Robotics lab report

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Except for the control signal you fed to the robot wheels; what other internal or external parameters had an impact on the robot movement path?

Several external factors impacted the robot's path such as friction, the weight distribution of the robot, wheels and the rigidity of the wheel axles. Since the robot with differential drive had a battery which was not fastened anywhere, its movement and the subsequent shifting of weight affected the path considerably. Furthermore the wheels of the robot were loose which caused turns to become less predictable and straight movement to veer depending on the angle/contact point of the wheels.

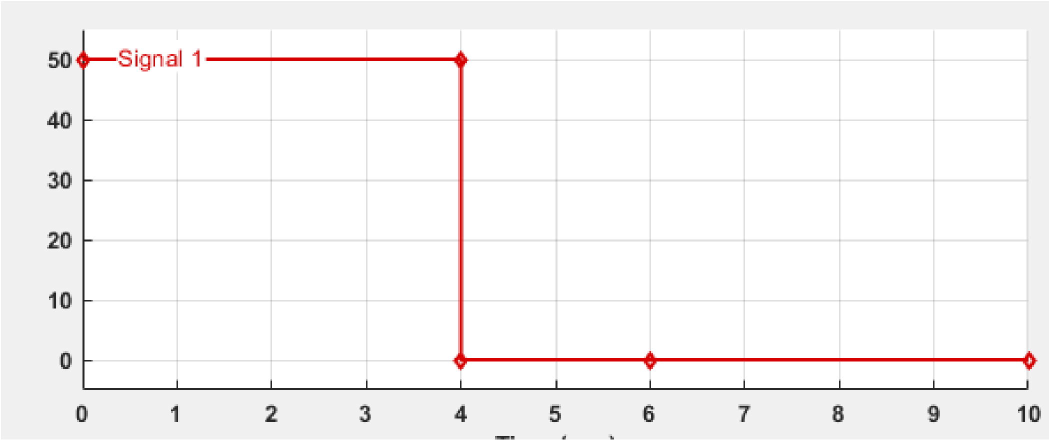
Could you compensate for the movement errors to follow the desired path in each manoeuvre? and how?

Two different methods were used to compensate for the deviations which both seek to remedy the strength difference between the motors. In the first method, compensation occurs by increasing the angular velocity. Since the robot rotates to the left when given no angular velocity, counteracting that rotation can correct these errors. The second technique relies on adjusting the scaling factor for the stronger motor to make them have an equal rpm for the same input. Both of these methods consisted of trial and error but the latter proved superior as it worked for different linear velocities. Counteracting the rotation by adjusting the angular velocity would require constant changes depending on the linear velocity while the scaling factor method does not have said dependency. Although the scaling factor method means that the motors operate below potential, it nonetheless functions as a more long lasting and adaptable compensation method.

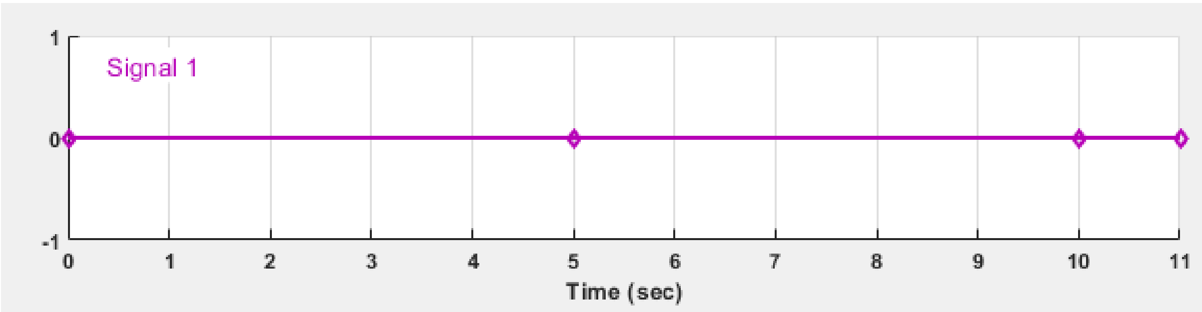
Signal configurations for the tasks.

Task 1: 3 meters straight line

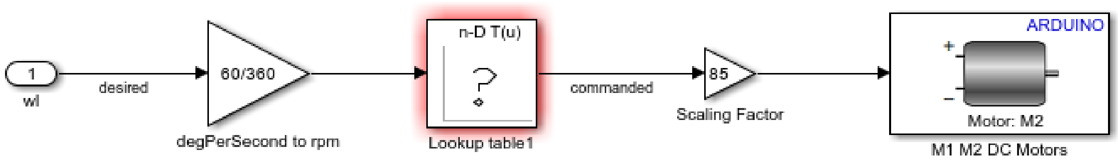
Originally a simple input of 30 cm/s linear velocity for 10 seconds was tested which in theory should yield a straight path of 3 meters. Upon execution, the robot veered consistently to the left despite no angular velocity existing. This prompted us to simply adjust the angular velocity until the robot drove straight. For 30 cm/s linear velocity an angular velocity of -35 deg/s was required to follow the path as “intended”. When attempting task 3 this method proved troublesome as the group wanted to do three laps which required higher speeds. The angular velocity method does by proxy the same thing as changing the scaling factor, thus we decided to correct the root cause by lowering the strength of the left motor. The following settings made the robot drive straight given no angular velocity. It is important to note that the robot travels only about 70-100 cm compared to the expected 120 cm or 120 $120 \bullet 0.85 = 102\ cm$ adjusted for the lower power.



