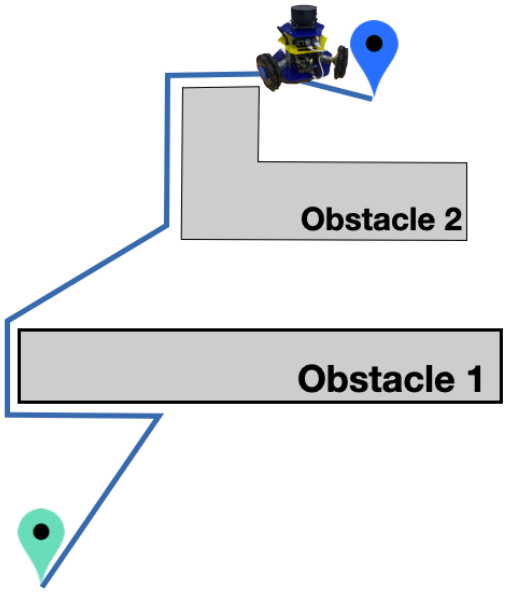
FSM and Pseudocode Checkpoint

Project 2 (Bug Algorithm)

HelloRob / Robotics 102



Introduction

For this activity, you will create an algorithm for autonomous navigation, express this algorithm graphically as a Finite State Machine (FSM), convert this FSM to instructions in pseudocode, and analyze the behavior of these instructions in various scenarios.

Your robot will be given a **goal location** in a 2D plane as the goal vector $G = [g_x, g_y]$, where g_x and g_y are the x-coordinates and y-coordinates of the goal location.

Assume your **robot starts at the origin** of the 2D plane at the zero location, as vector *[0,0]*

Assume your robot has access the following

- **Localization** that provides the robot's current location as pose vector $q = [q_x, q_y]$
    - Odometry will provide robot localization on the real robot
- **Range sensing** that provides the distance d to the nearest object in any direction θ around the robot, as a range function $f(\theta)$ that returns a distance
    - LiDAR data will provide range sensing on the real robot
- **Omnidirectional control** of the robot's movement as control vector $u = [u_x, u_y]$
    - Kiwi drive enables the real robot to move in any direction within the 2D plane

Activity Instructions

- Page 2: Respond to each of the following five questions on the next page on the design of your algorithm state machine
- Page 3: Write out the pseudocode for your autonomous navigation algorithm on
- Page 4: Find another person execute your navigation algorithm pseudocode to draw the path the robot will perform in the environment provided
- Pages 5-7: Draw example environments on that analyze how your algorithm would perform
    - Find another person to execute your algorithm in these environments

Navigation Algorithm State Machine

1. **Can you list the states that will be used in your state machine?**

2. **Can you list the transitions that will be used in your state machine?**

3. **Can you describe how each state of the state machine will be executed?**

4. **Can you describe how each transition of the state machine will be checked?**

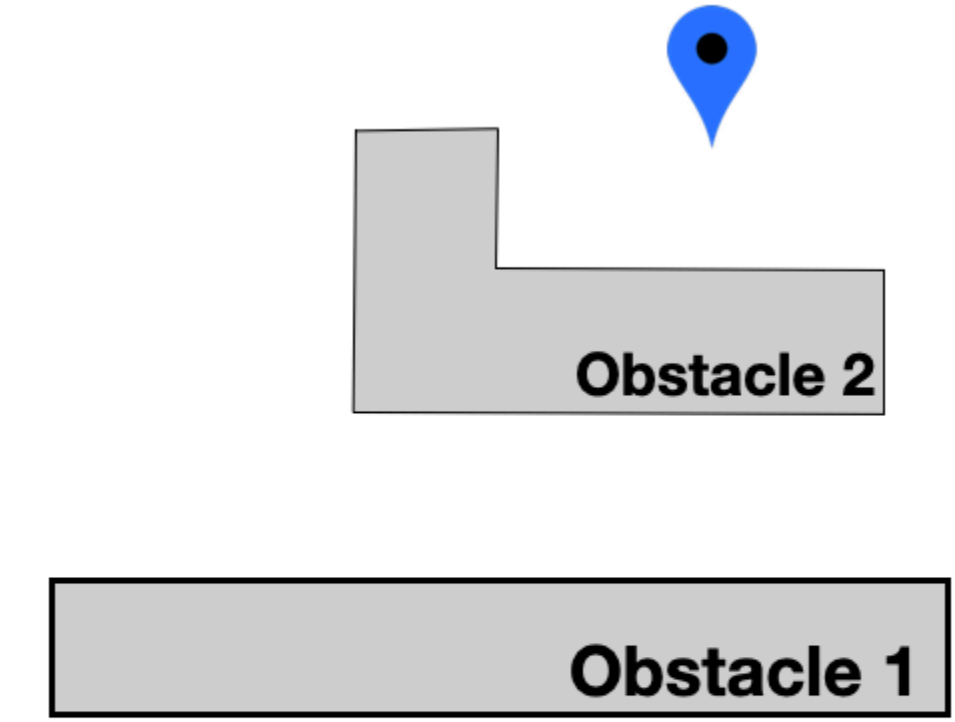
5. **Are there any conditions that would cause your algorithm to fail?**

Navigation Algorithm Pseudocode

With your completed algorithm pseudo code, draw three different environments. One where your algorithm will succeed, one where it will fail, and one where it will succeed and an alternative algorithm will fail.

In each case indicate the goal vector $G = [g_x, g_y]$, the origin $[0,0]$, and the obstacles in the environment (ideally as shaded shapes). Write a few sentences to analyze the outcome in each environment. How would your algorithm allow the robot to navigate successfully? Why would your algorithm fail? What part of your algorithm will allow the robot to navigate where other algorithms would fail?

6. **Find another person to execute your algorithm pseudocode (by following these instructions). This person should draw the path that the robot would produce in the environment below.**



7. **Draw an environment where your algorithm will succeed.**

   Find another person to execute your algorithm pseudocode and draw the path that the robot would produce in the environment below.

8. **Draw an environment where your algorithm will fail.**

   Find another person to execute your algorithm pseudocode and draw the path that the robot would produce in the environment below.

9. **Draw an environment where your algorithm will succeed, and an alternative algorithm will fail.**

   Find another person to execute your algorithm pseudocode and draw the path that the robot would produce in the environment below.