Lab Procedure for Python
Inverse Kinematics

Setup

1. It is recommended that you review Lab 2 – Application Guide before starting this lab.

2. Launch Quanser Interactive Labs, scroll to the "QBot Platform" menu item and then select the "Warehouse" world.

3. Run observer.py first to initiate receiving data feeds.

4. On a separate terminal, run inv_kin.py. When the script is run successfully, the QBot and the Environment should be spawn in Quanser Interactive Lab and User LEDs on the virtual QBot will turn blue. Verify that the QBot is spawn as shown in Figure 1, then press the "U" key to stop the script.

Figure 1. Successful set up of the Quanser Interactive Labs Workspace

Inverse Kinematics Formulation

1. In Section B of inv_kin.py, right click on the **QBPMovement()** object and select "Go to Definition". Verify that **diff_drive_forward_velocity_kinematics()** function has been completed. If not, copy the code from last lab to compete the function.

2. When considering a pure forward velocity for a differential drive robot, what do you expect each wheel to do? How about when turning?

3. When commanding a positive turn velocity for the QBot (counterclockwise), which wheel should spin faster?

4. Navigate to **diff_drive_inverse_velocity_kinematics()** under **QBPMovement()**. This function is incomplete and must be compete before use. This function should take body speeds as input and output QBot wheel speeds in rad/s.

5. Complete the **diff_drive_inverse_velocity_kinematics()** function. Save your changes to **QBPMovement()**. Go back to the inv_kin.py and use the function you completed on the previous step to **complete Section D**.

6. Run observer.py first, then run inv_kin.py, and drive the QBot. Focusing on the scope display window, how closely do the commanded wheel speeds output from your inverse kinematics function match the measured wheel velocities? Revise your function if needed.

7. How closely do the commanded body velocities match the measured velocities through forward kinematics?

8. When you're satisfied with the output of your function, take a screenshot of the scope windows.

9. What is the key difference between this application and the drive mode in the Play lab?

10. What is the maximum forward or turn speed of the robot you can command? What wheel velocity command does this correspond to?

11. Stop your script using the "U" key. Ensure that you save a copy of your completed files for review later.