Lab 6: Find and move a container

Lab objectives

In this lab you will design and program a robot to find, pick up and move to a new location a pallet style box in an enclosed flat area approximately 3m square. The objective is to place the box 50cm south and east[1] of where you found it, in the same orientation as it started. There is no particular need to keep the Tribot exactly as defined by the Lego design, in fact, you will have to change it considerably to succeed.

The rules:

- The box must be transported without it dragging on the floor.
- You can assume that the box is separated from the wall by at least 30cm, and is oriented parallel to the walls.
- The walls and floor will be more or less light in color, and the box will be dark.
- The box will be lightweight (<100g)
- The box will be elevated from the floor on legs, with a gap between them of at least 7.5 cm.
- The robot will start in the "southwest" corner of the box, approximately 30 cm from each wall
- The walls will be at least 20 cm high, and may be higher.

This lab leads into the project. Because it is a very challenging lab, it will be extended over two weeks. Part 1 must be completed and submitted the first week, and part 2 the second week.

Step-by-step

Part 1:

1. Experiment scanning with the ultrasound sensor and the light sensor. Determine how close you have to be to the box to detect it.? How accurate is the detection in terms of direction, and of reliability?
2. Design and implement a lifting mechanism that will allow the robot to lift the box and carry it around.
3. Demonstrate and explain your design to a TA

Part 2:

4. Design and implement an algorithm for the robot to
    e. Search the square and find the box
    f. Pick up the box
    g. Move the box 50m south and 50cm east of where you found it, putting it down in the same orientation as you picked it up
8. Run your robot on this problem 3 times, and report the time elapsed for each run. Put the box in a different position each time.
9. Demonstrate your working system to a TA. The TA will choose the position of the box (within the rules described above)

To Hand In

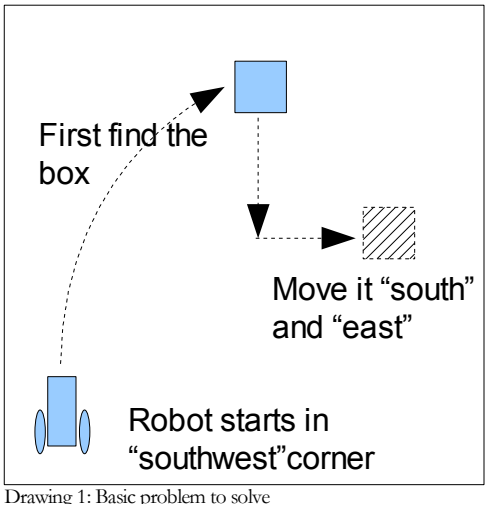
Part 1:

1. Discuss the ultrasound and light sensor capabilities. (6 marks)
   A) how close do you have to be to the box to detect it.
   B) how accurate is the detection in terms of direction?
   C) how reliable is the detection (can it be confused, does it fail occasionally, etc)?
2. A) Describe your mechanism (photos are encouraged) (6 marks)
   B) Discuss the limitations of your mechanism – how high can it lift, how much weight, what if the box dimensions change.(8 marks)
3. Demo: (10 marks)

Part 2

4. Describe your algorithm (5 marks)
5. Hand in your NXC code (5 marks)
6. Report the results of your experiments (5 marks)
7. Identify flaws in your design, and suggest improvements to make for the competition robot. (5 marks)
8. Demo. (10 marks)

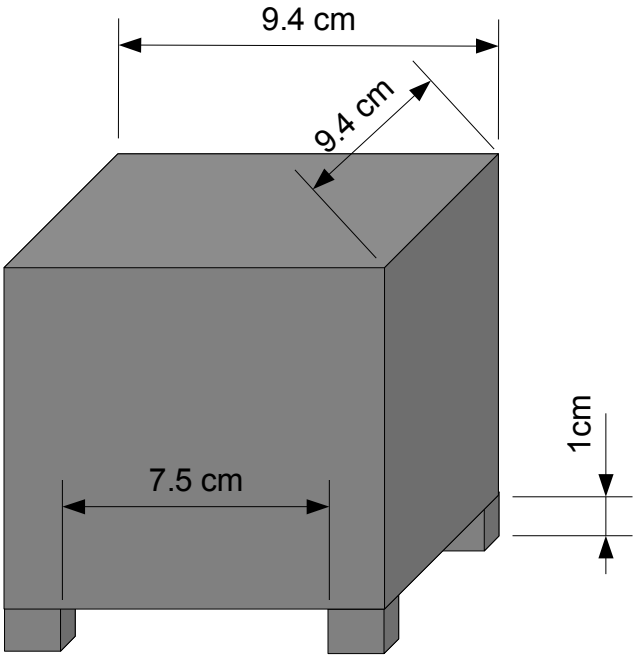
[1]Not necessarily the true compass south and east, but relative to where the robot starts in the test area.



Drawing 1: Basic problem to solve

The robot should find the box within an approximately 3m x 3m area enclosed by walls The area may not be exactly the size or shape shown.

The robot must lift the box and move it 50cm "south" and "west" from where it was found. Orientation should not change



Box is dark in color, 9.4 cm on the side. There will be a gap of at least 7.5 cm between the legs. The legs are at least 1cm high

Drawing 2: The box to lift