16-311 Spring 2016 Lab 10: Warehouse Keeper

Overall Lab Setup:

There will be four Lego palettes on four shelves of a unique height alongside a warehouse that contains four separate deposit areas for each of the palettes. You are responsible for transporting 1 palette into 1 deposit area and returning to your starting location. During demo, your team will be given the names of palette (A, B, C, D), as well as which deposit area each must be delivered to. You should be able to take this mapping quickly as an input.

Main Objective:

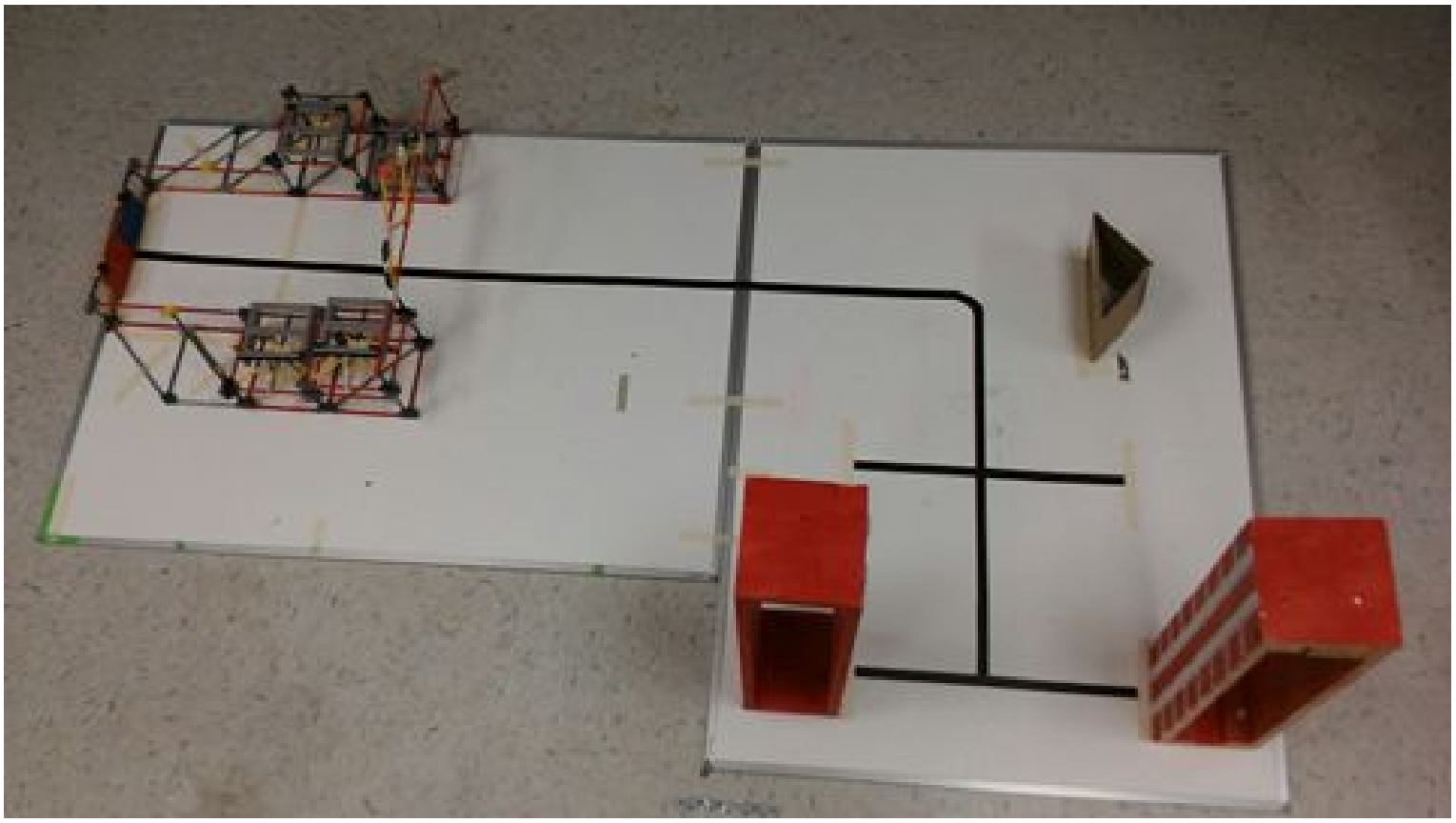
Pick up a palette from its shelf, place in their deposit areas inside the warehouse and return to your starting location.

Specifications:

The coordinates and heights of the 4 palette shelves (holding palettes A, B, C, D) inside the warehouse will be available ahead of time.

Your job involves:
(1) Picking up a palette from a shelf. Once you have picked up the block, you should require user input to continue. This is done to allow for block reset.
(2) Navigating under the cross beam
(3) Navigating to through the warehouse to the deposit area
(4) Depositing the palette in the deposit area
(5) Navigating back to your starting location

The warehouse map is provided below.



Grading

80 points will be given based on the robot performance. The exact breakdown can be found in the grading sheet. We note that once you have attempted to pick up a palette, you must have user input to continue. This is to allow for the fact that if you are unsuccessful at picking up the palette, a TA can place a palette on your robot such that you may continue with the rest of the lab.

You are allowed 3 trials. However, only first two trials will be conducted during your demo slot. Like in the USAR checkpoint, if you need a 3rd trial it will be done after everyone has finished with their demo. Also results from the 3rd trial will not count towards the competition.

The remaining 20 points of the lab with be based off of how well you explain your algorithms. Your group with meet with the Head Lab TA and discuss your methods for a few minutes at the conclusion of your demo slot. We are genuinely interested in how you approached this problem and intend to ask questions (and grade) accordingly.

Competition

For the competition teams will be ranked in order by the following metrics:
1) Points score on the lab (excluding algorithm questions)
2) The shelf height that you deposit the block at*
3) Time take to complete the course

*For full points on the lab you need only deposit the palette on the ground. However, to be competitive you should place the palette on the Velcro walls. Each shelf is marked at 3 inches high. Your height will be measured from the lowest point of the palette.

Prizes

As stated by the real course staff, the winning team is rewarded with exemption from the final.
The lab course staff has determined the last place team (in the competition with the same ranking strategy), will be receive ice cream sandwiches.

Jerk Policy

The course is not unbreakable. Therefore, if you damage the course intentionally in any way OR damage the course and do not take steps to fix it (i.e. fixing it yourself or notifying the student TAs), we will disqualify you from the competition. Hence, reasonable person principle / don't be a jerk.

Hints and Tips

To manipulate the palettes, we recommend using either:
(1) Forklift
(2) 4 Bar Linkage
(3) Build a chassis with as little slip as possible (possibly skid steering)

To navigate the warehouse, we recommend using some combination of:
(1) Path planning with dead reckoning based on time or distance
(2) Line following
(3) Logical reasoning for how to handle turns
(3) Ultrasonic sensor-enabled localization using the warehouse's walls