Experiment #8 Wall following – Rudimentary PD controller

At this point you have a nearly complete library of basic motion. You have written and tested numerous functions and you can drive the robot. The next step is rudimentary autonomous motion control i.e. following a wall. To follow the wall the robot must move parallel to the wall and correct for any lateral errors which creep in during motion.

You already have a function to align to the wall. What remains is correcting errors from the desired distance to the wall. The align to wall function can easily be modified to calculate the mean distance to the wall using the same measurements it takes to calculate the angle. This distance can be passed back by declaring the distance-to-wall variable globally.

The distance to wall error is corrected by pointing the robot at a target spot. The correction angle to use is the arctangent of the ratio of the distance error to the travel distance to the next target location. For a 12 inch travel distance this becomes

Correction_angle = atan((measured_dist – desired_distance)/12)*180/pi // correction angle in degrees

The desired_distance can be the starting distance or a design distance which may be different from the starting distance. The distances must be converted to inches and the direction signs must be resolved of course.

Functions

The align to wall function must be modified to simultaneously calculate the mean distance. This is simply the average of the two readings, (front_distance + rear_distance)/2. To avoid the problem of returning two different values from a function, you should use a global variable for the measured distance. Reuse the sensor.ping results from the measure angle to calculate the mean distance.

Follow_wall is a program you should write in setup(). It is not a standalone function.

Algorithm

1. Align to Wall and measure distance
2. Move 12 inches
3. Align to Wall and measure distance
4. Turn to correct distance error
5. Repeat steps 2-4 for a total of six 12 inch moves

Procedure

1. Modify MeasureAngle function
    a. Calculate mean distance
    b. Store as global variable
2. Write Follow Wall code in setup()
    a. Test and debug Follow Wall

Experiment #8 is a test of your learned capabilities. It is a simple 5 step algorithm you may write and test on your own.