Lab 5

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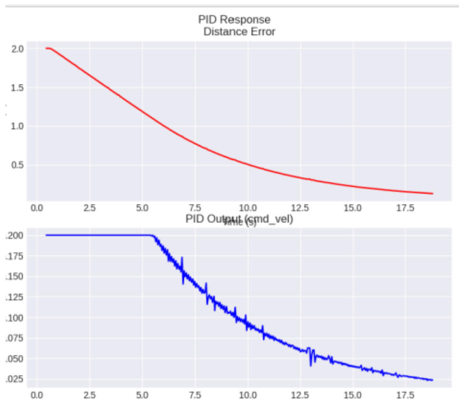
Open-Loop Motion

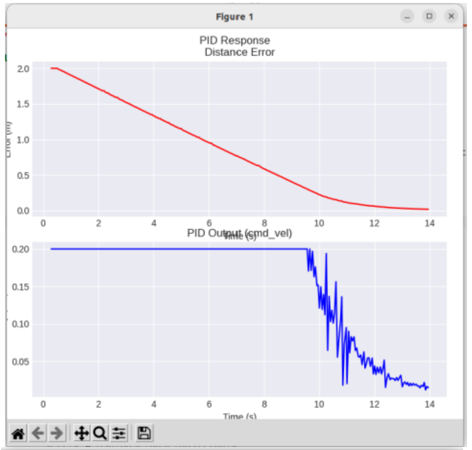
- Robot drives forward for a set amount of time at a set velocity.
- Robot turns in place for a set amount of time at a set angular velocity

Precision Stop

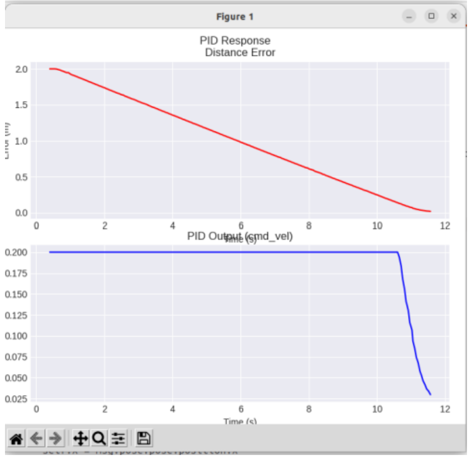
- PID controller used to drive robot and stop at specified distance.
- If gain was too low, it took too long for the robot to get up to speed.
- There was no steady-state error turning tuning so Ki = 0
- The most accurate results included a small Kd of 0.1
- A higher gain was used to get up to speed quickly (Kp=1.5)



