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Tentative Name: Delivery Bot?

Project Proposal

Abstract:

We plan on creating a flat environment space with a number of obstacles scattered throughout. Our goal is to have our robot navigate the environment without colliding with any of the obstacles while trying to get to the initial goal state. At the initial goal state there will be an object which would be placed on top of the navigating robot by a stationary robotic arm. The navigating robot would then deliver the object to some secondary goal state, where another robot arm would pick the object up off the robot and place it on some surface. And again, the navigating robot would avoid any collisions while carrying the object to its final destination. Each time the simulation is run, the locations of the obstacles will be randomized. With this, we will also implement an optimal path planning algorithm so that our e-puck takes the shortest path to both of our goal destinations.

Equipment:

We plan on using two main pieces of equipment. For our navigating robot we plan on using an E-puck, the same as we've used in all the labs. And for our robotic arm, we plan on using the Neuronics' IPR robotic arm.

Deliverables and Implementation Plan:

1. Environment creation - Lead: Sam/Tobias Deadline: 11/17
    - 1.1. Randomization of obstacles in environment
        - 1.1.1. Algorithm for randomization, while making sure there is a valid path for the robot to take, and certain other constraints like making sure there are enough obstacles to be challenging for the robot
    - 1.2. We will test this once the movement system is complete, and make sure that the robot has a valid path in each environment
2. Create E-puck Movement System - Lead: Sam/Tobias Deadline: 12/1
    - 2.1. Implement object detection using onboard sensors
    - 2.2. Path planning algorithm for the robot
    - 2.3. Implement navigation system to get E-puck to goal state
        - 2.3.1. State machine for movement, dropping off, and picking up
    - 2.4. We will test the movement system by creating multiple different environments for the robot to navigate from a start state to a goal state
3. Create Robot Arm Movement System - Lead: Sam/Tobias Deadline: 12/1

3.1. Implement E-puck location/detection system
    3.1.1. So that we know where to place the object onto and pick up the object from
3.2. Implement Pick up/put down movement
    3.2.1. Applies to placing the object and picking up the object
    3.2.2. Implement inverse kinematic equations for robot arm positions
    3.2.3. Will test this with the object of choice assuming the robot is already in the desired goal position, and see if it places the object on the designated surface

Demo:

Our final demonstration will be a running simulation of the robot at its initial state, having the first robotic arm place an object on the delivery bot, navigating the robot through the environment to the second goal, and finally using the second robotic arm to pick up the object and set it on a surface. Each time the simulation is run the environment will be randomized and so we will use an optimal path planning algorithm to navigate from our current state to the goal states.