Robot Programming with ROS

Group Assignment

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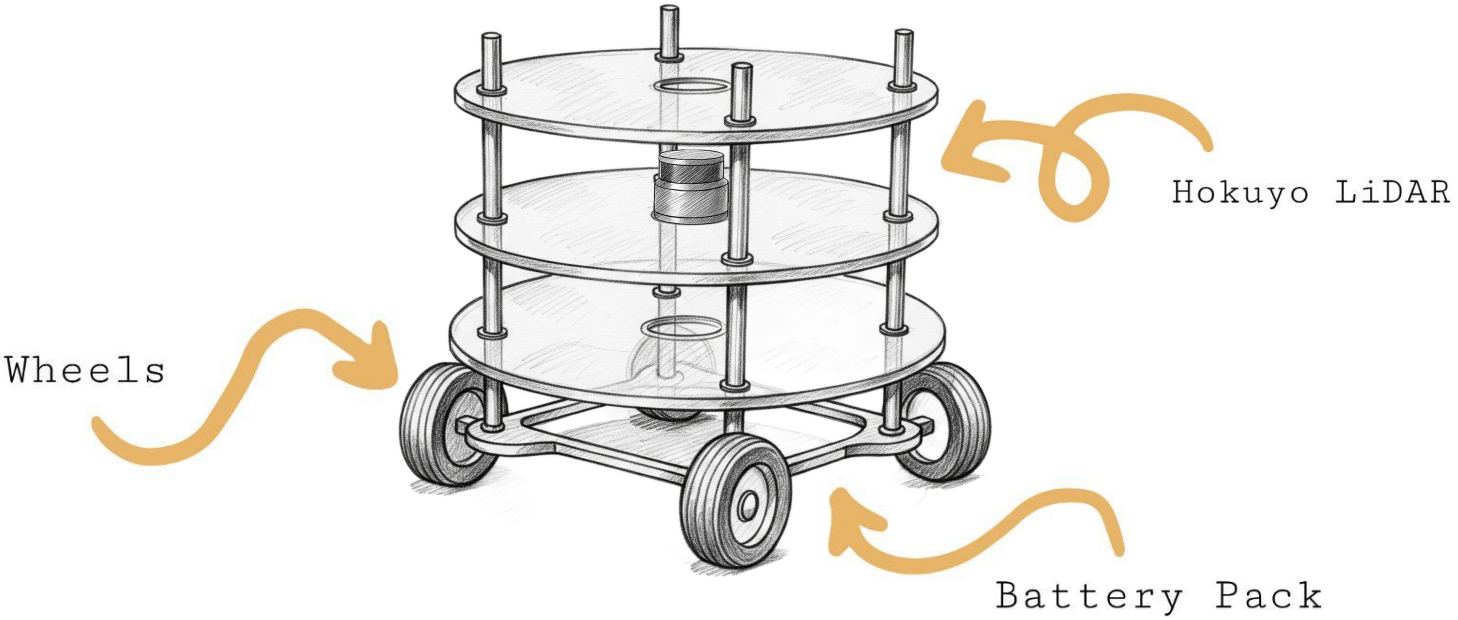
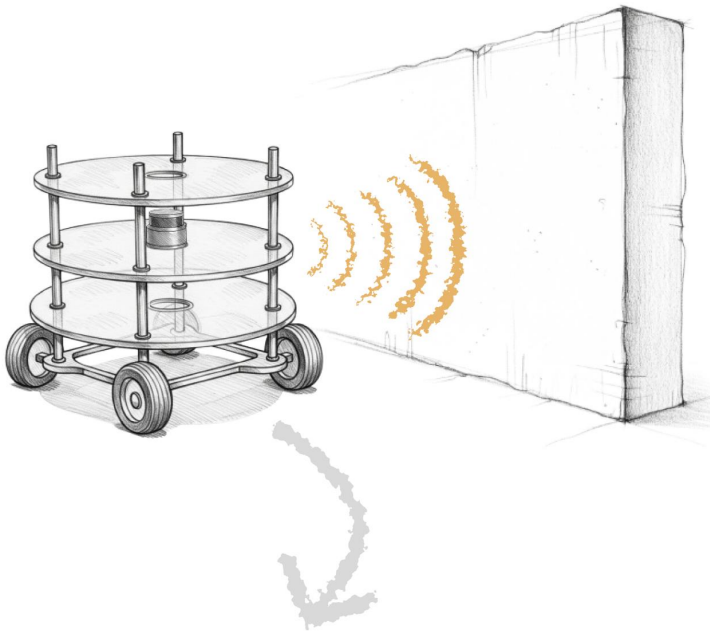
Group 6

