

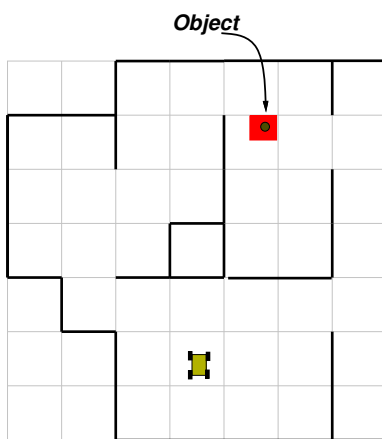
# CSE 4360 / 5364 - *Autonomous Robots*

Project 2- Fall 2021

Due Date: November 30, 2021

## Behavior-based Object Clearance Robot

The goal of this project is to design a behavior-based object finding and removal robot that is able to move from an unknown position in an in-door environment to look for an object, raise an alarm, and push the object off its location on the floor. The robot should use a set of behaviors, including “wander” (search) and “wall following”. The walls of the rooms will be marked with 2” wide (1.88” is ok) blue painters tape and the object will be an empty soda can sitting on top of a red square made with red painters tape. There will be no ”door” openings to the outside of the house and the robot is to find the object, move towards it, indicate when it is within 1 foot of the object (using either a tone or a light), and then push it off the marking it is sitting on. The following figure shows an example environment:



The behavioral repertoire of your robot should include “wander”, i.e a behavior that enables the robot to move in freespace looking for either a wall or the object, “wall following” which should permit the robot to move along the wall to be able to get to all the rooms in the environment (you might want to implement only one direction, i.e. clockwise or counterclockwise wall following), “goal finding” which should allow you to detect the object and move to it, and a “clearing” behavior which can remove the can from the mark on the floor.

As the walls are represented by blue painters tape, it is ok for the wall detection sensor (the color sensor) to cross on top of the wall. However, the center of the robot is not allowed to ever move on top of the blue tape. All walls will be either horizontal or vertical (i.e. all angles in the environment will be right angles), any piece of wall will be at least 1 foot long, and the marking on the floor under the can will be an area of red painters tape covering a 1 square foot area.

At the end of the project each group has to hand in a report, the code, and a recording of your system, and give a short demonstration of their robot. During this demonstration you should

provide a short description of the robot and of the details of your behavior-based control system.

## **The Project**

1. Build a mobile robot for this task.

Using the parts in your robot kit, build a mobile robot for the task. (In this assignment the robot has to be able to detect and follow “walls” and to detect the object. Robot localization, on the other hand, is not important since the start location of the robot and the location of the object will not be known. One way to perform “wall following” in the given environment would be to use the color sensor to keep track of the wall.)

Your project report should include a short description of your robot design (including the critical design choices made).

2. Implement “wander”, “wall following”, ”goal finding”, and ”clearing” on the robot.

To address the given task you have to implement a “wander” (search), a “wall following”, a ”goal finding” and identification, and a ”clearing” behavior for your robot. “Wander” is intended here to move the robot through freespace to a wall, “wall following” is intended to permit the robot to move between rooms, ”goal finding” is intended to locate the object, and ”clearing” is intended to move the object off of its current location on the floor. To integrate these behaviors you also have to implement a behavior coordination mechanism (e.g. subsumption, weighted averaging, etc.). Once the object has been found and your system has moved closer than 1 foot, your robot should indicate this by starting an alarm and it should then attempt to clear the object from the location (the easiest would simply be to push it for at least 1 foot to make sure it clears the area it is standing on).

Your report should contain a description of the important components of your control system. The submission should also contain the actual code for the robot and a recording of the system performing the task.