AUTONOMOUS DRIVING STACK

Danlaw Inc., Novi, MI

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Hardware + Software Stack

DANLAW

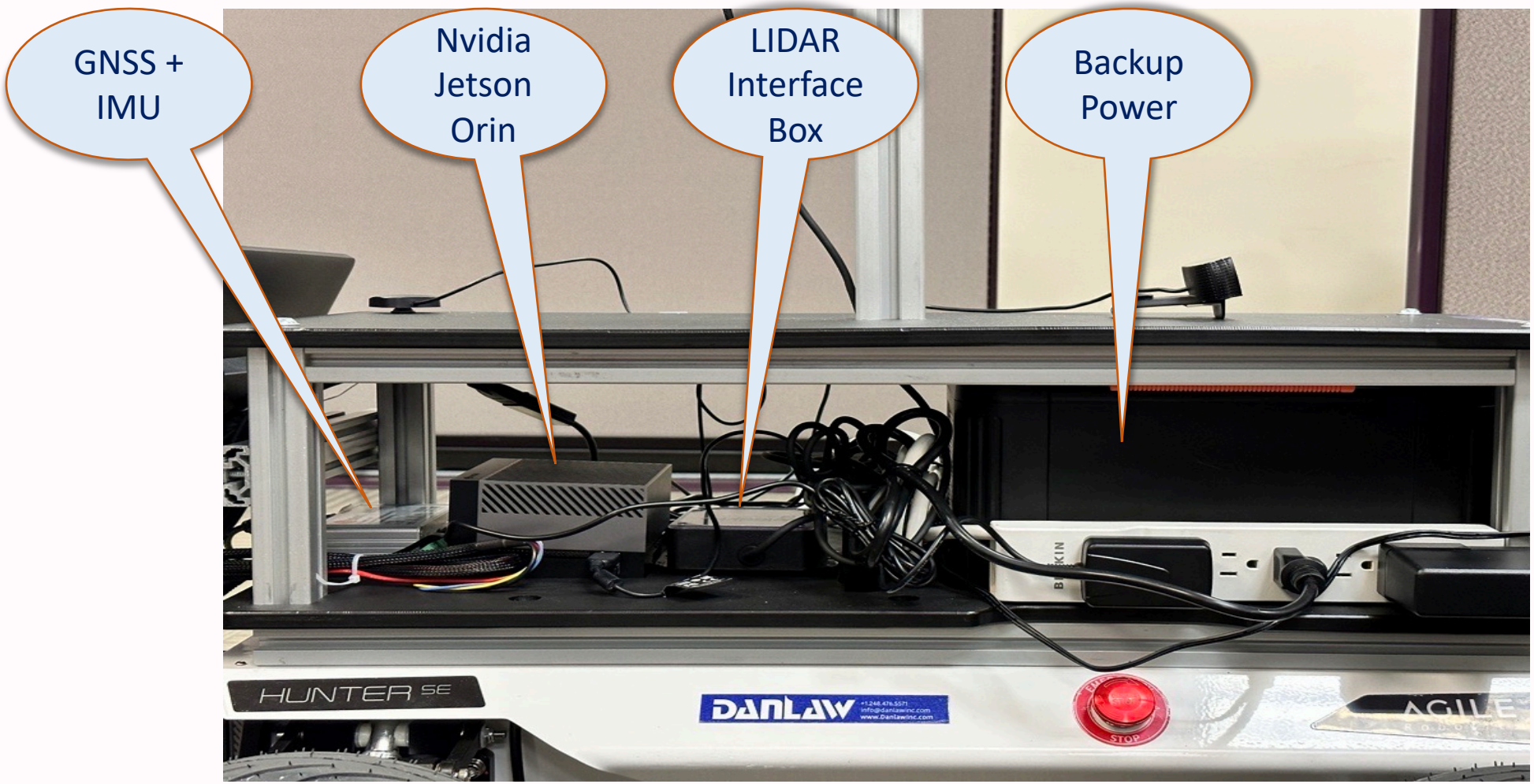
Velodyne Lidar

THE AUTOWARE FOUNDATION

NVIDIA

