2、Hand-held lidar mapping

Note: Section 2-10 takes the transbot crawler as an example. Users need to modify it according to their own motion model. These courses are only used as running demos.

2.1 Install the dependent library, take the ros-melodic version as an example, enter the terminal,

```
sudo apt install ros-melodic-moveit ros-melodic-moveit-visual-tools ros-melodic-
kdl-* ros-melodic-joint-state-publisher-gui ros-melodic-trac-ik liborocos-kdl-dev
ros-melodic-teleop-twist-keyboard ros-melodic-moveit-resources ros-melodic-
navigation ros-melodic-gmapping ros-melodic-hector-slam ros-melodic-slam-karto
ros-melodic-robot-state-publisher ros-melodic-geographic-msgs ros-melodic-libuvc-
* ros-melodic-rtabmap-ros libavformat-dev libavcodec-dev libswresample-dev
libswscale-dev libavutil-dev libsdl1.2-dev ros-melodic-pointcloud-to-laserscan
ros-melodic-mbf-msgs ros-melodic-mbf-costmap-core ros-melodic-costmap-converter
ros-melodic-bfl ros-melodic-serial ros-melodic-teleop-twist-joy ros-melodic-
laser-proc ros-melodic-rosserial-arduino ros-melodic-rosserial-python ros-
melodic-rosserial-server ros-melodic-rosserial-client ros-melodic-rosserial-msgs
ros-melodic-amcl ros-melodic-map-server ros-melodic-urdf ros-melodic-xacro ros-
melodic-interactive-markers ros-melodic-octomap* ros-melodic-joy* ros-melodic-
dwa-local-planner ros-melodic-multirobot-map-merge python-catkin-tools python3-
dev python3-catkin-pkg-modules python3-numpy python3-yaml build-essential ros-
melodic-imu-tools ros-melodic-cartographer*
```

If it is a new environment, you need to copy the lua file and launch file of cartographer to the corresponding location

```
cd ~/ydlidar_ws/src/transbot_nav/scripts/
sudo bash create.sh
```

2.2. Mapping startup command, terminal input,

```
roslaunch transbot_nav laser_map.launch map_type:=gmapping robot_model:=astra
```

- map_type: mapping algorithm [gmapping, hector, karto, cartographer], the default is [gmapping].
- robot_model: Simulation model [astra, camera].

When building a map in rviz, if [LaserScan] reports an error and fails to load lidar data; after selecting it, click [Remove] to move Remove,

click [Add] to re-add. Just select the appropriate topic.

2.3 map save

Several mapping algorithms save maps in different ways.

- cartographer: execute the following commands

```
bash ~/ydlidar_ws/src/transbot_nav/maps/carto_map.sh
```

- gmapping, hector, karto: execute the following command to save

```
rosrun map_server map_saver -f ~/rplidar_ws/src/transbot_nav/maps/my_map #  The
first way
bash ~/ydlidar_ws/src/transbot_nav/maps/map.sh # The second way
```

The map will be saved to ~/ydlidar_ws/src/transbot_nav/maps/ folder, a pgm image, a yaml file.

map.yaml

```
image: map.pgm
resolution: 0.05
origin: [-15.4,-12.2,0.0]
negate: 0
occupied_thresh: 0.65
free_thresh:  0.196
```

Parameter parsing:

