Lab Procedure for Python
Play

Keyboard Control

Your keyboard is used in the labs to control the virtual QBot. To be enable the movement of the QBot, press and hold the **Space Bar** to arm the motors, and release it to brake. The movement of robot is controlled via "**WASD**" keys and "**IJKL**" keys. Pressing and holding a movement key gradually increases the speed in the associated direction until the limit is reached, and the speed is maintained after releasing the movement key. By using movement keys in opposite directions, the speeds of the QBot can be fine tuned, and they can be reset by releasing the **Space Bar**. The "**7**" key is occasionally used to turn on and off additional features implemented in the application, such as line following. Finally, press the "**U**" key if you wish to terminate the application.

Setup

1. It is recommended that you review Lab 1 – Application Guide before starting this lab.
2. Launch Quanser Interactive Labs, scroll to the "QBot Platform" menu item and then select the "Warehouse" world.

Note: In steps 3 to 5, we will go through some key parts of the code that will run on the QBot Platform (play.py)

3. Open play.py, in Section A of the code, the **setup()** method communicates with Quanser Interactive Labs and create the environment for this lab.
4. In Section B, right click on **QBotPlatformDriver()** and select "Go to Definition". Observe how this object sends commands to the QBot and stores the sensor data from the QBot. The communication is executed through Quanser Stream API.
5. Go back to play.py, in Section F, relevant data is read from the keyboard, then converted to speed commands, arm command, and stop command. **read_write_std()** in Section D sends these commands to the QBot.
6. Run observer.py first to initiate receiving data feeds from the QBot Platform.
7. On a separate terminal, run play.py. When the script is run successfully, the QBot and the Environment should be spawn in Quanser Interactive Labs and user LEDs on the virtual QBot will turn blue, as shown in Figure 2.

Figure 2. Successful set up of the Quanser Interactive Labs Workspace

Drive with Keyboard

1. Press and hold the Space Bar to arm the robot. Notice that the LEDs turn green. Keep this key pressed as you teleoperate the QBot for future labs as well.

   Note: If your robot is ever in a position where it may collide with obstacles, disarm the robot by releasing the Space Bar. The LEDs will turn blue again, indicating that the QBot Platform is disarmed.

2. While armed, use the following keys to move the QBot.

   a. press the "A" and "D" keys and determine the positive convention of the QBot body turn speed.

   b. press the "I" and "K" keys and determine the positive convention of the QBot body forward speed.

3. Observe through the Quanser Interactive Lab window, combine the keyboard commands, and drive the QBot freely.

4. Investigate different sensors that the QBot is equipped with as you drive the QBot.

   a. If observer.py is running, it should output an RBG video feed from the front camera. Now try to navigate the QBot using only the video feed.

b. Uncomment observer display named "Downward Facing Image" in observer.py and the code for the downward camera feed in both section C and E in play.py to enable the camera feed. Drive the QBot again with the RGB and downward facing camera feeds side by side and take notes on the differences in the video quality.

c. The QBot is also equipped with a LiDAR, and a depth camera. You can select data feed of interest to further investigate by uncommenting and commenting respective regions in both observer.py and play.py (Section C deals with the connection and setup for each sensor that matches the observer.py file and section E deals with reading and sending the sensors at different rates). Analyse the LiDAR sensor and depth camera output and document your observations.

d. Explore driving QBot with different combinations of data feeds. Reflect on your experience and take notes of the usefulness and limitations of each data type in navigation.

5. Stop your script using the "U" key. Ensure that you save a copy of your completed files for review later. Close Quanser Interactive Labs.