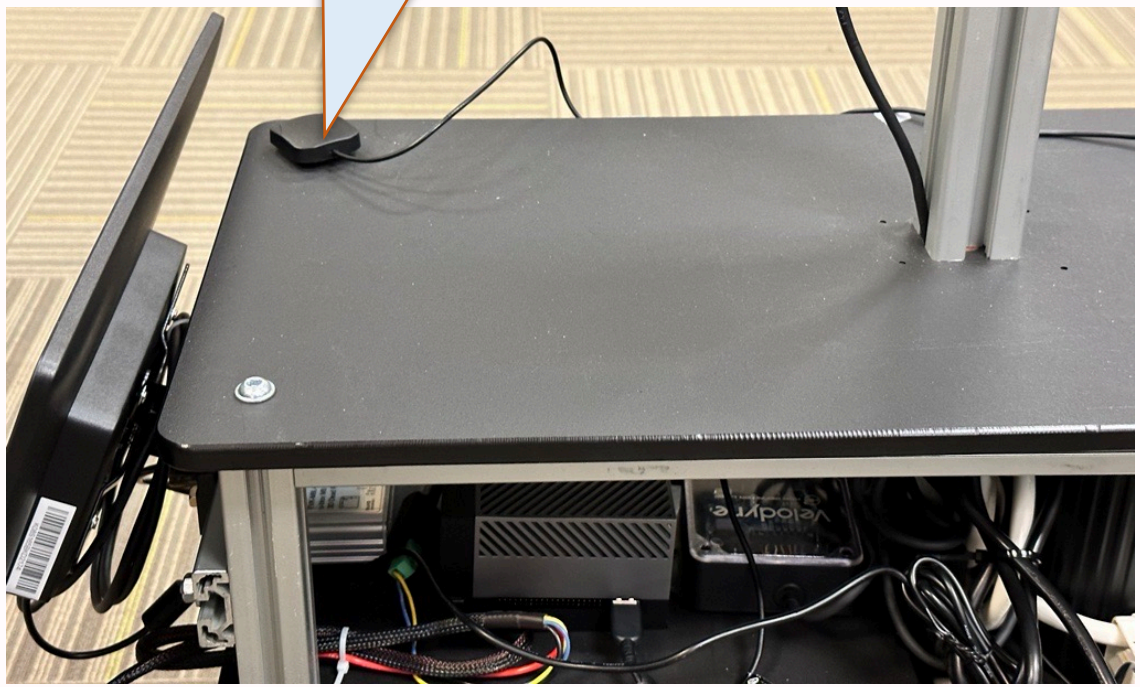
ROS 2

Setup

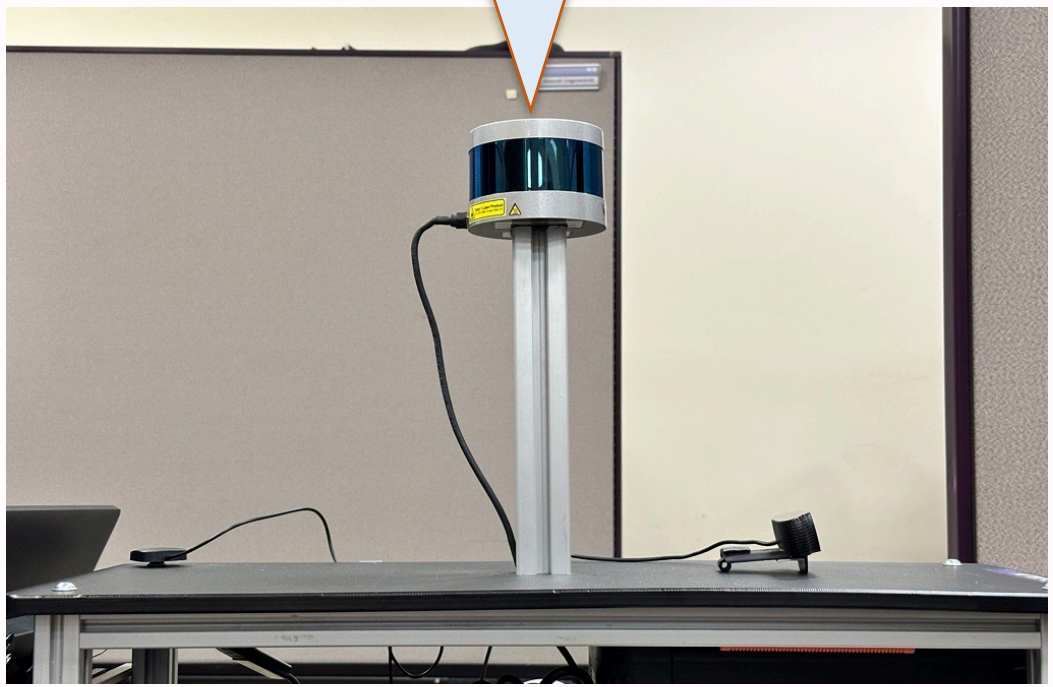

GNSS + IMU
Nvidia Jetson Orin
LIDAR Interface Box
Backup Power
HUNTER SE
DANLAW
STOP

Setup

GNSS Antenna



Top-mount Velodyne LIDAR



Hardware + Software Stack

- Vehicle : Hunter SE Robot Chassis with Ackermann steering and CAN DbW interface
- Processor : Jetson ORIN AGX DevKit
- Software : ROS2 based AUTOWARE
- Sensors :
  - Velodyne VLP-16 Hi-Res LIDAR (Off-the-shelf support from AUTOWARE)

