

# SLAM & Wall Detection

# SLAM

- Creates a map and localizes the car simultaneously
- Implementations usually based on stationary anchor points
- Can be augmented using additional sensor data
- We used hector\_slam

# hector\_slam

A metapackage which contains:

hector\_mapping (main SLAM node)

hector\_geotiff (saves map and trajectory as image files)

hector\_trajectory\_server (tracks path and trajectory)

# hector\_mapping

SLAM approach that can be used without odometry

Publishes /map [nav\_msgs/OccupancyGrid]

Subscribes to /scan [sensor\_msgs/LaserScan]

# What We Did

- Installed hector\_slam and its dependencies
- Figured out all the required nodes and their interdependencies and configurations
- Added a tf\_static\_transform node to complete a missing link
- Created a launch file which makes running SLAM just one command
- Created a ROS node which could highlight walls on the map

# /map [nav\_msgs/OccupancyGrid]

```
# This represents a 2-D grid map, in which each cell represents the probability of  
# occupancy.
```

```
Header header
```

```
#MetaData for the map
```

```
MapMetaData info
```

```
# The map data, in row-major order, starting with (0,0).  Occupancy  
# probabilities are in the range [0,100].  Unknown is -1.
```

```
int8[] data
```

```
# This hold basic information about the characterists of the OccupancyGrid
```

```
# The time at which the map was loaded
```

```
time map_load_time
```

```
# The map_resolution [m/cell]
```

```
float32 resolution
```

```
# Map width [cells]
```

```
uint32 width
```

```
# Map height [cells]
```

```
uint32 height
```

```
# The origin of the map [m, m, rad].  This is the real-world pose of the
```

```
# cell (0,0) in the map.
```

```
geometry_msgs/Pose origin
```

# Wall Detection

- rviz is a 3D visualization tool for ROS
  - Supports built-in display types, which allow shapes to be displayed through a topic
- We used the object type of Marker, which can be used to draw lines between pairs of points
- Subscribed to the /map topic
- Published Markers to the /walls topic, which was displayed by rviz

mapping.rviz\* - RViz

Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point

Displays

Global Options

Fixed Frame: map  
Background Color: 48; 48; 28  
Frame Rate: 30  
Default Light: ☒

Global Status: Ok

Fixed Frame: OK

Grid: ☒

Map: ☒

Status: Ok

Topic: /map  
Alpha: 0.7  
Color Scheme: map  
Draw Behind: ☐

Resolution: 0.05  
Width: 2048  
Height: 2048

Position: -51.225; -51.225; 0

Orientation: 0; 0; 1

Unreliable: ☐

Use Timestamp: ☐

Path: ☒

Status: Ok

Topic: /trajectory  
Unreliable: ☐

Line Style: Lines  
Color: 25; 255; 0  
Alpha: 1  
Buffer Length: 1

Offset: 0; 0; 0

Pose Style: None

Pose: ☒

Status: Ok

Topic: /slam\_out\_pose  
Unreliable: ☐

Shape: Axes  
Axes Length: 1  
Axes Radius: 0.1

Marker: ☒

Status: Ok

Marker Topic: /walls  
Queue Size: 100

Add
Duplicate
Remove
Rename

Views

Type: XYOrbit (rviz)
Zero

Current View
XYOrbit (rviz)

Near Clip ...: 0.01  
Invert Z Axis: ☐  
Target Fra...: <Fixed Frame>  
Distance: 17.5905  
Focal Shap...: 0.05  
Focal Shap...: ☒  
Yaw: 5.66859  
Pitch: 1.5048  
Focal Point: 1.7291; -1.4438; ...

Save
Remove
Rename

Time

ROS Time: 1556672701.69
ROS Elapsed: 40.20
Wall Time: 1556672701.72
Wall Elapsed: 40.14

Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click: Move Z. Shift: More options.

Experimental
31 fps