# Wall Follower & Safety Controller

Lab 3. 03/13/2023

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6.2 ‘25

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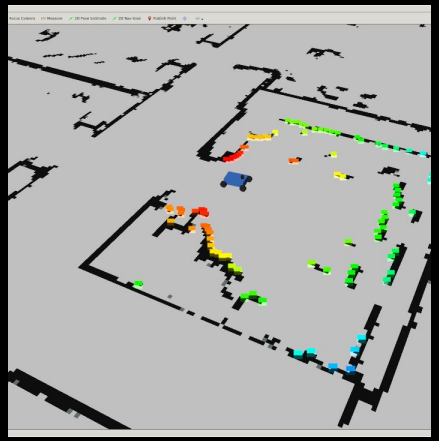
# Challenge & goals:



1. Implement a wall-following algorithm

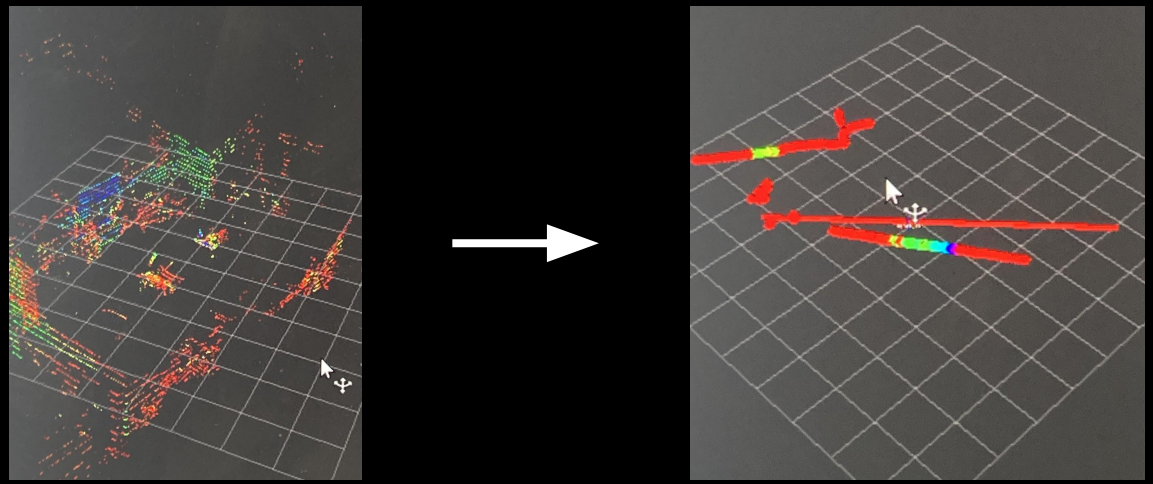

2. Design a safety controller


3. Design features for development & measure

# 1. Wall-Following

# Robot is blind. We convert Velodyne Lidar scans from velodyne 2D scans to 2d LaserScan Data!

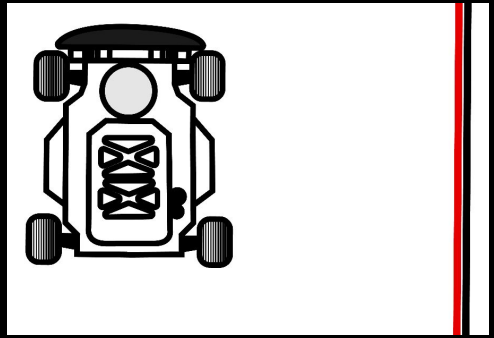
- This requires patching two datasets from the velodyne puck together, which can be done using numpy arrays!

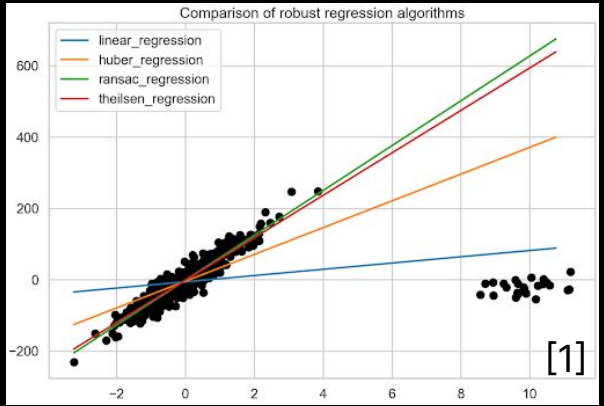


1. Wall-following

# How to Determine the Distance from the Wall.

- By taking all the data on a given “side” the wall follower can perform a linear regression on the range data and turn that into a given line that represents the wall!
- While outlier objects (such as people, chairs, etc.) can distract the model, other regression methods can perform better wall detection in future labs