Velocity v(cm/s)



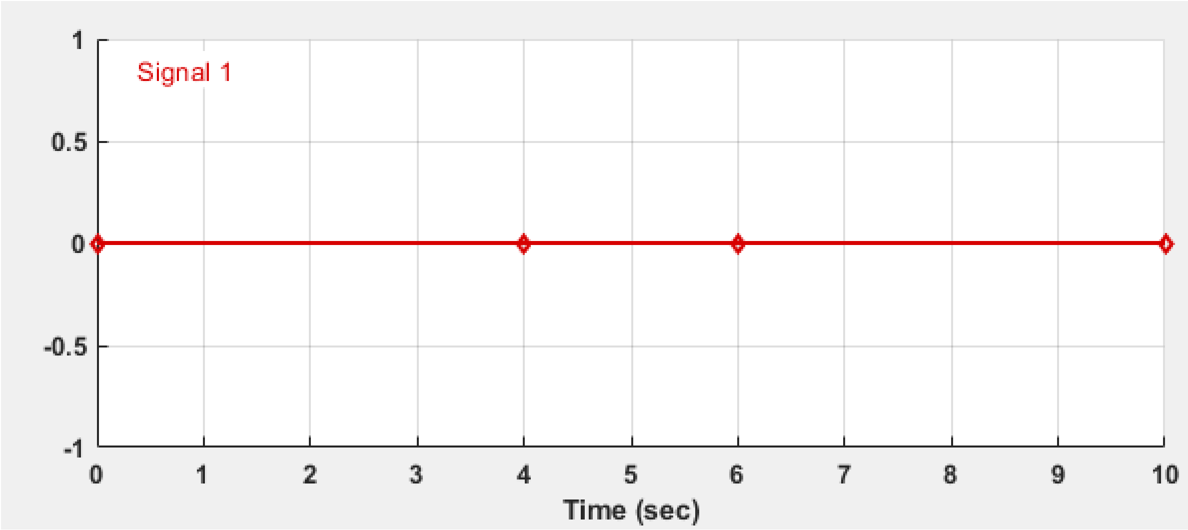
Angular velocity w(deg/s)



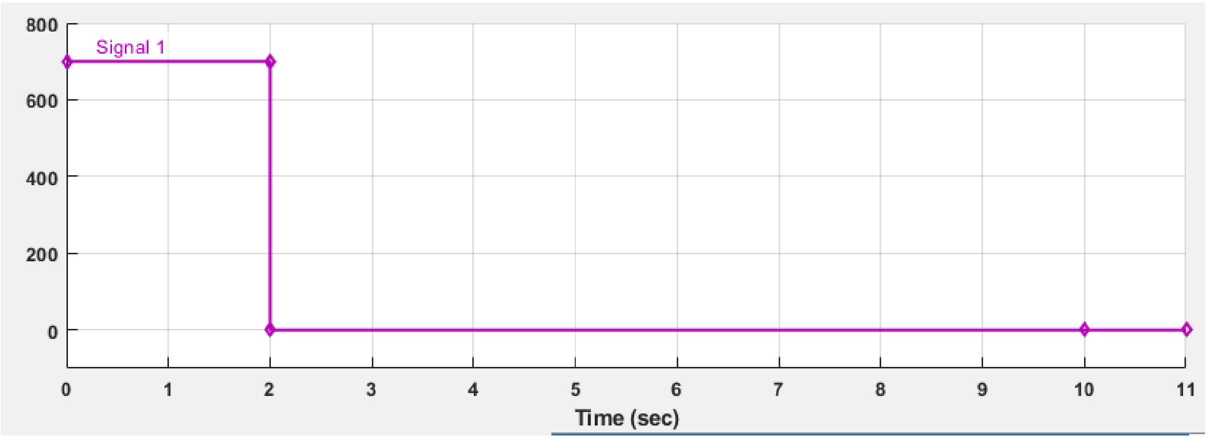
right motor, scaling factor

Task 2: Rotate over a fixed point.

A full rotation of 360 degrees was set as a goal and once again the theoretical values were initially tested. A high angular velocity and short execution time was chosen to account for the robot's dead zones, namely 130 deg/s over 2 seconds. This was not enough and only resulted in a roughly 30 degree change in rotation. 720 deg/s was then tested and manages to rotate 360 degrees over 2 seconds but varies ± 30 deg presumably due to friction and the wheels.