- image: The path of the map file, which can be an absolute path or a relative path
- resolution: the resolution of the map, m/pixel
- origin: 2D pose (x, y, yaw) in the lower left corner of the map, where yaw is rotated counterclockwise (yaw=0 means no rotation
- negate: whether to reverse the meaning of white/black, freedom/occupancy (the interpretation of the threshold is not affected)
- occupied_thresh: Pixels with an occupancy probability greater than this threshold will be considered fully occupied.
- free_thresh: Pixels with an occupancy probability less than this threshold will be considered completely free.
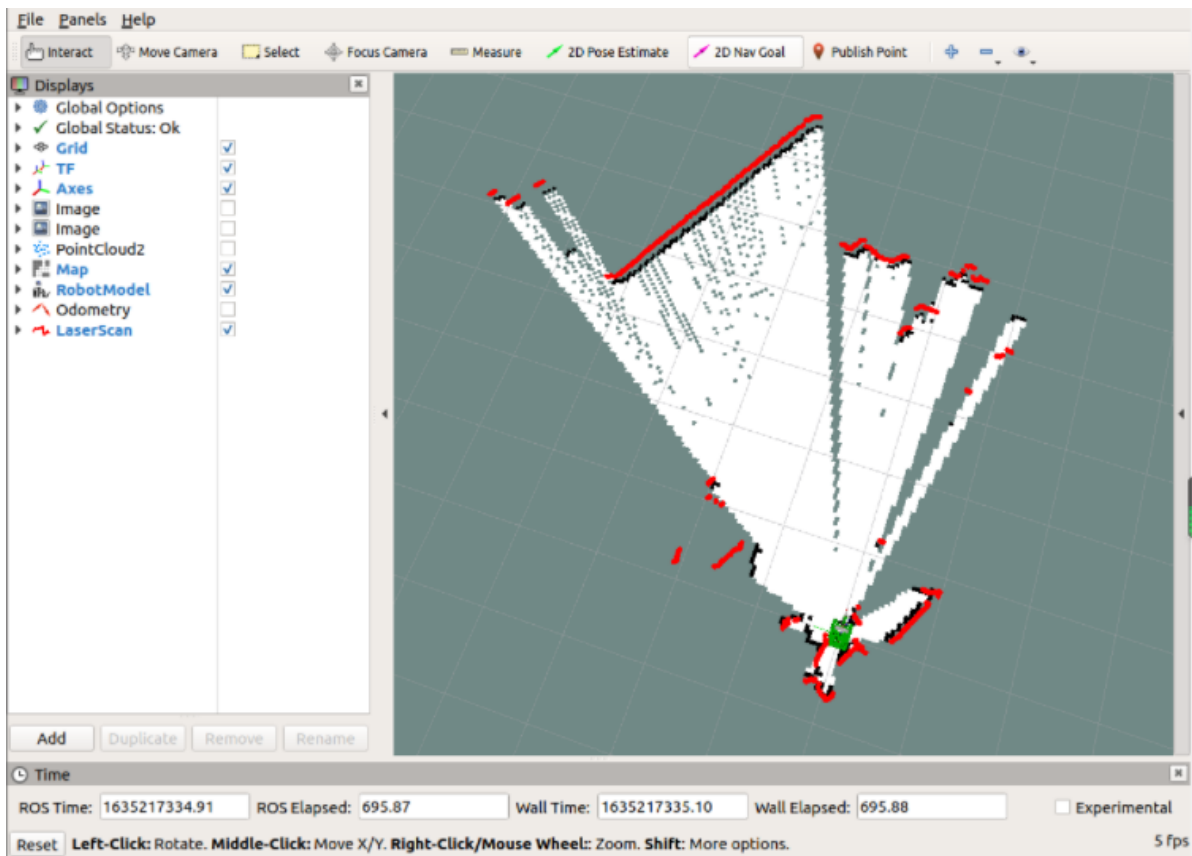
2.4 View related information

View tf tree

```
rosrun rqt_tf_tree rqt_tf_tree
```

Node view

```
rqt_graph
```

2.5 Run the screenshot, take the gmapping mapping algorithm as an example

2.6、 For detailed information of each mapping algorithm, please refer to the following website

- Mapping algorithm:

Gmapping： http://wiki.ros.org/gmapping/

hector_slam： http://wiki.ros.org/hector_slam

hector_slam/Tutorials： http://wiki.ros.org/hector_slam/Tutorials/SettingUpForYourRobot

hector_mapping： http://wiki.ros.org/hector_mapping

karto： http://wiki.ros.org/slam_karto

Cartographer： https://google-cartographer.readthedocs.io/en/latest/

Cartographer ROS： https://google-cartographer-ros.readthedocs.io/en/latest/

- Self-built map navigation:

rrt_exploration： http://wiki.ros.org/rrt_exploration

rrt_exploration/Tutorials： http://wiki.ros.org/rrt_exploration/Tutorials

- Save the map:

map_server： https://wiki.ros.org/map_server