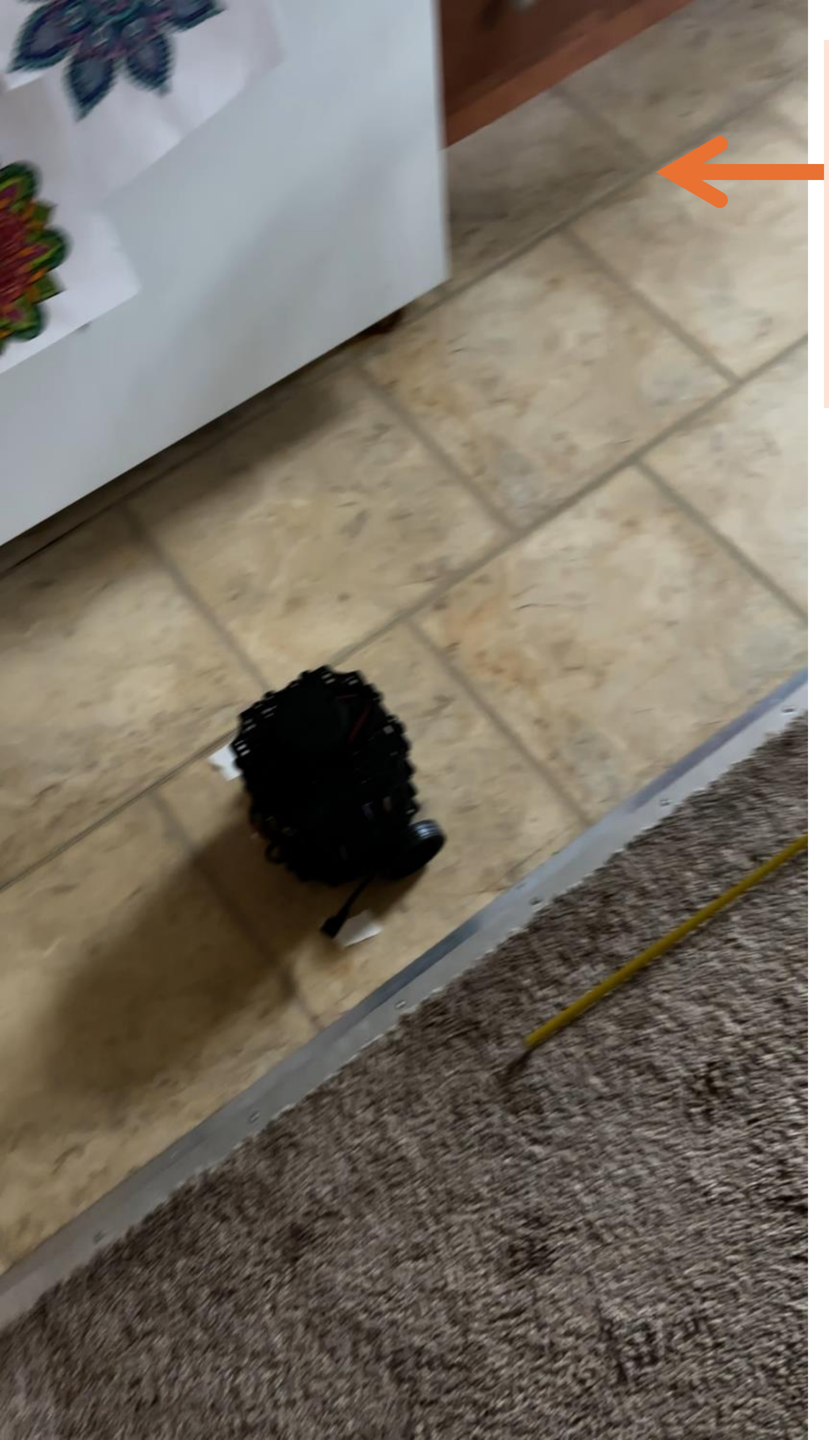
Kp = 0.2
Ki = 0
Kd = 0.1



Kp = 1.0
Ki = 0
Kd = 0.5

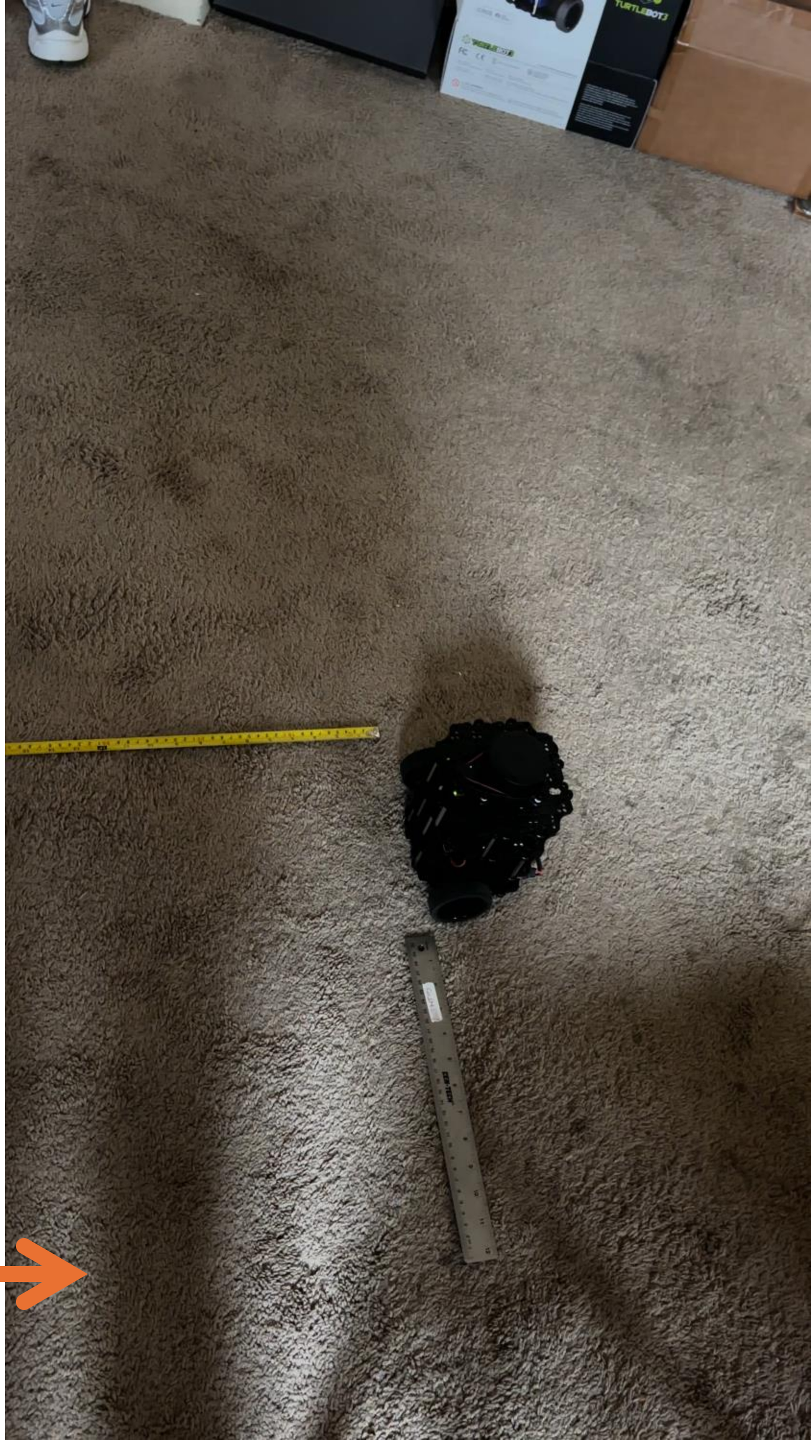


Kp = 1.5
Ki = 0
Kd = 0



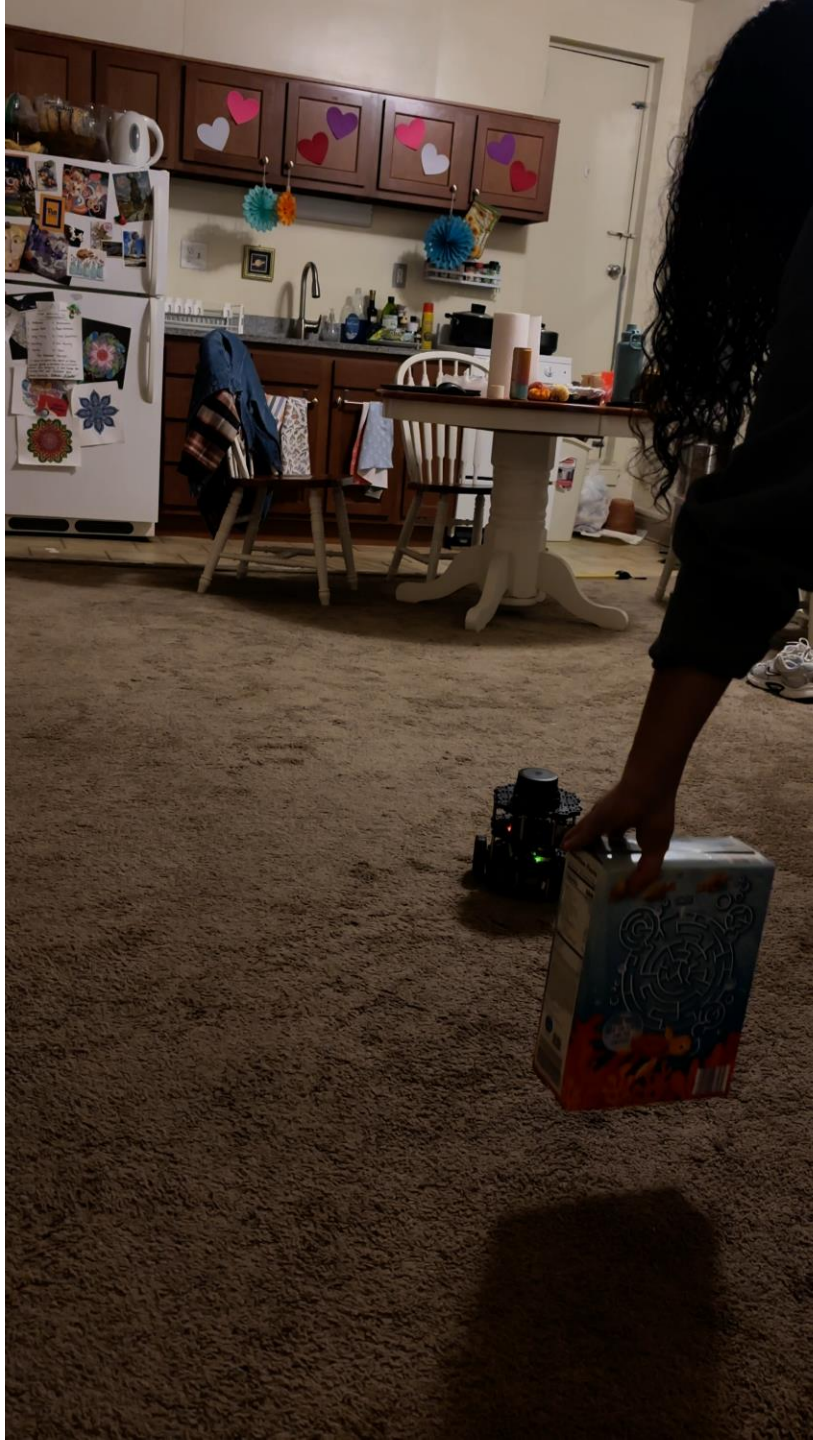
Measured to 2m. We don’t really have a non-carpeted space to run 3m and this demos the precision better. Robot stops accurately at the line. It does experience a slight turn to the left even though the angular velocity is set to 0.

