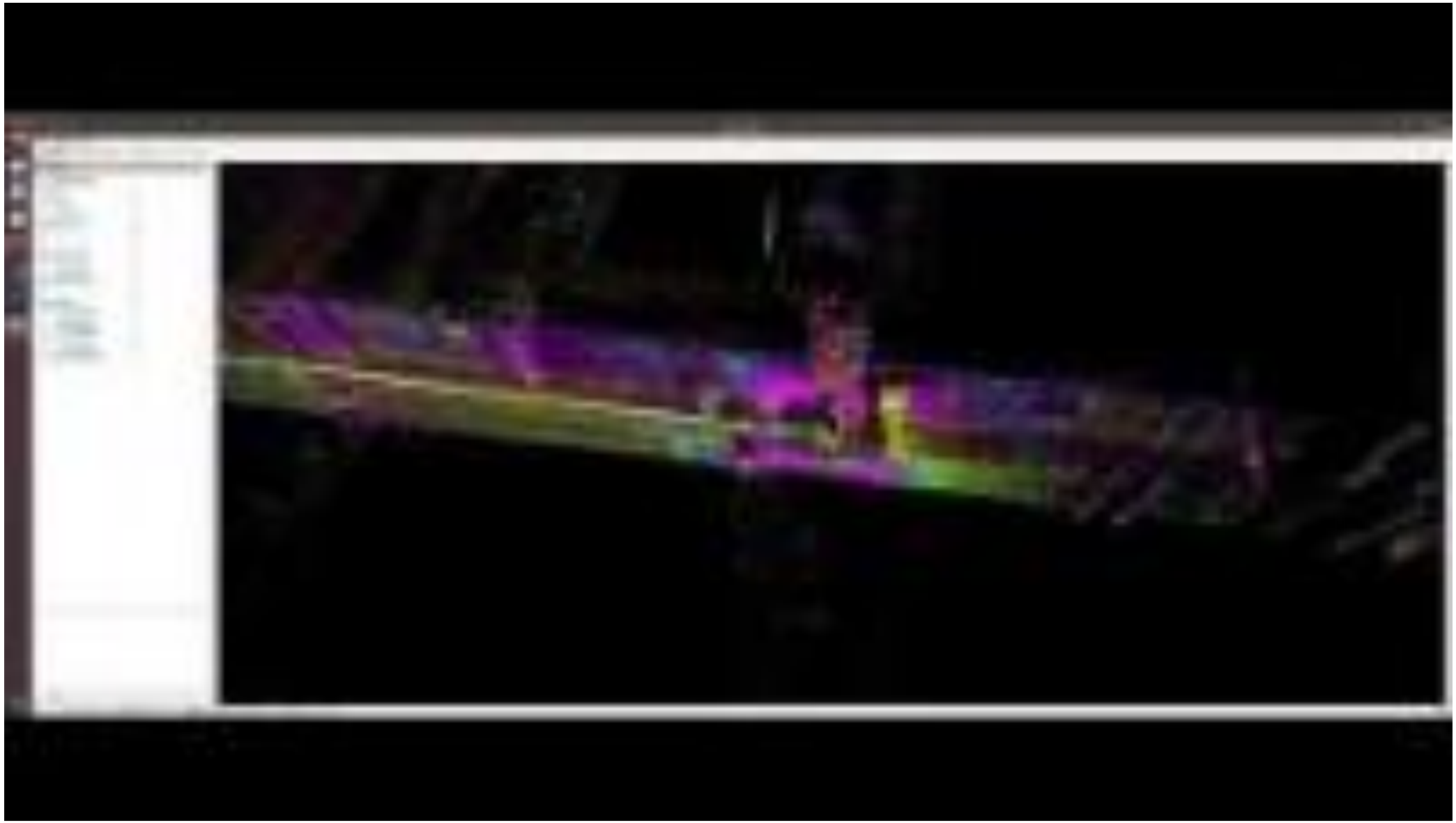
12th floor

PointCloud
Thermal Image
IMU data

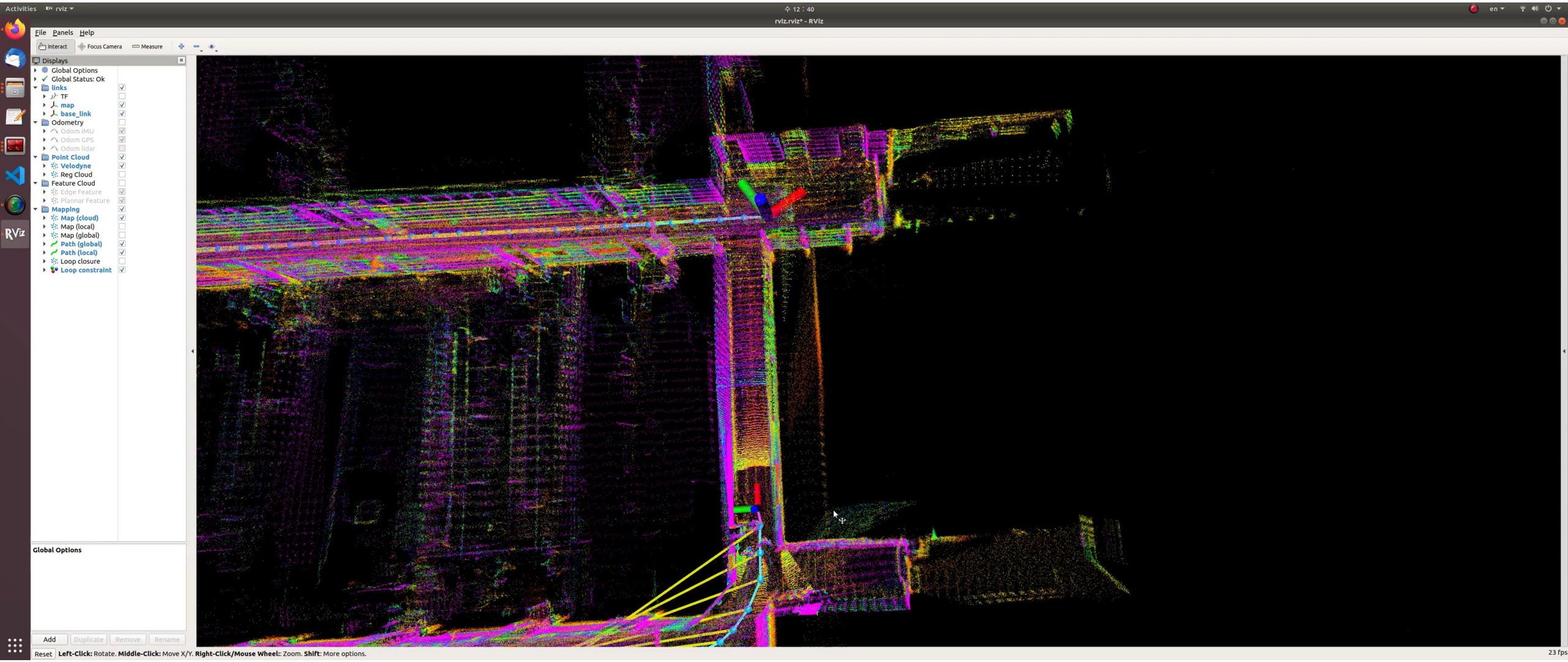


1st floor