Robot



Lane Keeping Assist

The robot should detect collisions and correct the movement to avoid an accident. The correction should be as smooth as possible. You don't want to slow down. Only stop if there is something directly in front of the robot.



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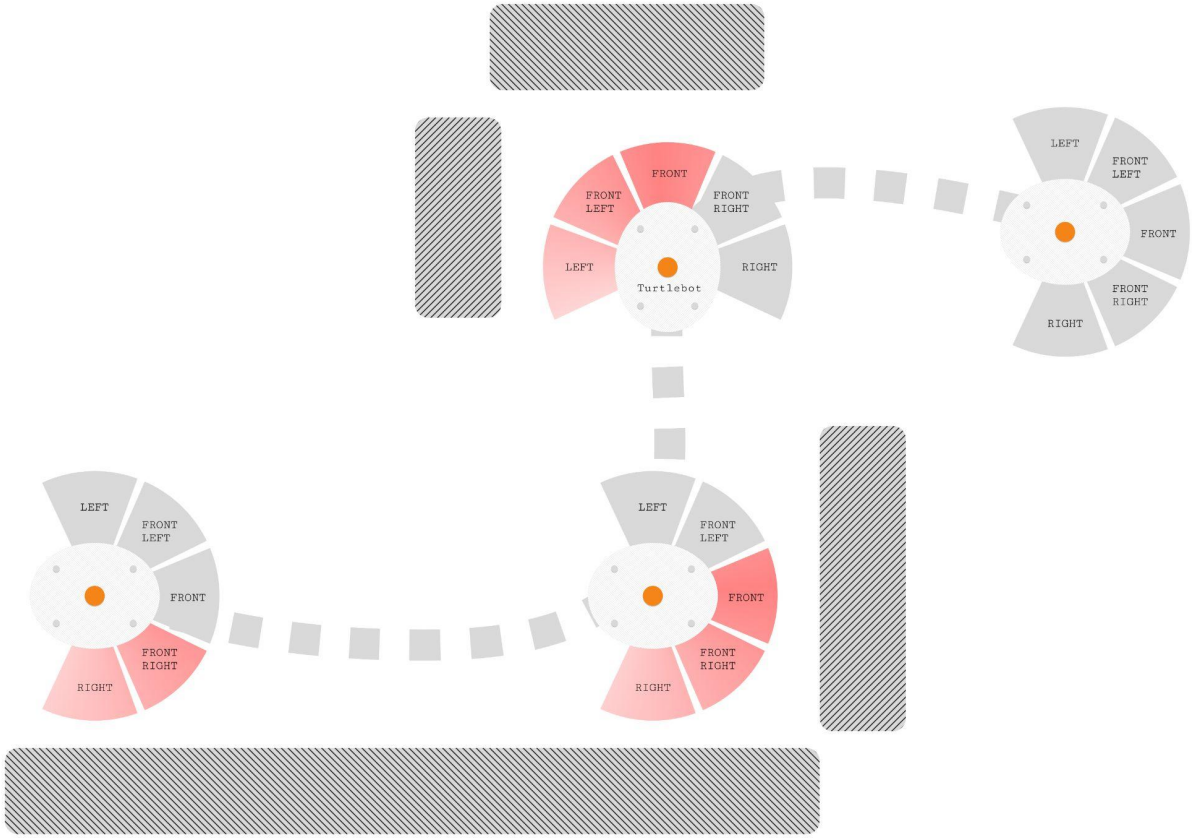
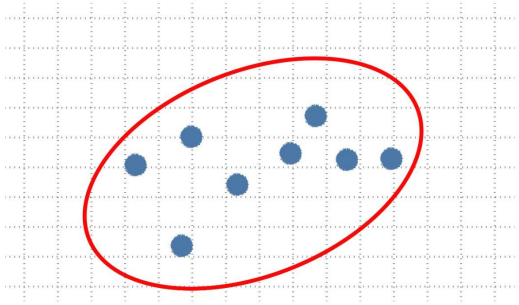
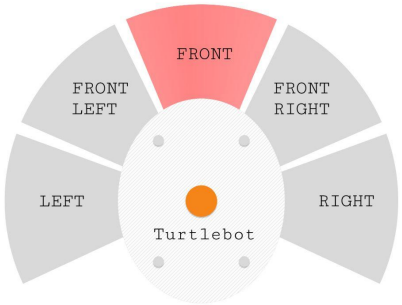
Smooth Assistance