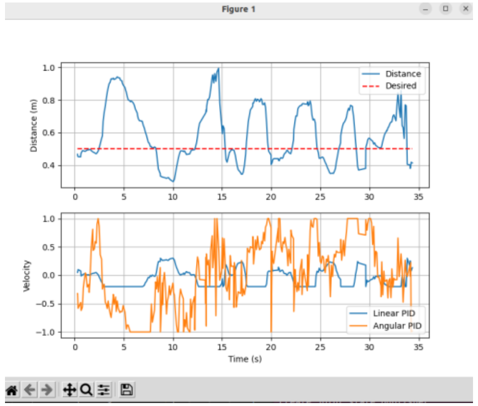
Here is a 3m test. The carpet makes the robot turning much worse, so it does not drive straight. However, it does stop when the odometer measures 3m. Would need to include more than just the simple linear PID controller to have the robot drive straight.



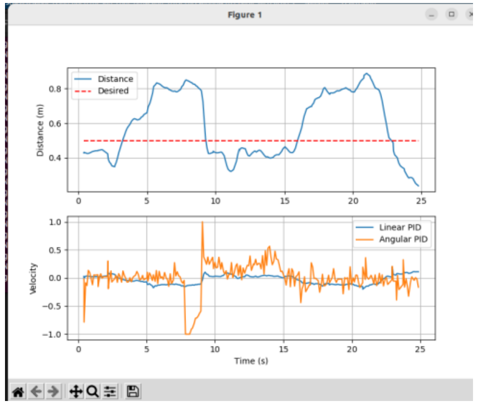
Box Follower

- This node runs with the same pid settings as the precision stop, as the tuning proved them to also be ideal here. (Kp = 1.5, Ki=0, Kd=0.1)
- The robot turns towards the box if it is in the front 180 degrees of the robot and will follow it at a distance of 0.5m.
- To help reduce traffic on the lidar readings, the robot will stop following the box if it is over 1.5m away.
- The robot will drive forward if too far from the box and backwards if too close.