LIO-SAM : 12th Floor

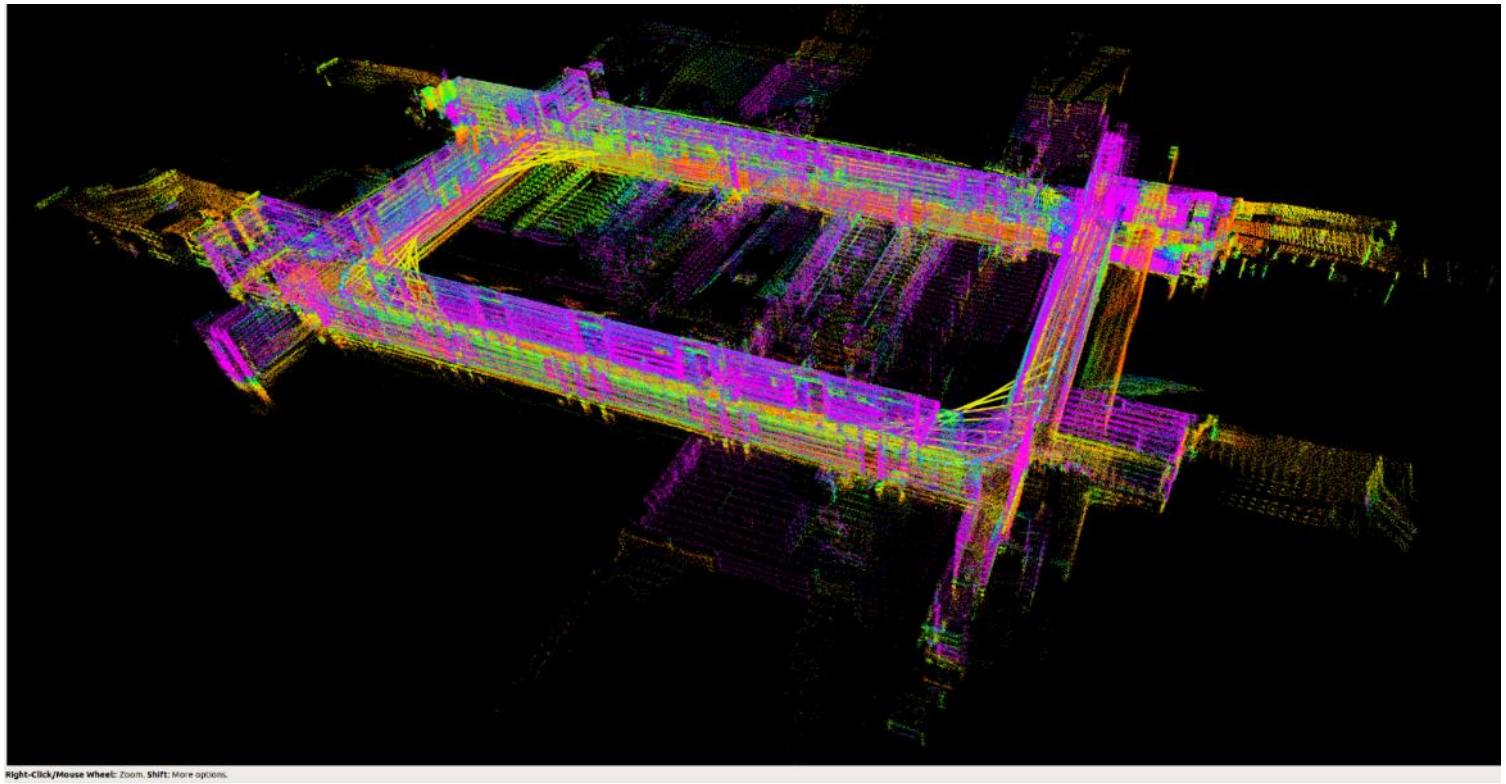


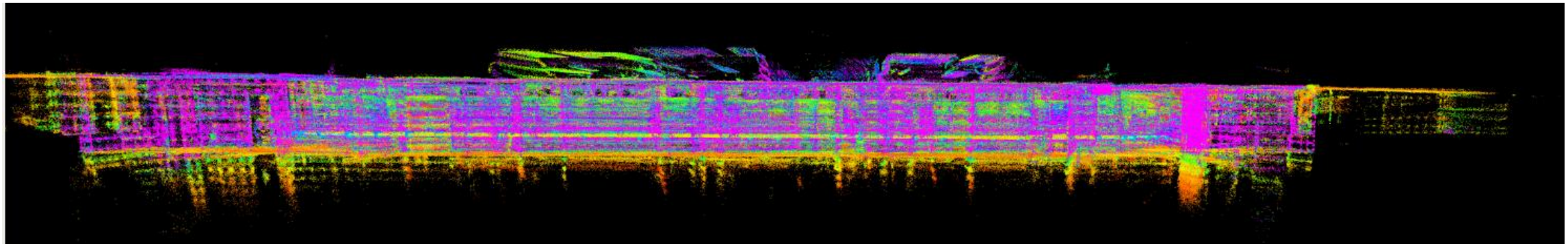
LIO-SAM : 12th Floor



Loop Closure

