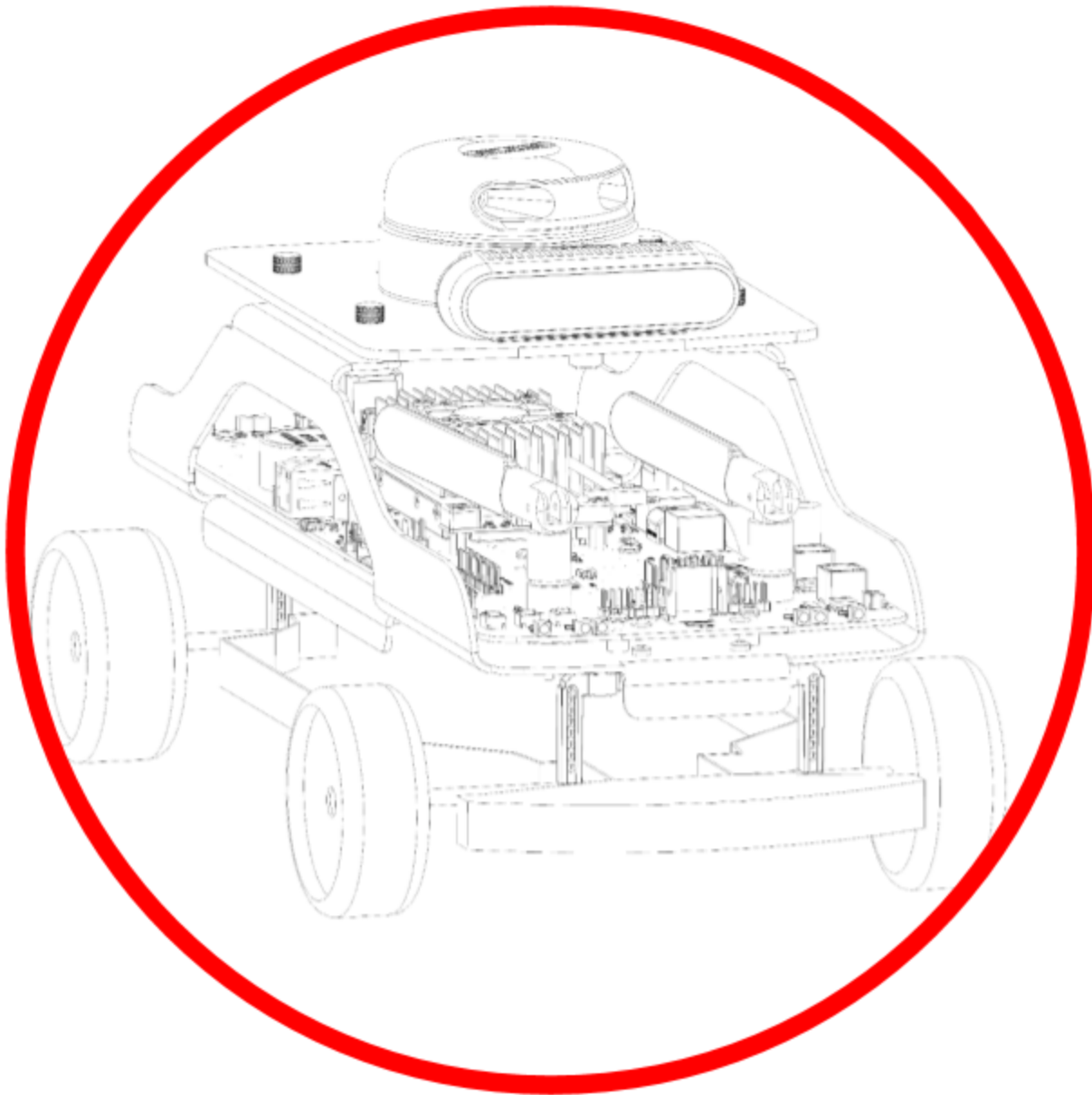


# Self Driving Car Research Studio



## Localization via LiDAR - ROS

V 1.0 (July 2020)

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## I. System Description

In this application we will use a combination of the Hector SLAM packages, gamepad control node and QCar control node to generate an occupancy grid which is visible via RViZ.

