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| To: | Dr. Berry |
| From: | Christopher Collinsworth, Jordan Patterson |
| Date: | 1/10/2016 |
| Re: | Lab 4 – Wall Following |

The purpose of this lab was to implement a wall following behavior on the Arduino robot by using feedback control, specifically proportional-derivative (PD) control, which maintains a distance of 4-6 inches between the wall and the robot. The subsumption architecture from Lab 3 was also modified to include this wall following behavior, such that layer three consisted of the robot following a wall on either side and layer four consisted of the robot detecting walls on each of its sides and moving to the center of these two walls.

To implement layer three, distance values from the ultrasonic sensors were continually read in and used in the left and right PD algorithms shown below:

The desired distance between the robot and wall was set at 5 inches and subtracting the actual distance values from the desired value resulted in the error. The derivatives were calculated by subtracting this error from the previous error and dividing by the change in time. The motor speeds were calculated by multiplying the errors and derivatives by the proportional and derivative gains respectively, and . The final values for these gains were and . To implement layer four, the same PD algorithms above were used together, allowing for each motor speed to be changed simultaneously when detecting a wall on both sides.

In conclusion, the robot performed all tasks well during the demo of this lab. It was successfully able to follow a wall on either side of it, as well as move and stay in the middle of two walls. It was able to navigate doorways, corners, and obstacles placed next to walls. It was also able to detect a wall while in random wander and switch over to following the wall until it was lost.