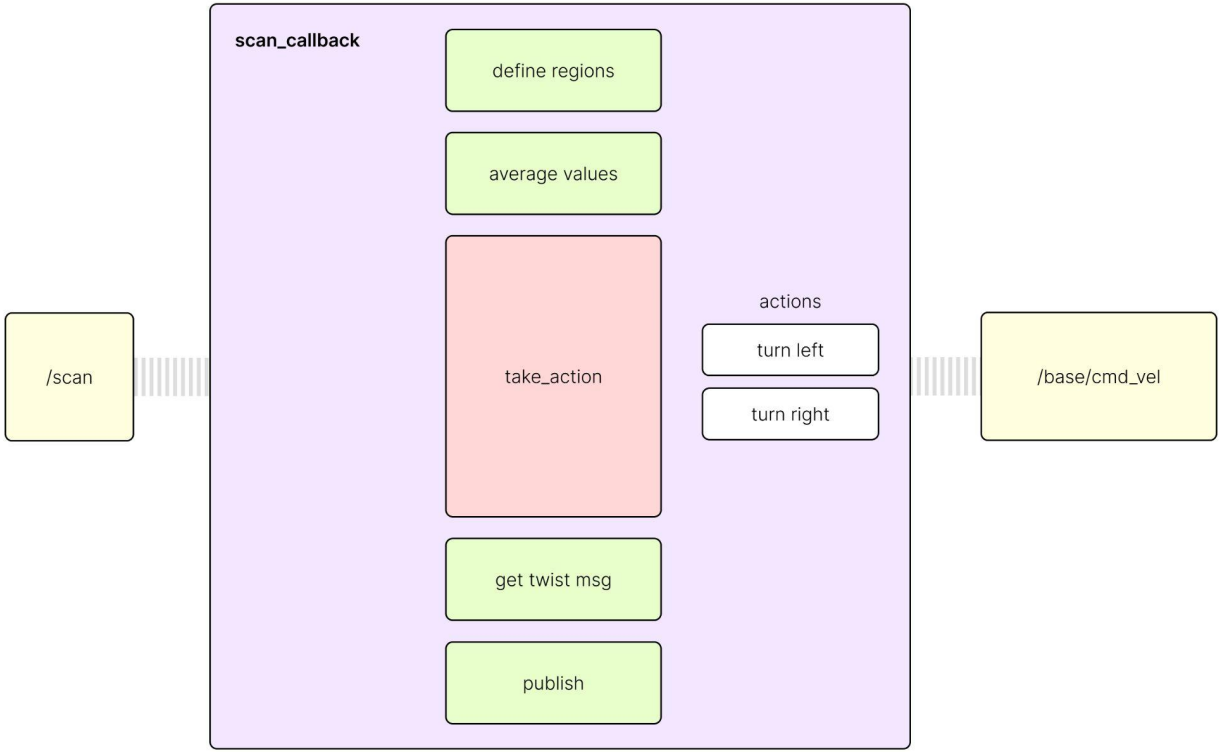
Sensor Readings

Average to reduce sensitivity



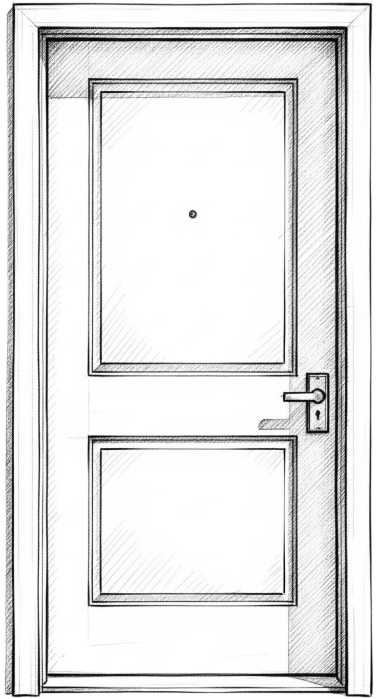


Script

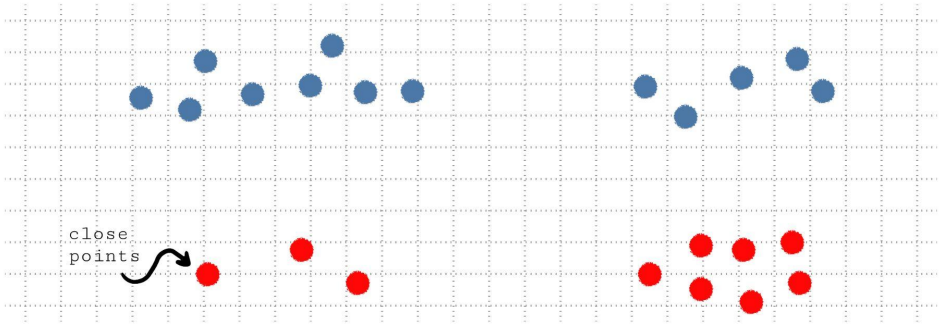

scan_callback
define regions
average values
take_action
get twist msg
publish
actions
turn left
turn right
/scan
/base/cmd_vel

