Lab 2: Odometry (30 points)

In this lab, the accuracy of an odometry system is determined and a simple correction using a light sensor is implemented. This lab demo consists of two parts as discussed below.

Part 1: Float Motors (15 points)

The TA will check whether the **X, Y** and **θ values** are updated correctly on the robot's LCD screen by floating the robot's motors/wheels. Note that you can choose any **X, Y, θ** convention as long as you remain consistent throughout the demo. Also, the **θ values** should wrap around to **[0°, 360°]**. Hence, a displayed value of **-30°** is considered incorrect.

All three axes (**X, Y, θ**) are checked for evaluation:

- **X values work** → **5 points**
- **Y values work** → **5 points**
- **θ values work** → **5 points**

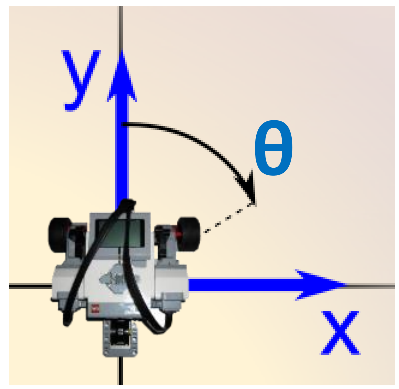

Figure 1. Robot faces due North at 0°

E.g. if the (**X, Y, θ**) convention is set as in **Figure 1**, then:

- moving both wheels **forward** should **increase Y**
- moving both wheels **backward** should **decrease Y**
- moving the right wheel **backward** and the left wheel **forward** simultaneously should **increase θ**
- moving the right wheel **forward** and the left wheel **backward** simultaneously should **decrease θ**

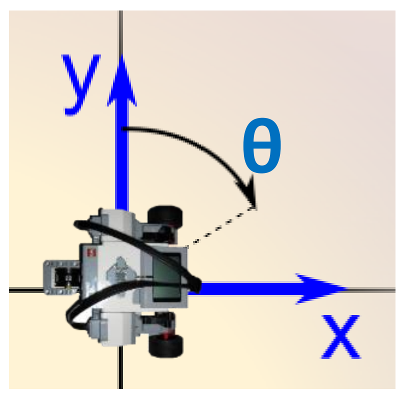

Figure 2. Robot faces due East at 90°

E.g. if the (**X, Y, θ**) convention is set as in **Figure 2**, then:

- moving both wheels **forward** should **increase X**
- moving both wheels **backward** should **decrease X**
- moving the right wheel **backward** and the left wheel **forward** simultaneously should **increase θ**
- moving the right wheel **forward** and the left wheel **backward** simultaneously should **decrease θ**

Part 2: Odometry Check (15 points)

The TA will ask you to run your robot off the center of a tile, as shown by **S** in **Figure 3**. The robot should then follow the **3-by-3 tile square trajectory** using SquareDriver. Throughout the demo, the TA will observe the reported (**X, Y, θ**) values on the robot's LCD screen. When the robot stops at **S**, the final (**X, Y, θ**) readings on the LCD screen are used to evaluate the odometry' s accuracy and calculate the **error distance** as $\epsilon = \sqrt{X^2 + Y^2}$.

These points are awarded for the **error distance**:

- **[0, 3] cm → 10 points**
- **(3, 4] cm → 9 points**
- **(4, 5] cm → 8 points**
- **(5, 6] cm → 7 points**
- **(6, 7] cm → 6 points**
- **(7, 8] cm → 5 points**
- **(8, 9] cm → 4 points**
- **(9, 10] cm → 3 points**
- **(10, 11] cm → 2 points**
- **(11, 12] cm → 1 point**
- **(12, ∞) cm → 0 points**

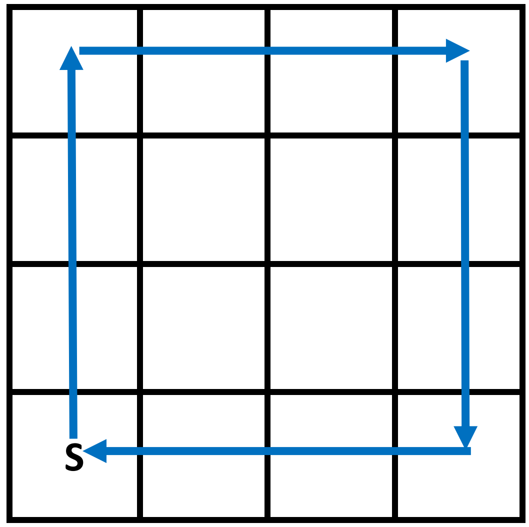

Figure 3. 3-by-3 tile trajectory of SquareDriver

These points are awarded for the **displayed θ**:

- **[0, 10] ° → 5 points**
- **(10, 15] ° → 4 points**
- **(15, 20] ° → 3 points**
- **(20, 25] ° → 2 points**
- **(25, 30] ° → 1 point**
- **(30, ∞) ° → 0 points**

Frequently Asked Questions (FAQ)

1. **Are partial points awarded in Part 1?**
   No partial points are awarded. Possible demo points: {0, 5, 10, 15}.

2. **Do the displayed values of θ have to be in ° (degrees)?**
   No, you can even use radians for the displayed values.

3. **Do I have to follow the same (X, Y, θ) convention as in Figure 1 and Figure 2?**
   No, you can use any (**X, Y, θ**) as long as you remain consistent within the demo.

4. **Where should my group sign-up for a demo bin?**
   Your group can sign-up for a lab 2 demo bin at https://goo.gl/HhwJoU.