1. Wall-following

# Real-Time Wall Follower Implementation

1. Wall-following

# 2. Safety Controller

# Safety Controller Considerations

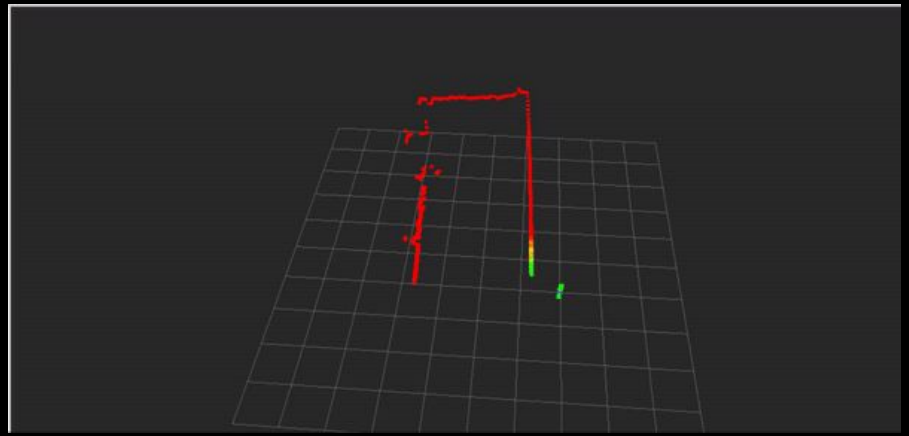
- The safety controller must:
  - Respond to external stimuli
  - Intercept the existing drive command
  - Publish a killer drive command.

# 3. Development & Measure

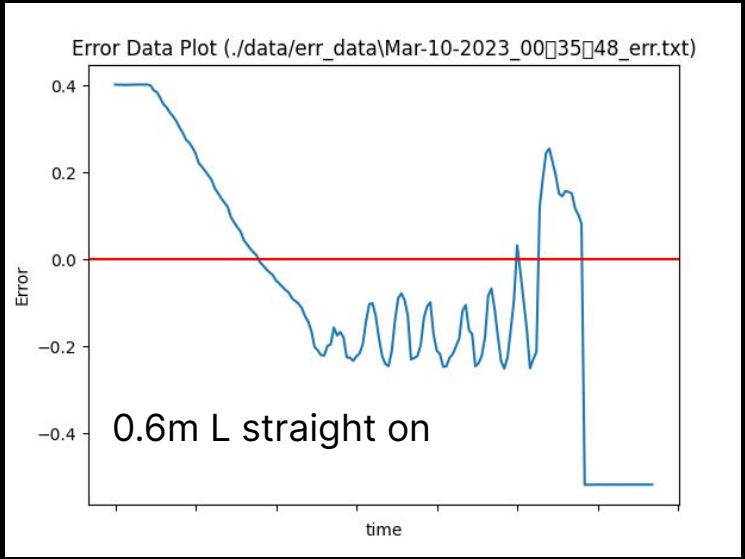
# Recording Sensor Data

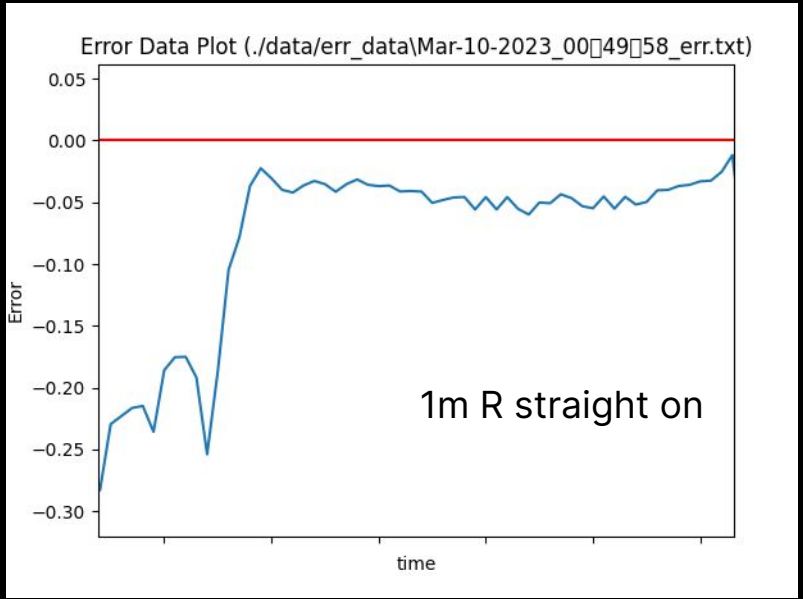
We want to record the sensor data being used by the robot:

- Take the re-formatted data
- 3 times per second (to save space)