Knock Knock

Put the robot in front of a door. Stand still as long the door is closed. When the door is open and the path is free, drive through the door without collision.

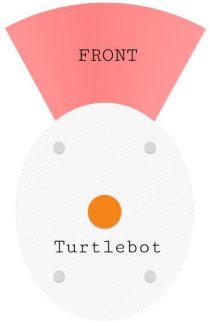


Approach



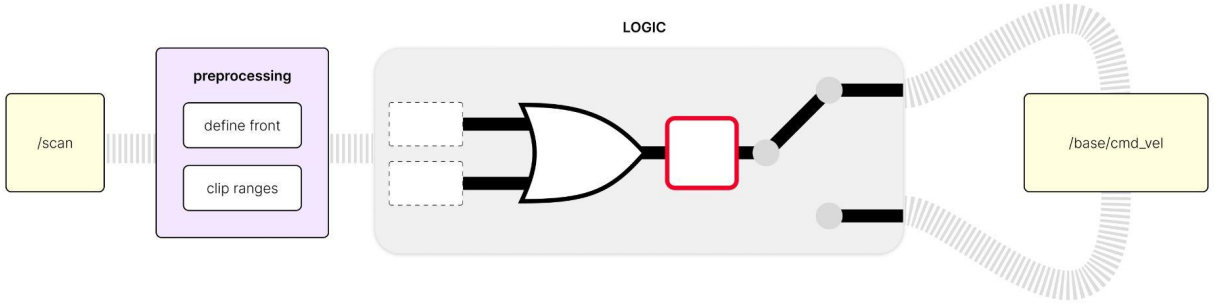
few_obstacles = TRUE
high_free_ratio = TRUE

