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CSC463

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September 11, 2017

**Assignment 1 – Line Following Lab**

**Robot Description:**

The Handy-Bug design from the book was kept mostly intact. The front wheels were connected to the motor in the same way with an additional gear added to the axle which allowed the wheels to spin more efficiently. Additionally, two back wheels were added and connected to the front wheels via a chain link. Any other excess or unneeded parts were taken off such as the touch sensor bumper and any parts connecting to this part. After the excess parts were taken off, the light sensor was added to the front of the robot and pointed down using a piece with a 90° turn. Then, a small box was attached to the back of the robot so that the motor wires could be concealed and run up into our Handy-Board. Lastly, a cradle for the handy board was placed on top of the robot so that it would have a level and secure place to sit on the robot. After dropping the Handy-Board a number of times, it was decided to add a cross bar across the top of the cradle to completely hold the board in place.

**Part 1:**

1. In our original design, we had changed the front wheels so that they were connected directly to the motor axle. This was an issue because of the wheels, in this configuration, were too far apart and would often drag and cause our wheels to lock up on themselves. After connecting the wheels to a separate axle that was connected to the main motor axle the wheels were closer together and allowed tighter and more efficient turns. Other than design the code worked well but needed adjustments in the values that determined the time spent searching for the line.
2. Performance could be improved by adding an additional light sensor. With two sensors working together, there could be less time spent “searching for the line” on tight turns. Depending on the tape path, the robot’s performance could be improved by programming it to favor searching to the right rather than the left first. Additional algorithm changes could be made to make searching sweeps more subtle. Performance could also be improved by different lighting or higher quality sensors. All problems were solved.

**Part 2:**

1. The only problem encountered was the need to adjust the detection values for the IR sensor. An average value was used just like in part 1, but we needed to set a lower threshold for comparing the black tape to the white board since the values for the different colors had a much greater difference as compared to the light sensor.
2. While performance was improved with the IR sensor when compared with the light sensor, adding one or two additional sensors could possibly improve the performance. The two sensors would be able to detect more of the line when working in unison and make adjustments ahead of time. The algorithm used by the robot would not necessarily need to be adjusted like in part 1 due to a much more accurate detection of the line with the IR sensor.
3. The IR sensor performed much better than the light sensor. The value readings from the IR sensor were extreme opposites. The black tape was detected as over 200 and the white surface was detected as less than 100. These values allowed for more accurate line detection and less time spent searching for the line due to an extended range of values. We did not adjust any of our code from part 1 to part 2 besides variable names and the detection values.