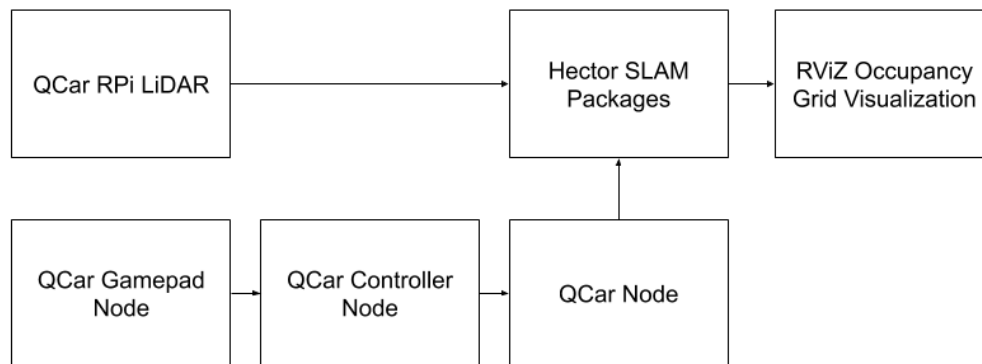


Figure 1. Component diagram

We will use the gamepad to control the speed and orientation of the QCar as it drives around the environment.

**Note:** The map generated in section II was done directly in the QCar and viewed once the QCar had returned back to its starting position. Xlaunch has been known to have compatibility issues when viewing RViz and hence the reason why this example was run directly on the QCar.