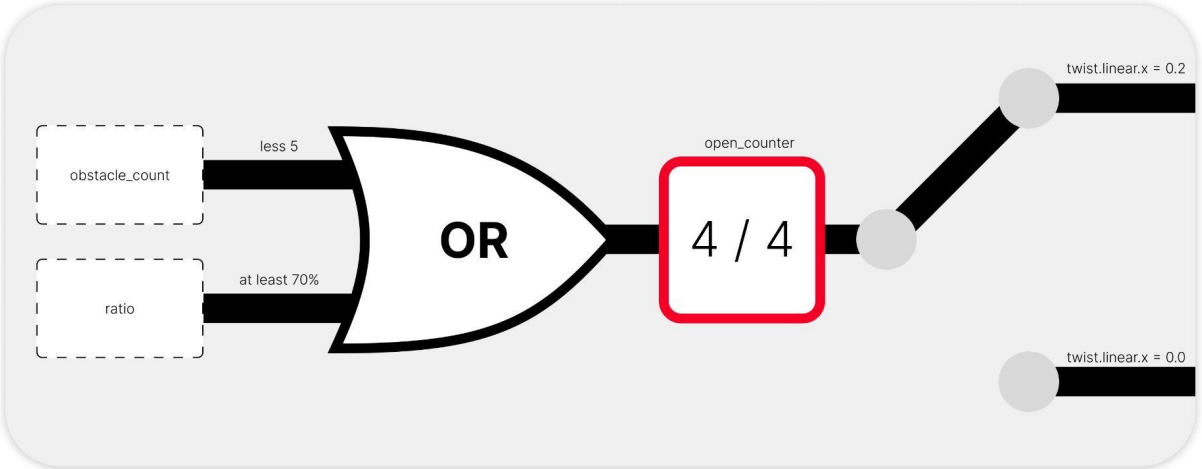
Door is OPEN



few_obstacles = FALSE
high_free_ratio = FALSE

Door is CLOSED

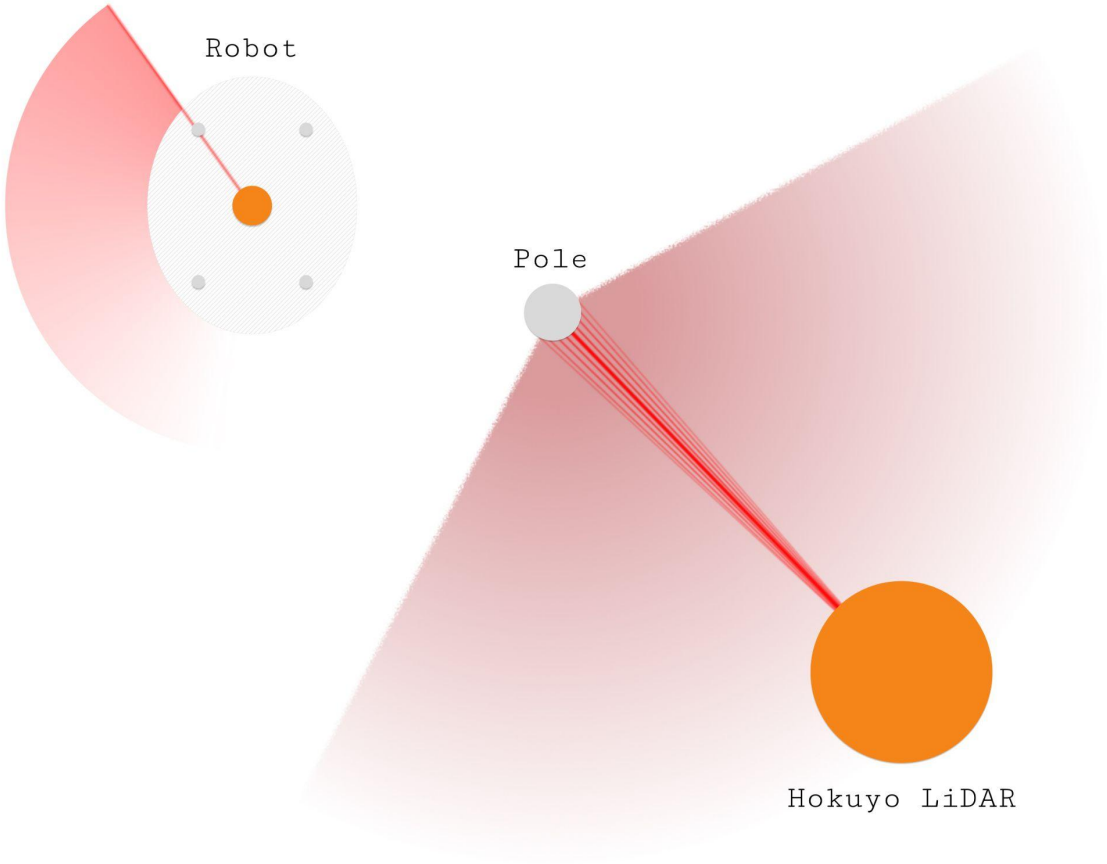

LOGIC
/scan
preprocessing
define front
clip ranges
/base/cmd_vel


obstacle_count
ratio
less 5
at least 70%
OR
open_counter
4 / 4
twist.linear.x = 0.2
twist.linear.x = 0.0

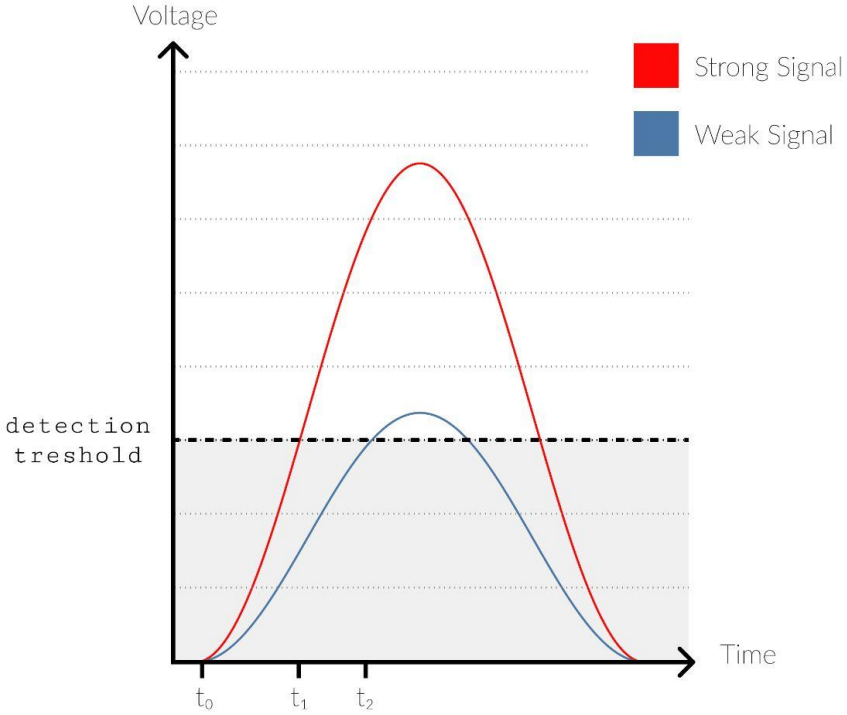
Filter The Scan

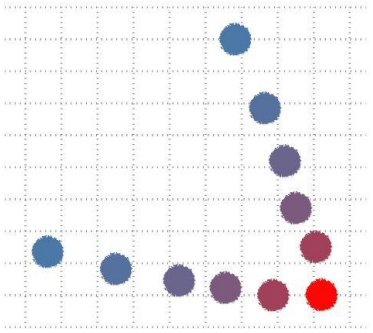
Write a filter for the */scan* topic to reduce noise. This involves reducing the resolution by migrating similar data points close to each other. Also remove points that are too close - as for the pole reflections - or too far away. Calculations must be quick to filter in real time.