LIO-SAM : 12th Floor





LIO-SAM : 1st Floor

LIO-SAM : 1st Floor

LiDAR- Camera Calibration

https://github.com/heethesh/lidar_camera_calibration

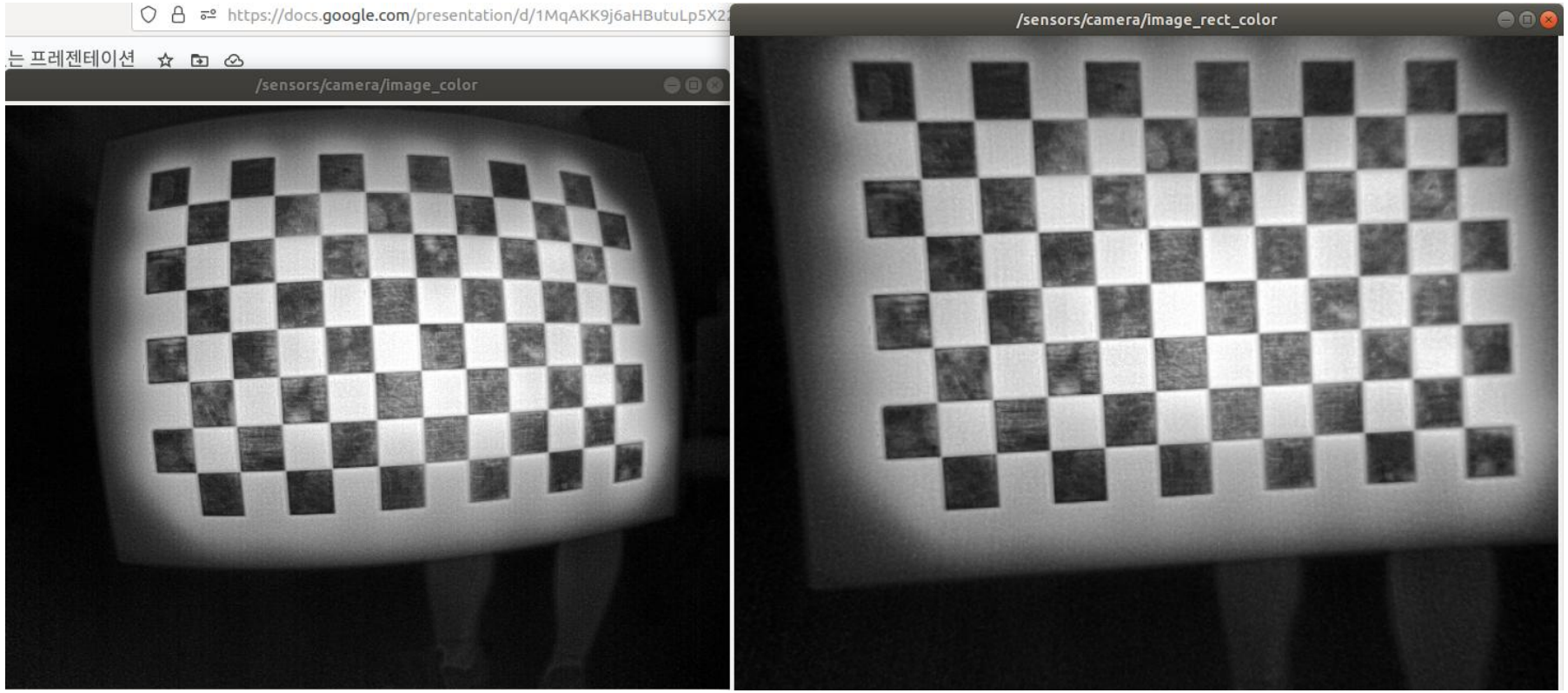


Image undistortion & Intrinsic parameters

LiDAR- Camera Calibration

Extrinsic parameters