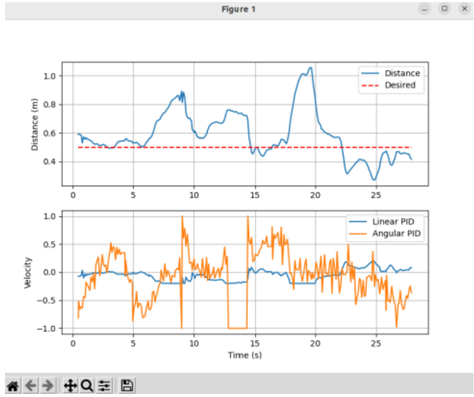




Kp = 1.5
Ki=0.0
Kd= 0.1
Angular Kp = 2x linar Kp



Kp = 0.4
Ki=0.0
Kd= 0.1
Angular Kp = 2x linar Kp

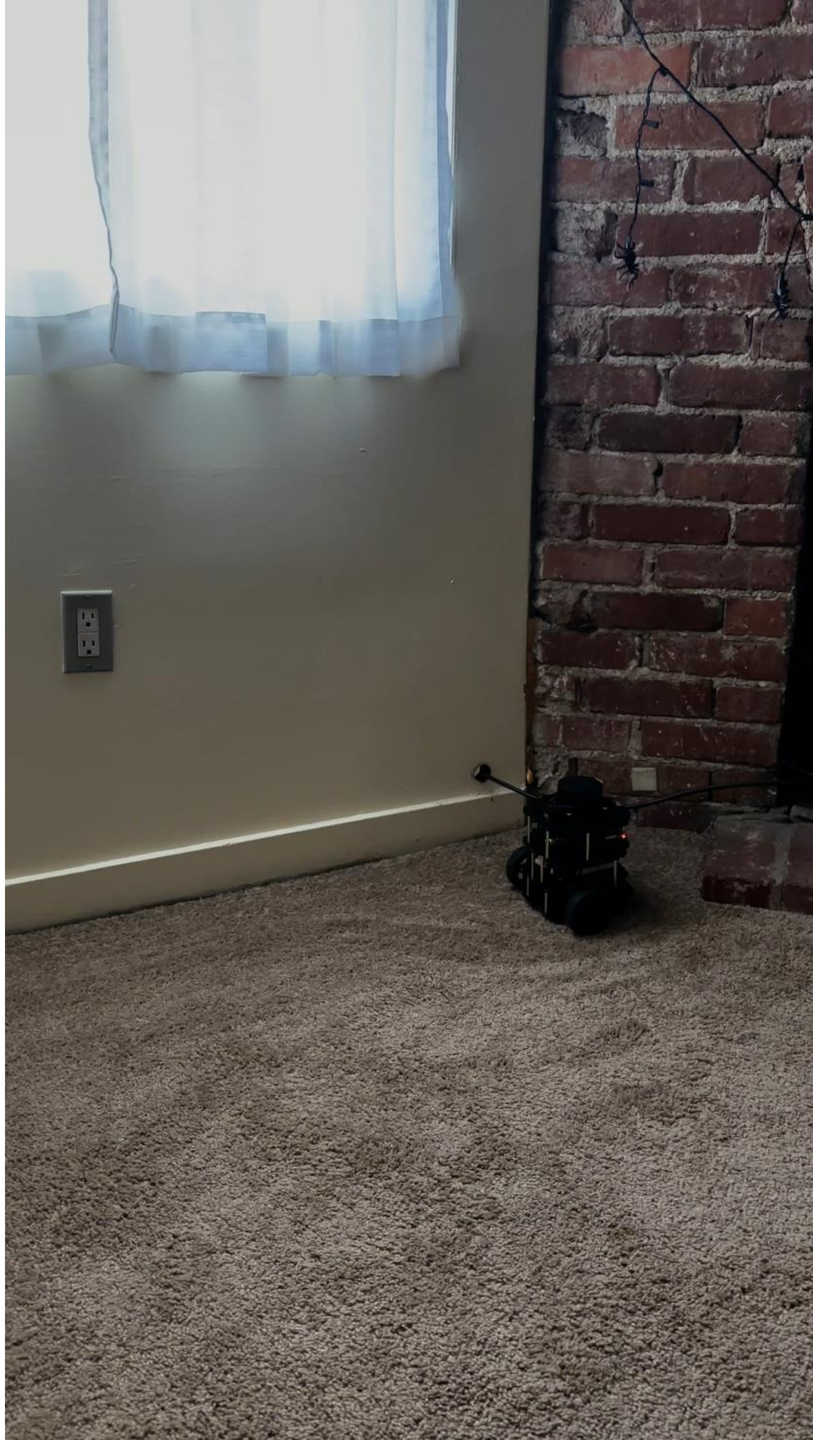


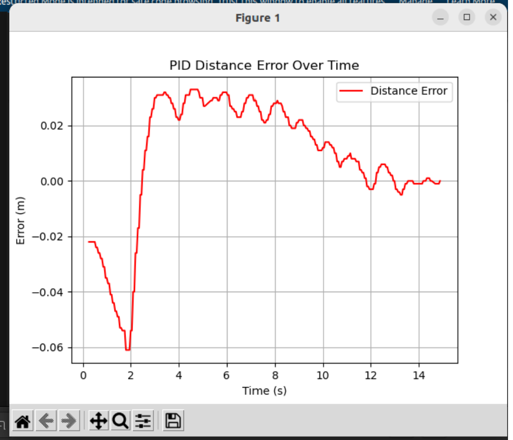
Kp = 0.4
Ki=0.0
Kd= 0.1
Angular Kp = 2x linar Kp

- There was no steady-state error.
- If the gain was too high, the robot would experience a rocking motion, especially when doing slight up and back movements
- A medium gain allowed the robot to respond quickly without rocking.

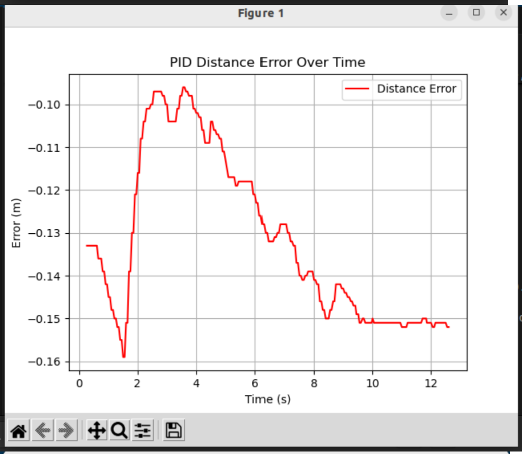
Wall/Maze Follower