DANLAW capabilities and contributions

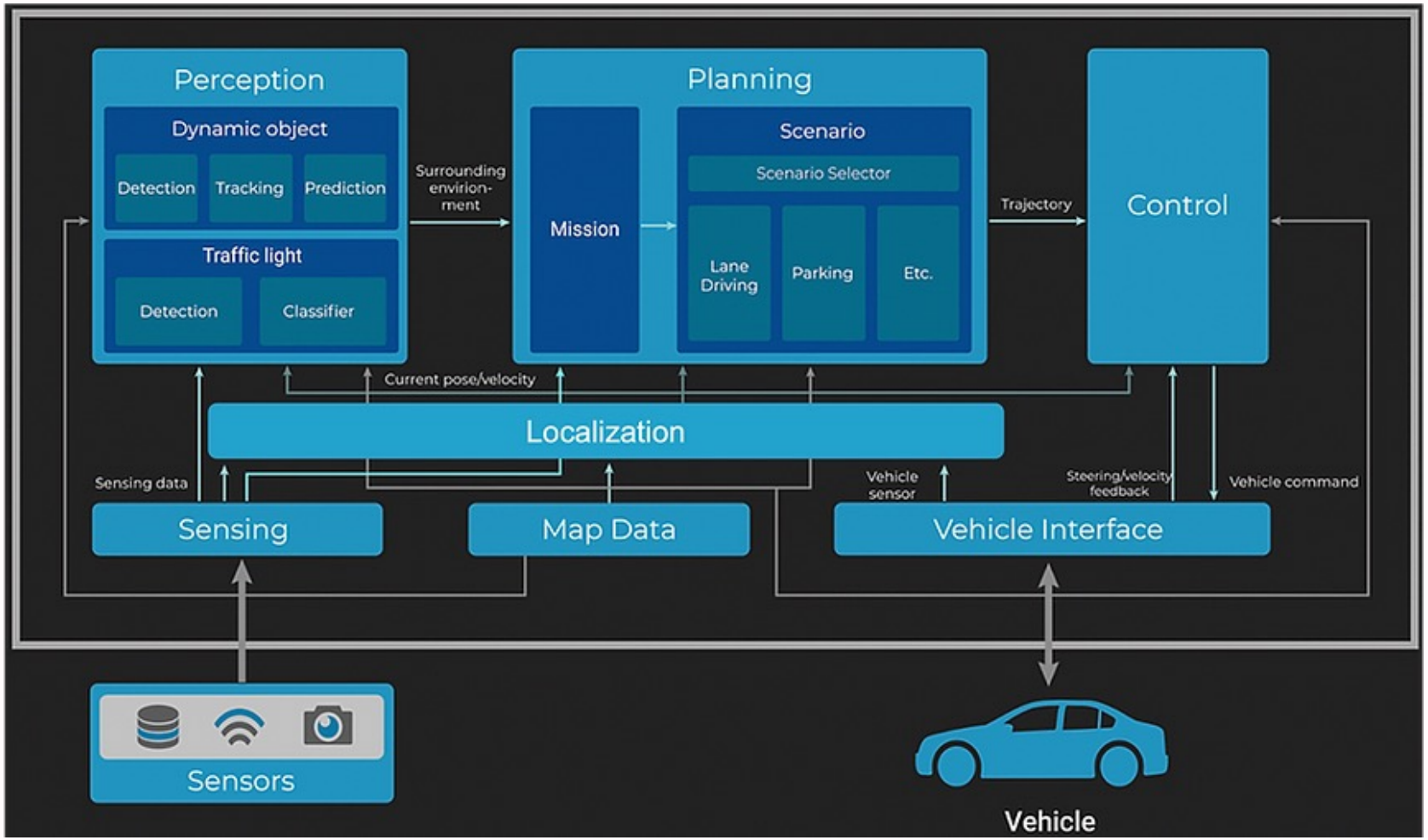
- Partner member of AUTOWARE, an open-source software framework for Autonomous Driving
- Close interaction with AUTOWARE API Workgroup
- Developed custom interface between Autonomous Driving Software and vehicle **D**rive**b**y**W**ire(DbW) system
- Sensor integration (LiDAR)
- Ublox Deadreckoning GNSS+IMU – ROS2
- Map Generation using multi-sensor fusion for Ground Truth Data

