

# Memorandum

Great job  
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To: Dr Carlotta Berry

From: [REDACTED]

RE: Robotics Lab 6

Team Maggie

Heat Seeking Lab 6

The purpose of this lab was to home the robot on a heat beacon using behavior-based control. Unlike the previous lab, the robot will have no information about where the heat source is located, and will search for it by wandering the room randomly.

To start this lab, we first took the code from the previous lab and tested it to make sure the heat sensing and homing routine still work. Then we added a random wander method to the code, and updated the obstacle avoidance routine to make the robots movements more random. We used threading and set obstacle avoidance to highest priority, followed random wander and heat sensing. The whole time the robot is randomly wandering, it is also searching for any heat source with temperature greater than 100 degrees. Once it detects a heat source, it rotates in small angle until it is perfectly aligned with the heat source. Then it homes on the heat source and docks.

In the previous lab, the robot had a partial world map, so we were able to use this to implement hybrid control, where the robot plans a path, and updates the path as it comes across obstacles. Using behavior based control of course took longer for the robot to find the source, but it is more flexible than hybrid control, because the location of the heat source can be changed at any time and the robot will still find it.

We did not really observe any emergent behaviors. The robot acted erratic sometimes and homed on Dr. Berry once, but usually the behaviors were all expected.

One behavior that could have improved our scanning routine is if we had the servo pan continuously and scan for heat sources. But we felt this would take time to code in, and we wanted to do our demo on time, so we decided not to implement it.

We found that using behavior based control and random wander took much longer to home in on the source than using hybrid or deliberative. Deliberative was the fastest because the robot knows the environment, it knows where the heat source is. It just calculates a path and moves to it right away. Hybrid is the second fastest, because the robot comes across unforeseen obstacles and has to avoid it and recalculate the path. Behavior based was slowest because the robot has no idea where the source is, and has to search for it and find it before it can home in

on it. Having a world model can make homing much quicker because the robot would know where to go, and what obstacles to expect.

Behavior based architecture, though slow, is the most adaptive of the three because it can perform well in a dynamic environment and it is very handle changes fairly well. Hybrid architecture can be adaptive to a certain extent, but not as much as behavior based architecture. Deliberative is not adaptive at all.

Another way to improve this behavior based model would be to have the robot make a map as it moves. This way, we could program the robot so that it doesn't search the same spot repeatedly, and thereby make it more efficient. Another way would be to change the random wander behavior to have the robot perform calculated sweeps. We could have the robot move in a certain patten such that it covers the whole room one part at a time, rather than just wandering about randomly. But these are all advanced behaviors that would be hard to implement.

Overall this lab was pretty simple and easy to implement (which was good because we were starting to fall behind on our labs). We just had to modify the lab 5 code to include random wander and better obstacle avoidance. But it was still a good learning experience because we were able to compare different control architectures. Our program was slightly buggy initially, but we were able to fix it, and by the end of it, the robot homed on the heat source pretty consistently.