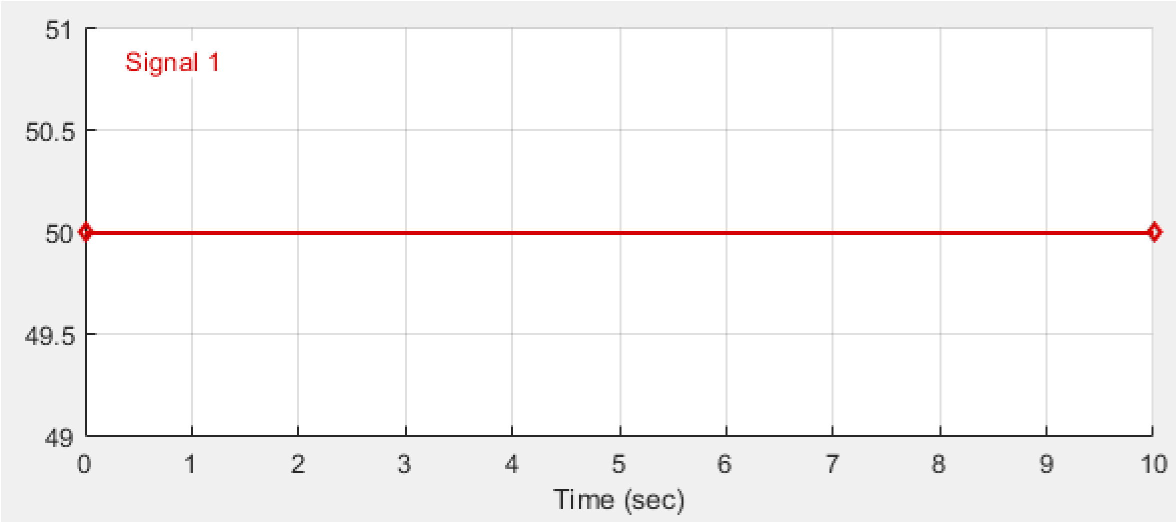
Velocity v(cm/s)



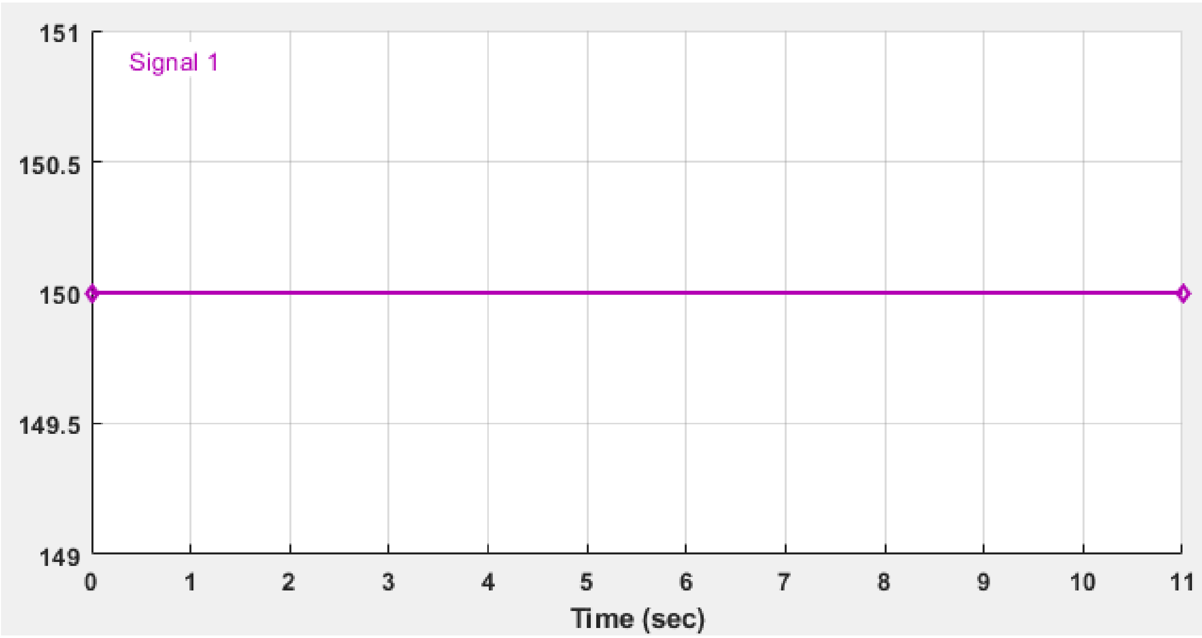
Angular velocity w(deg/s)

Task 3: 3 times rotation over a circle of 1-meter diameter.

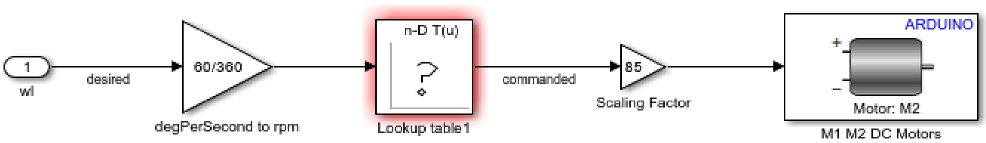
The following settings cause the robot to rotate along a circular path indefinitely which has a diameter close to one meter. A shift of 10 cm from the starting circle occurs during each rotation which could be due to a lack of friction or calibration issues.



Velocity v(cm/s)



Angular velocity w(deg/s)



right motor, scaling factor