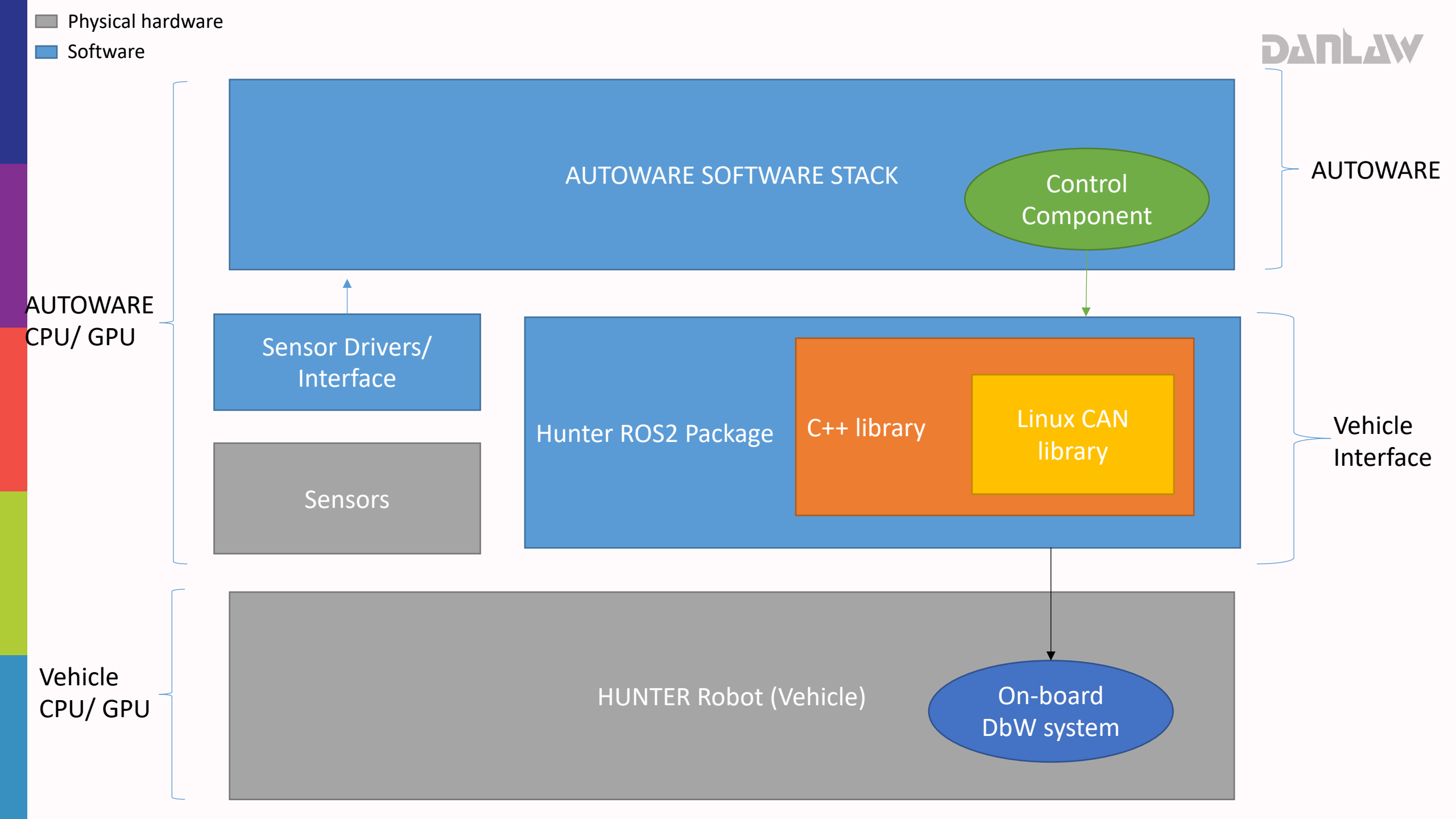
- Performance improvement by using multiple processors on a local network
- Remote monitoring and control on a local network
- V2X OBU integration (In Progress)
- Sensor Fusion (Camera + Radar) (Work In Progress)
  - Integrating a Smartmicro radar with the system

