Phototrophic Robot

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1 Purpose

The goal of our project was to make a simple phototrophic robot that will follow a black line on a white surface.

2 Circuit

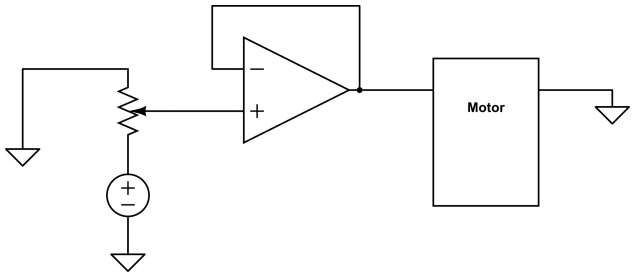

Figure 1: Left Motor

The left motor is run at constant speed that can be adjusted by changing the position of the potentiometer. This voltage is then ran through a buffer to prevent loading on the potentiometer.

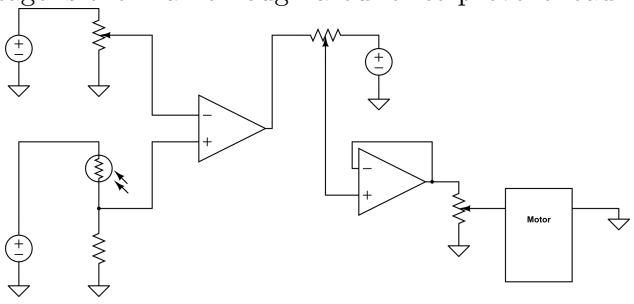

Figure 2: Right Motor

In the right motor circuit an op-amp is used as a comparator between a voltage set by a potentiometer and a voltage determined by the resistance of a photo-resistor. When the surface is lighter there is less resistance in the photo-resistor. This increases the voltage going into the positive input of the potentiometer. The goal is to set the potentiometer such that its voltage output to the negative input is less than the voltage being input at the positive terminal when the photo-resistor is over light, but more than the voltage of the photo-resistor over a dark surface.

When the motor is over a light surface the op amp will output 9 volts, when it is over a dark surface the op amp will output -9 volts. To prevent the motor from spinning full speed backwards,

we added a voltage divider connected between the op amp output and +9 Volts. This potentiometer is adjusted so that the right wheel slowly spins backwards when the resistor is over a black surface. The output of the voltage divider is run through a buffer preventing loading from the motor.

3 How it Runs

When over a light surface the output of the right motor will be greater than the left motor causing the robot to turn to the left. When over a dark surface the right motor is spinning backwards and the left motor is spinning forward, this causes a sharp turn to the right.

The robot slowly turns to the left searching for a line, when it finds a line it sharply turns back to the right until the photo-resistor is over a light surface. This starts the cycle over again, and the robot diagonally 'climbs' around the line.

4 Mechanical Design

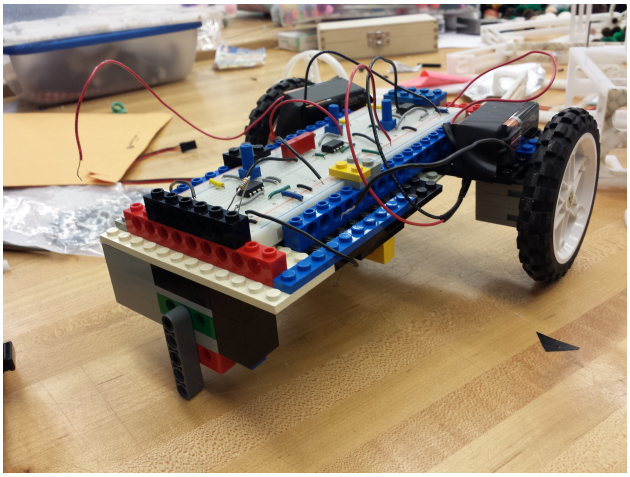

Figure 3: Robot

Due to material shortages we had very few wheels to work with. We took advantage of Legos being nearly frictionless to make a support that would hold up the robot, but also slide easily on the ground so the robot would still be able to turn as one side of the motor spins faster. The construction materials are entirely Lego. The photo-resistor is mounted under the center of the robot with a Lego bracket.

5 Conclusion

Our robot works very well. It can follow most curves; we could improve this ability by increasing its turning radius. To do this the right wheel must spin faster relative to left wheel when the photo-resistor is over a light surface. However, with this change comes a tradeoff in how fast the robot will actually travel along a line. This is because the angle of travel relative to the line it is following becomes much sharper.