- The robot self-adjusts to be able to maintain a 0.3 m distance from the wall.
- The node is programed to follow a right wall.
- It was found that a smaller gain was better suited for this application.
- Our chosen PID setting were: Kp= 0.6, Ki=0.1, Kd=0.05

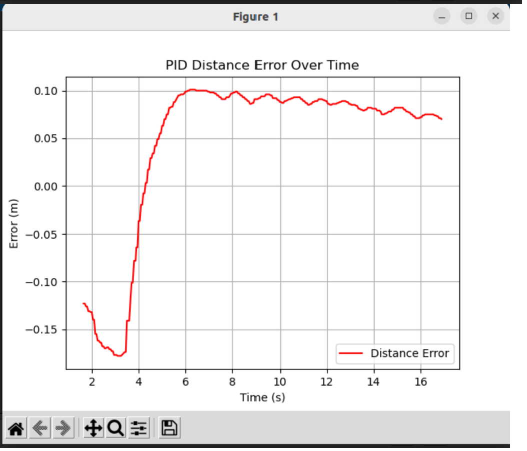




Kd= 0.6
Ki= 0.1
Kd= 0.05



Kd= 0.3
Ki= 0.0
Kd= 0.05



Kd= 0.4
Ki= 0.1
Kd= 0.2

- We found that if Kd was too high, it would take a very long time for the error to climb back to zero
- There was a constant steady-state offset of 0.1
- The higher the gain, the faster the error was able to move towards zero.