Challenge



Signal

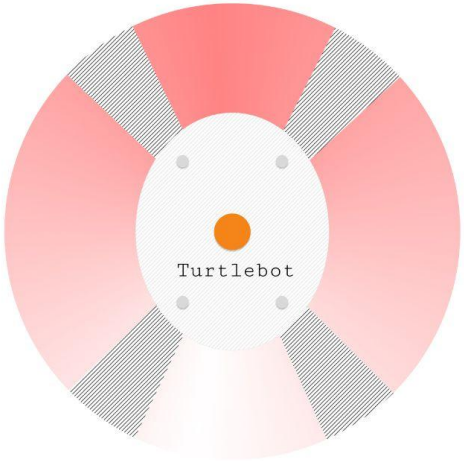


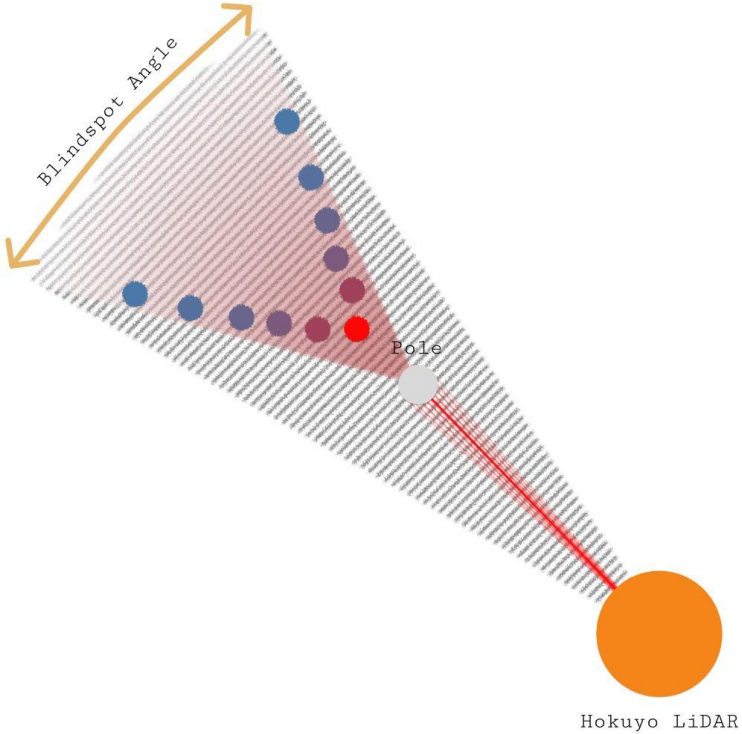


Pole image after scan

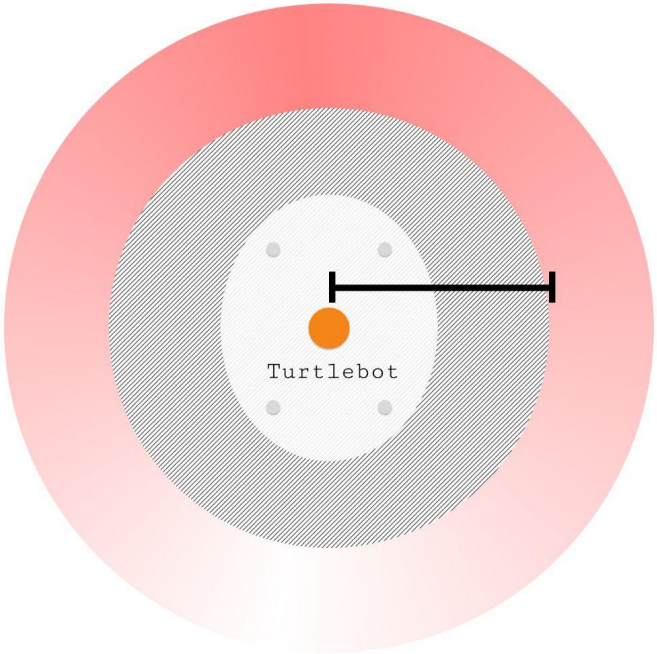
$$D = \left(\frac{c \times t}{2} \right)$$