## II. Running the example

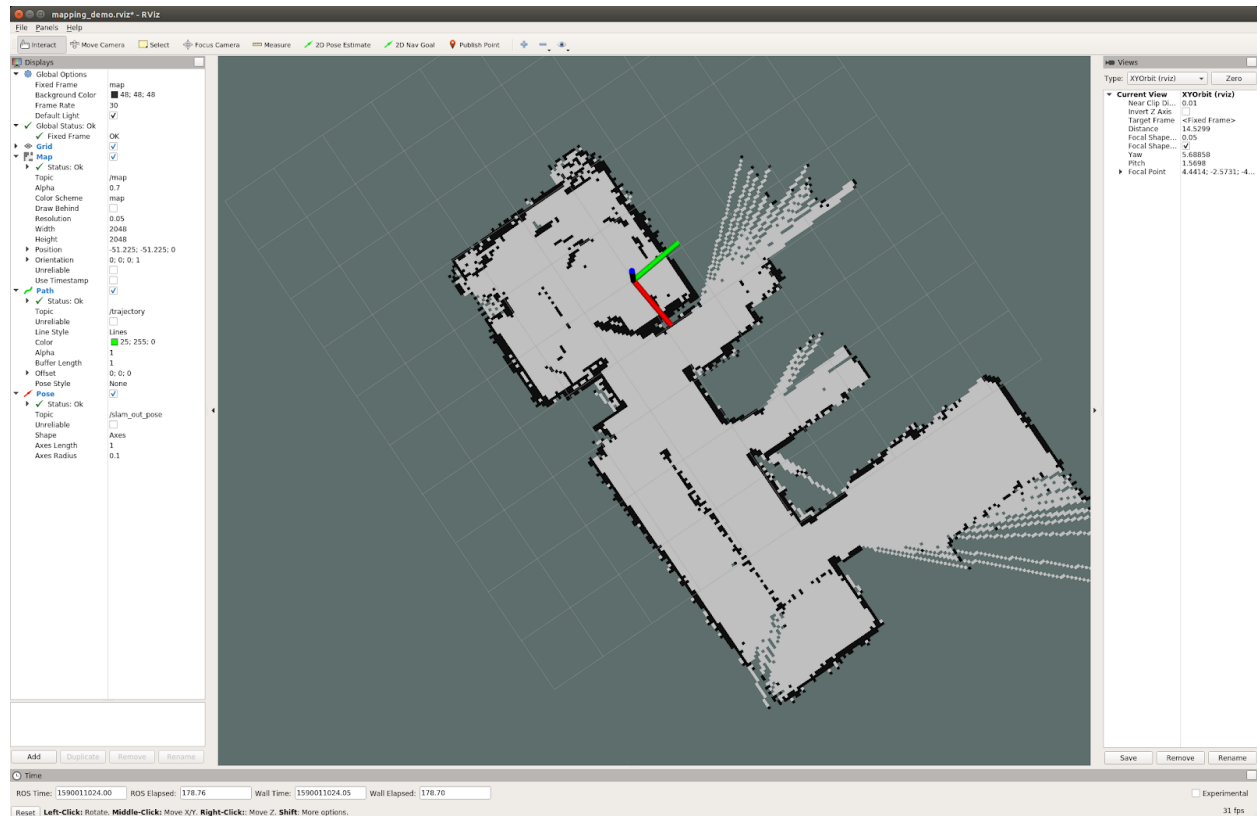


Figure 2. Example occupancy grid generated via Hector SLAM packages..

Running the Hector SLAM example requires you to copy the file called `slam.sh` into the ROS1 directory found inside the QCar. For information on how to transfer files to and from the QCar please review the user guide **III - Connectivity User Guide** document. Copy the `HardwareStop.py` script in the same location as the scripts for the python hardware test described in **II - Hardware Tests.- Python** You will also need to extract and transfer the content inside the `qcar.zip` to the following directory in the QCar: `~/ros1/src`.

You will need the Logitech gamepad for this example. Please refer to the **II - Hardware Tests - Python** for the steps necessary to identify the device ID for the logitech gamepad. Once you have the gamepad device ID please go to the following directory: `~/ros1/src/qcar/src` and **modify** the file `commandnode.py`. You will need to edit the following line:

```
self.gpad = gamepadViaTarget(<LOGITECH_GAMEPAD_ID>).
```

Navigate back to the `~/ros1` directory and with super user authority run the `slam.h` script using the following line:

```
sudo . slam.h
```

Controlling the QCar:

- Use the **LB** button on the Logitech gamepad to **enable** motor commands,
- Use the **RT** to **accelerate** forwards and use the **left joystick** to **steer**.

- To move in **reverse** hold the **LB** and **A buttons** while using the **RT** to control acceleration.

Once you are ready to stop the example you can use the **ctrl+C** keyboard interrupt to terminate the ROS application. To stop the hardware on the QCar run the HardwareStop.py script using super user authority..

### III. Details

Hector SLAM is accomplished by using the following set of standard packages:

- rplidar\_ros
- hector\_mapping
- hector\_geotiff

They are evoked within the slam.launch file located inside of the following directory: **~/ros1/src/qcar/launch.**

As part of this example the following packages have been customized:

- rplidar\_ros
- hector\_mapping

Please do not upgrade these packages as changes to these files can cause the example to run incorrectly. For the **rplidar\_ros** package, a modification to the default communication port was changed from `/tty/USB0` to `/tty/THS2`. Within the **Hector mapping** package the default mapping launch file was modified to include different variables for the frame names.

The **slam.sh** file launches a simplified set of nodes for the QCar using the launch file slam.launch. The following nodes are specific to the QCar:

- qcarnode.py
- commandnode.py

The command node configures the publishing of linear and angular commands generated by the logitech gamepad. The qcarnode.py publishes two topics unique to the QCar, the battery level and the QCar estimated velocity. A subscriber is set up to receive linear and angular velocity commands being sent to the QCar.

A useful topic which can be subscribed to while running Hector SLAM is called **poseupdate**. This topic gives you the position of the QCar relative to its starting position within the built occupancy grid.

If you are going to **rosvbag** to collect all the lidar data and reproduce the SLAM afterward, please check [http://wiki.ros.org/hector\\_slam/Tutorials/MappingUsingLoggedData](http://wiki.ros.org/hector_slam/Tutorials/MappingUsingLoggedData) for more information.