Notes specific to Jetson Orin

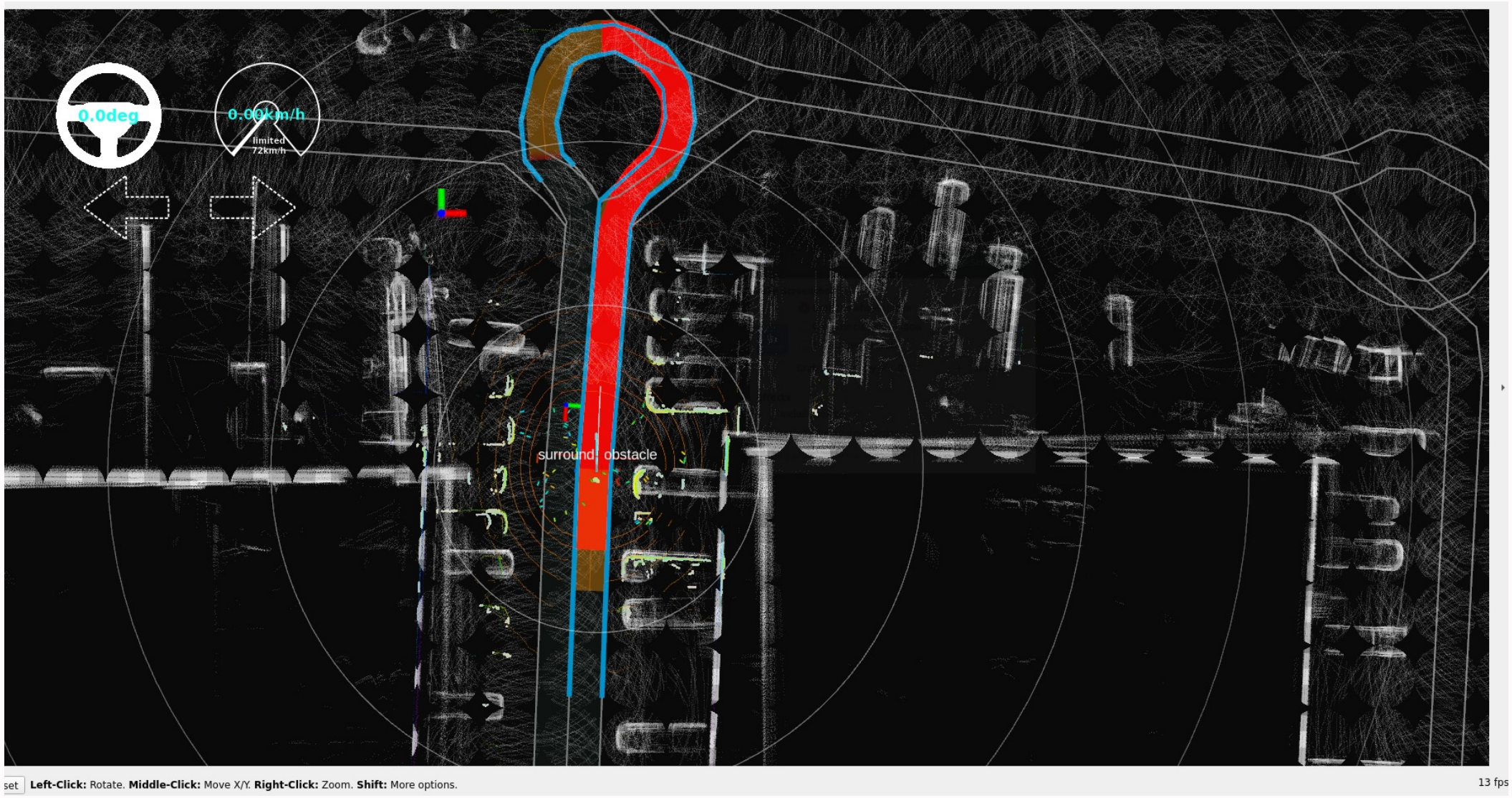
- We attempted Source installation as well as Docker installation.
  - Source installation – Did not give reproducible and reliable results
  - Docker installation – Using Autoware provided base image and Danlaw in-house source code
- Currently unable to use ‘lidar_centerpoint’ model with Jetson Orin due to GPU compatibility issues.
- Using ‘lidar_centerpoint_tvm’ for Lidar perception (Referenced here)
- Issues with ‘lidar_centerpoint’ on Jetson AGX Orin Discussion (here)
- Updated documentation here

AUTOWARE Stack




Physical hardware
Software
AUTOWARE SOFTWARE STACK
Control Component
AUTOWARE
AUTOWARE CPU/ GPU
Sensor Drivers/ Interface
Sensors
Hunter ROS2 Package
C++ library
Linux CAN library
Vehicle Interface
Vehicle CPU/ GPU
HUNTER Robot (Vehicle)
On-board DbW system