Blindspots





Minimum Distance



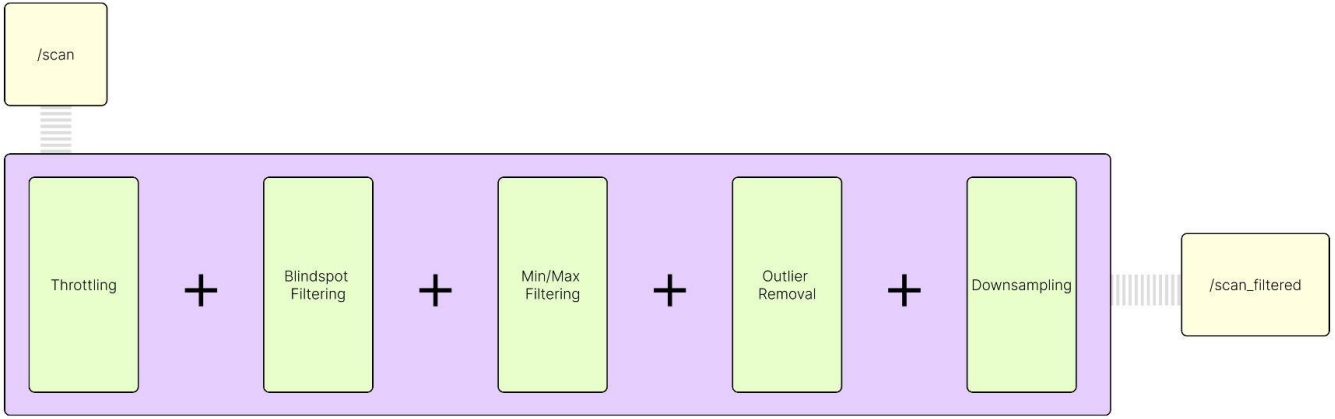
Ignores signal from
inside the shaded area

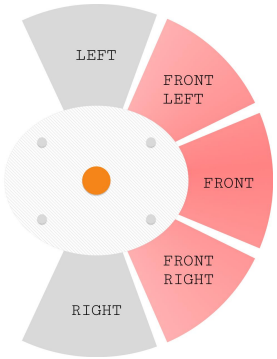
Other Solutions

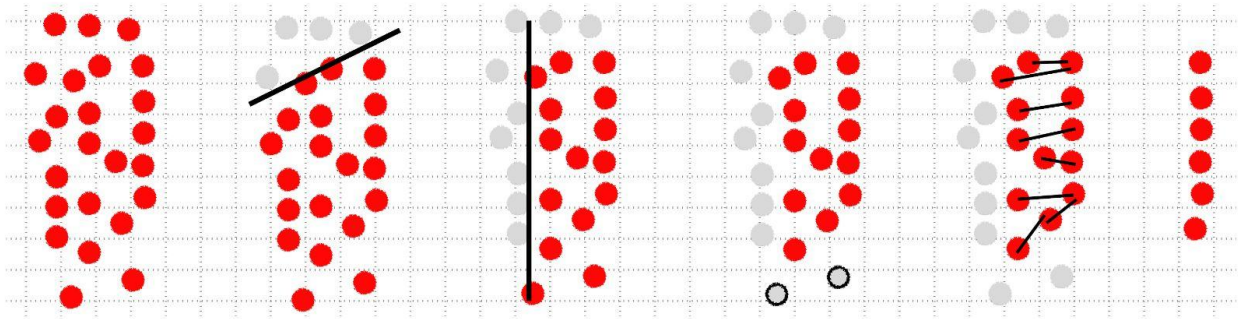
Tape on the poles

Change the location of the sensor

Script


/scan
Throttling
+
Blindspot Filtering
+
Min/Max Filtering
+
Outlier Removal
+
Downsampling
/scan_filtered


LEFT
FRONT LEFT
FRONT
FRONT RIGHT
RIGHT



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VIDEO DEMO

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Thank you!