Great job
10/10

Memo For: Dr. Berry Team Moe

From: [redacted]

Date: 7 May 2009

Subject: ~~Lab 5 Results~~ Heat Seeking Lab 5

In this lab, we attempted to write a program for our robot to navigate to a heat source and dock at it by turning its back toward the heat source using hybrid control and some knowledge of the environment. We assumed that our environment would be such that the robot would start out facing directly toward the heat source which would be at least 6ft and no more than 10 ft from the robot. There would also be either one or no obstacles between the robot and the heat source. If there were an obstacle, it would be a 12” by 12” box located directly in between the robot and the heat source and the face of the box would be parallel to the front of the robot.

To implement, we have our robot attempt to move forward 5’ initially. If it encounters no obstacle, it stops at 5’ and pans the servo in an attempt to locate the heat source. Once it locates the heat source, it moves to it and docks. If it encounters the obstacle, it turns left and travels 20”, then turns back right and travels 30”. It then attempts to locate the heat source by panning the servo, then moves to the heat source and docks after it detects the heat source.

We found that our program worked very well in navigating to and docking at the heat source both with and without the obstacle in the way.

Answers to Lab 5 questions:

1. The servo and thermopile array worked amazingly well, but the compass left much to be desired given the amount of interference in D219.

2. Answered in text above. Move toward light, avoid obstacle if there is one, search for light, move to light, rotate 180 degrees to dock.

3,4. The thermopile was very reliable at detecting heat sources, both human and heater. Humans appeared to be between 85 and 100 degrees while heaters tended to be in excess of 100 degrees

5. Temperatures between adjacent thermopile sensors could be as great a 10 degrees while looking at a non-heat source such as a wall. However, by determining a heat source to be at least 15 degrees greater than ambient temperature allowed us to differentiate between heat sources and sensor noise. We used the angle of the servo when detecting a heat source to determine which direction to turn our robot to approach the heat source.

6. Temperature readings from a heat source did not vary too significantly with distance, but it was a factor. With distances greater than 5 to 6ft, a low level heat source (100 to 130 degrees Fahrenheit) was lost in sensor noise while strong heat sources (in excess of 130 degrees Fahrenheit) could be detected above sensor noise from further away. We did not use this information to determine distance, favoring the use of sonar instead.

7. The compass was unreliable in providing directional information given the amount of electromagnetic interference created in this room due to numerous wireless signals in addition to noise from the power lines in the room.

8. It responded well. Simply a small change in start conditions for the robot and light location within the program.

9. The robot only responded well to the expected 12” by 12” box anticipated by the program. The space for testing was cleared before running the robot.

10. I don’t think the world map could be improved. However, if the PID motor controller class worked correctly, the world map we have would have more than sufficed.

11. Main challenge was that PID motor controller was inaccurate so that distances and rotation angles were frequently skewed between 0 and 20%.

12. Robot homing could be improved by implementing the program on board the robot itself rather than controlling the robot remotely and by improving the PID motor controller.

13. Docking the robot did not significantly change the homing algorithm. It simply added a rotate 180 degrees command after navigating to the light.

14. Locate the persons body heat, then turn the servo right if the person is detected on sensor 6, 7, or 8 and turn the servo left if the person is detected on sensors 1, 2, or 3.