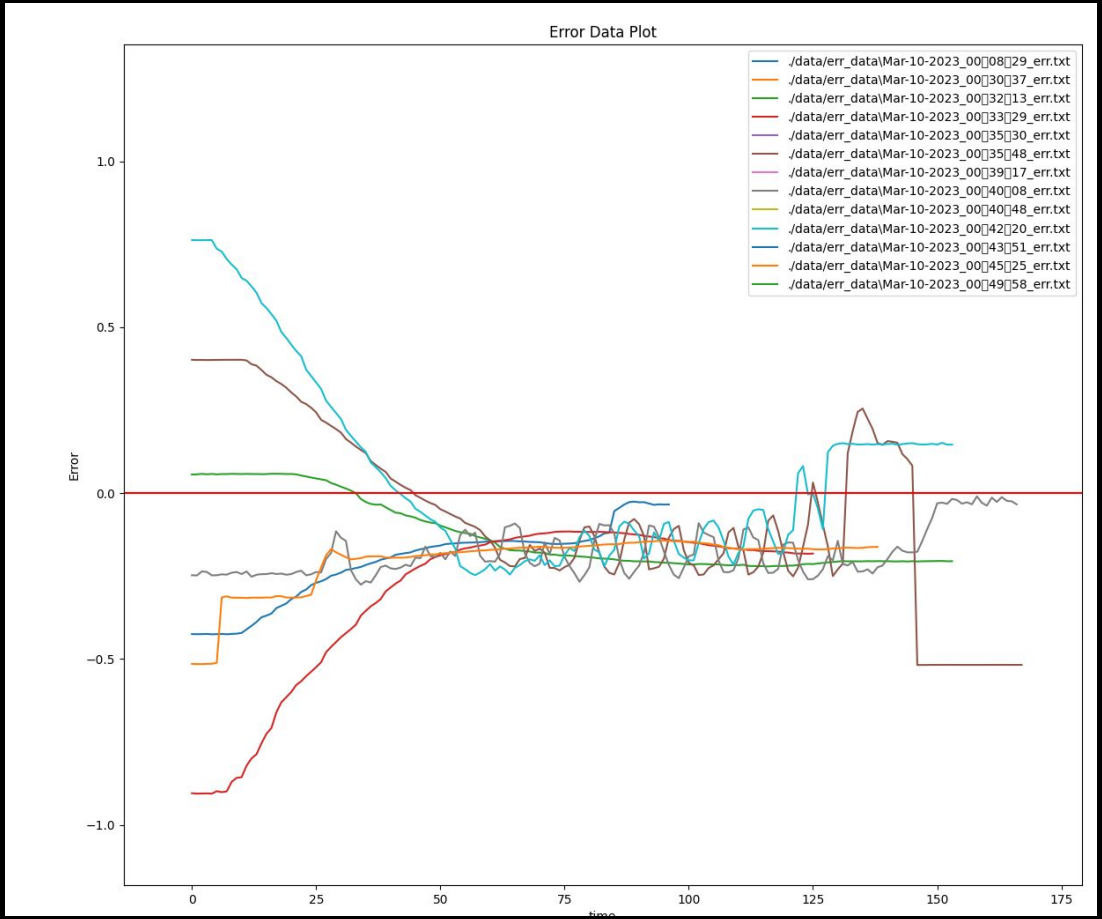
# Recording Perception and Error



# We speed up development process with dynamic reconfiguration of parameters

# Experimental Evaluation


Error Data Plot
./data/err_data\Mar-10-2023_00□08□29_err.txt
./data/err_data\Mar-10-2023_00□30□37_err.txt
./data/err_data\Mar-10-2023_00□32□13_err.txt
./data/err_data\Mar-10-2023_00□33□29_err.txt
./data/err_data\Mar-10-2023_00□35□30_err.txt
./data/err_data\Mar-10-2023_00□35□48_err.txt
./data/err_data\Mar-10-2023_00□39□17_err.txt
./data/err_data\Mar-10-2023_00□40□08_err.txt
./data/err_data\Mar-10-2023_00□40□48_err.txt
./data/err_data\Mar-10-2023_00□42□20_err.txt
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./data/err_data\Mar-10-2023_00□45□25_err.txt
./data/err_data\Mar-10-2023_00□49□58_err.txt
Error
1.0
0.5
0.0
−0.5
−1.0
0
25
50
75
100
125
150
175
time

# Conclusions

# We learned & next steps

1. Transforming sensory data
2. Using publishers hierarchy
3. Recording data for analysis
4. Improving development workflow

→ Refactor for multi-modular bot

→ Edge-case safety controller testing

Questions?

# Citations


- [1] NVIDIA : 3 robust linear regression models to handle outliers. NVIDIA Technical Blog. (2022, October 19). Retrieved March 10, 2023, from https://developer.nvidia.com/blog/dealing-with-outliers-using-three-robust-linear-regression-models/

# Appendix