Sample Path with 2-way lane

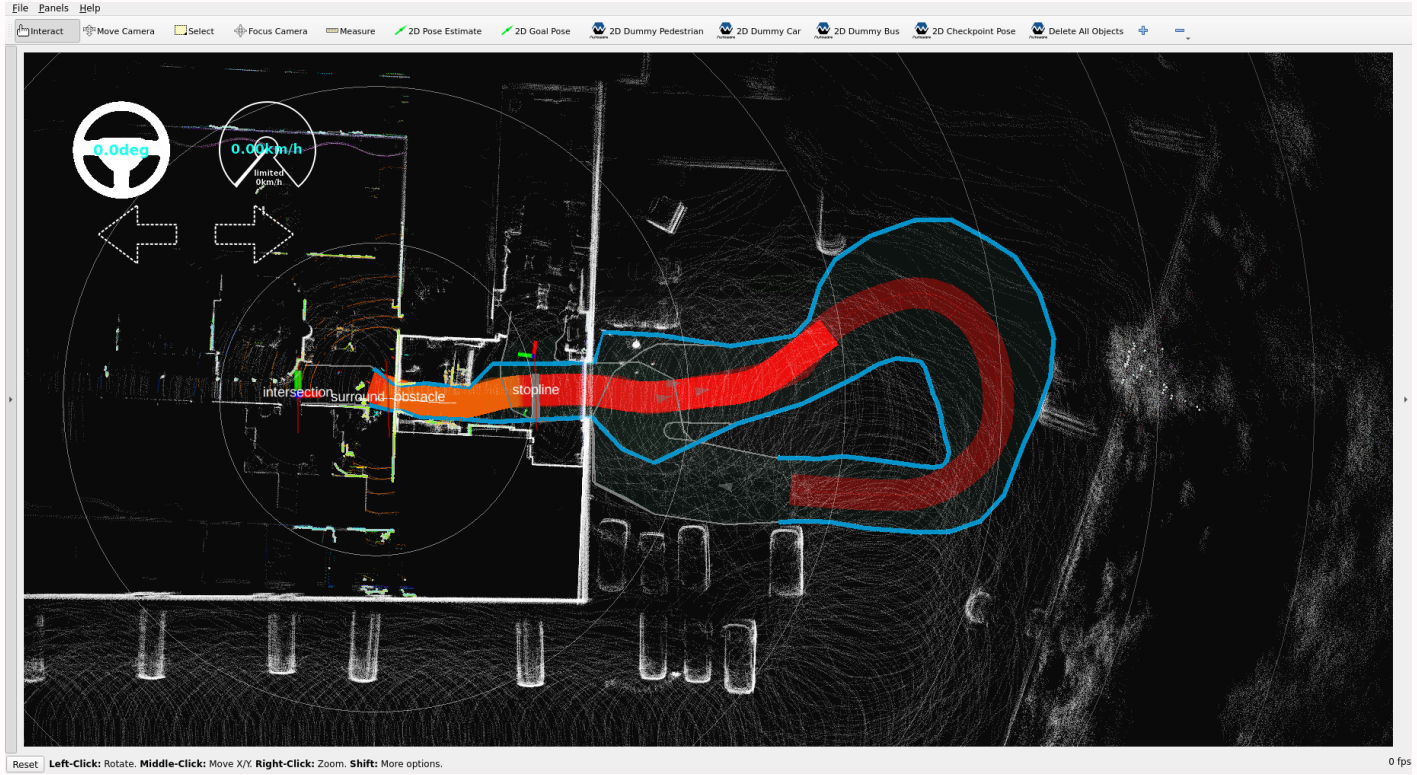


Live Demonstration – Autonomous Driving

- ✓Traffic features :
  - Stop Sign/ Line
  - Intersection
- ✓Curved lanes
- ✓Pedestrian detection/avoidance
- ✓Variable speed limits

