ENGN4627: PenguinPi Notes

1 Motor Control

The motors of the PenguinPi robots are individually controlled. The MATLAB interface allows you to send velocities as integers in the range of -100 to 100. Once these are received by the robot, they are divided by 5 and put in a PI control loop using the encoders used by each of the motors. This division is, however, an integer division in c, which means it is 'truncated toward zero'.

Here are some examples of how velocities are processed by the robot:

$$\begin{aligned} 4 &\mapsto 4/5 = 0.8 \mapsto 0 \\ 5 &\mapsto 5/5 = 1.0 \mapsto 1 \\ 6 &\mapsto 6/5 = 1.2 \mapsto 1 \\ -4 &\mapsto -4/5 = -0.8 \mapsto 0 \\ -5 &\mapsto -5/5 = -1.0 \mapsto -1 \\ -6 &\mapsto -6/5 = -1.2 \mapsto -1 \\ 41 &\mapsto 41/5 = 8.4 \mapsto 8 \\ 44 &\mapsto 44/5 = 8.8 \mapsto 8 \end{aligned}$$

Figure 1 shows the velocity conversion for all requested velocities between -100 and 100. Note the effect of the truncation to zero.

Suppose you have a system that chooses a control input for your robot, such as a line following algorithm. The following steps will allow you to match your control input to what is understood by the robot.

1. Obtain wheel velocity inputs $\dot{\phi}_L, \dot{\phi}_R$ in ticks/s.
2. Clip the inputs to the range [-100,100]. That is, if an input is bigger then 100, set it to 100, and if it is smaller than -100, set it to -100.
3. Round the result to the nearest integer.
4. Divide the result by 5, and round towards zero, as shown in Figure 1.
5. Multiply the result by 5. You should now have an integer multiple of 5 in the range of [-100, 100].
6. Finally, send the result to the robot. This result is the velocity (in ticks/s) that will be practically used by your robot.

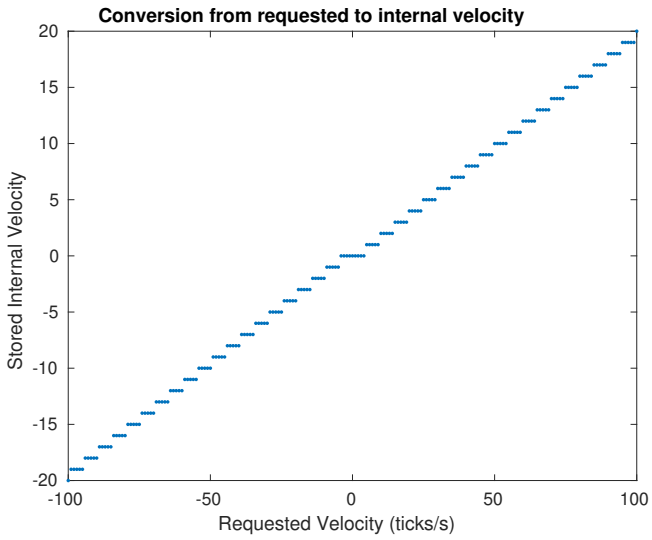

Figure 1: The conversion from an integer velocity requested from the PenguinPi to the internal velocity stored by the PenguinPi.

2 Connection Basics

To connect to your robot with your laptop, follow these steps. Turn on your robot using the switch shown in Figure 2, and wait for the LED display to turn on. When the robot is finished starting up, the LED display should look

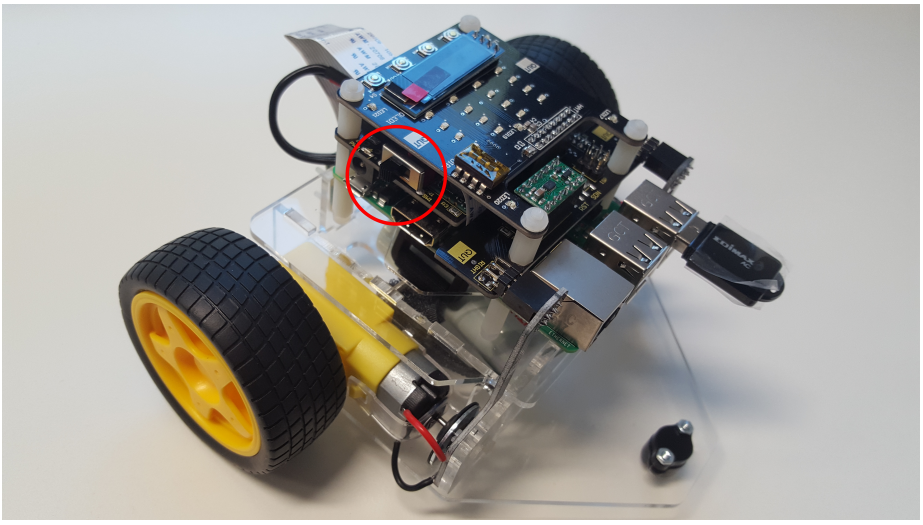

Figure 2: The ON/OFF switch of the pibot

similar to figure 3. The robot should now be broadcasting a wifi network. The name of your robot's network is given as `penguinpi:XX:XX:XX`, where the six `X`s are replaced by the last six characters of your robot's wmac address. For

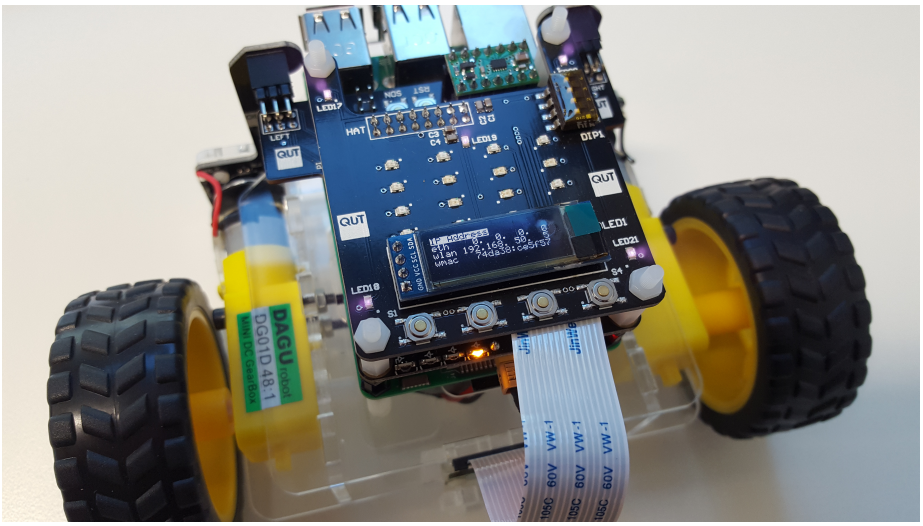

Figure 3: The robot is on and ready to connect

example, the robot shown in Figure 3 will broadcast a wifi network with the name `penguinpi:ce:5f:57`. Connect to this wifi network with your laptops using the password `egb439123`.

In some cases, the robot's network name is different from the last 6 characters of the robot's mac address. In this case, you will need to determine your robot's network name by isolating the robot from other robots and searching for wifi networks. In this environment, there should be only one robot network, which is yours. Write this down, as this will be the network name you need to connect to your robot.

Once you have connected over wifi, you can test your connection by opening a web browser and entering the address `XXX.XXX.XXX.XXX:8080`, where the first part is replaced by your robot's wlan address. For example, for the robot shown in Figure 3, the address would be `192.168.50.5:8080`. On this webpage you will be able to test the motors and camera, as well as see a range of diagnostic information relating to your robot.