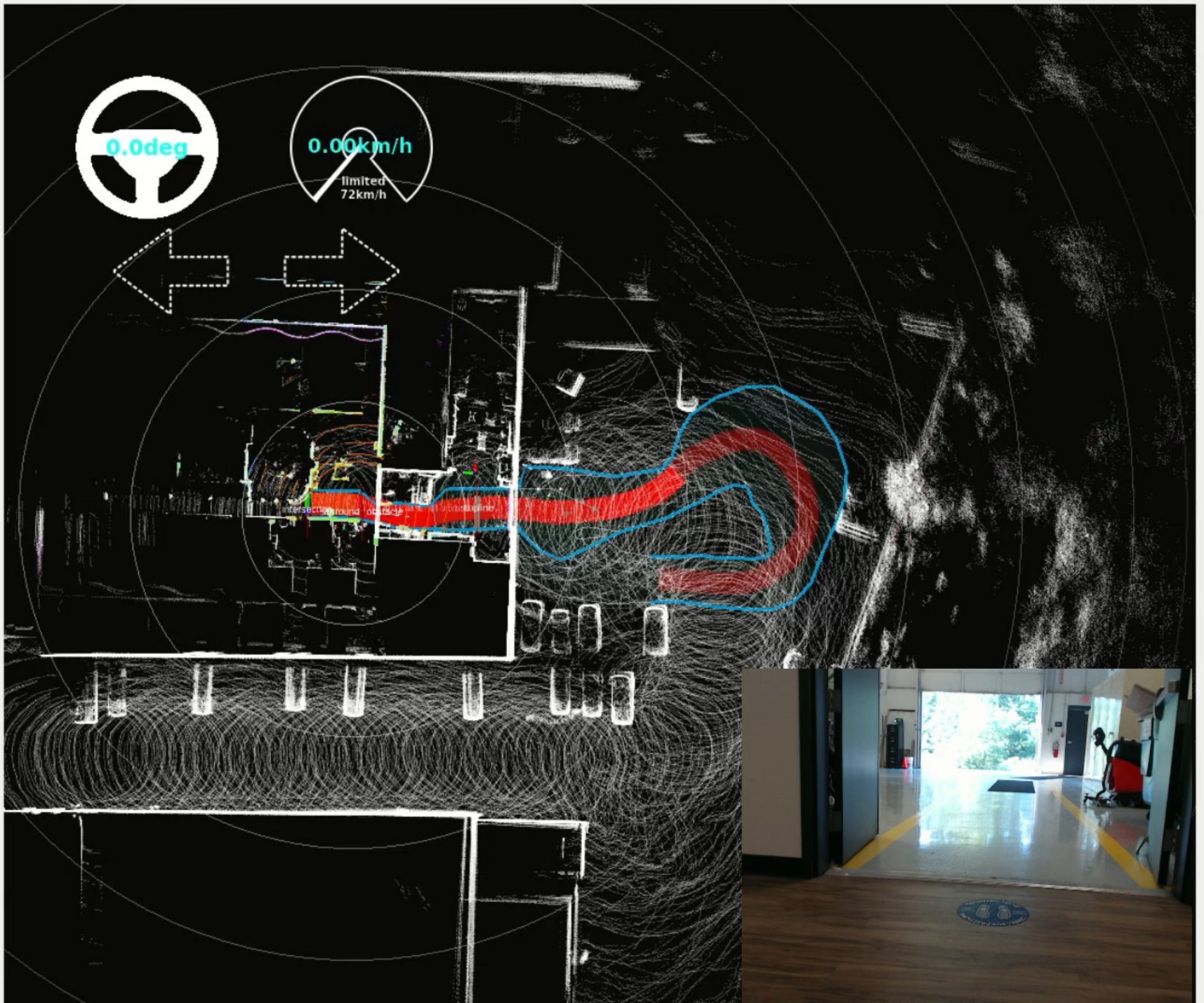
Other Key features :

- ✓HIL Testing
- ✓Performance evaluation
- ✓Flexible hardware integration




File
Panels
Help
Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Goal Pose
2D Dummy Pedestrian
2D Dummy Car
2D Dummy Bus
2D Checkpoint Pose
Delete All Objects
0.0deg
0.00km/h
limited
0km/h
intersection
surround
obstacle
stopline
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click: Zoom. Shift: More options.
0 fps

Scenario 1 : Outdoor Environment


0.0deg
0.00km/h
limited
72km/h

Scenario 2 : Indoor Environment


1.1deg
0.98km/h
limited
1km/h
intersection