



CECS 311 - Final Project

Line Following Robot

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A line following robot

Made up of analog
components

Introduction

The mission of this project is to create a line following robot completely out of analog parts. This means that it must function with only discrete components and must not be programmed digitally. The robot will follow a black line (electric tape) on a white surface (poster board).

Description of Operation

This robot runs autonomously and requires little to no input from the user. When the robot is switched on, the robot will follow the electric tape by using two sensors that consists of a white LED and a 5549-type photoresistor respectively. When the sensor hits the black tape, the robot will turn off the motor that is connected to that sensor. This will cause it to turn to the direction of the black tape since the other motor would still be running. The robot will run in a straight line as long as the sensors does not detect the black tape.

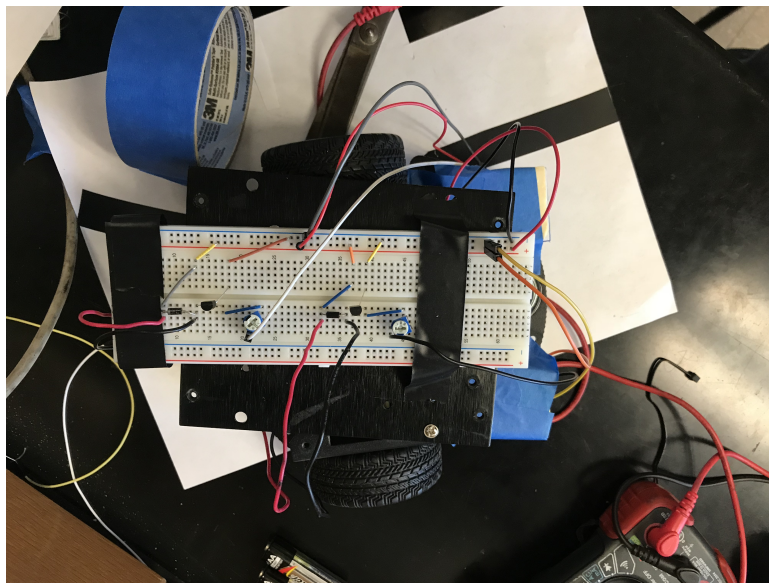
Description of Construction

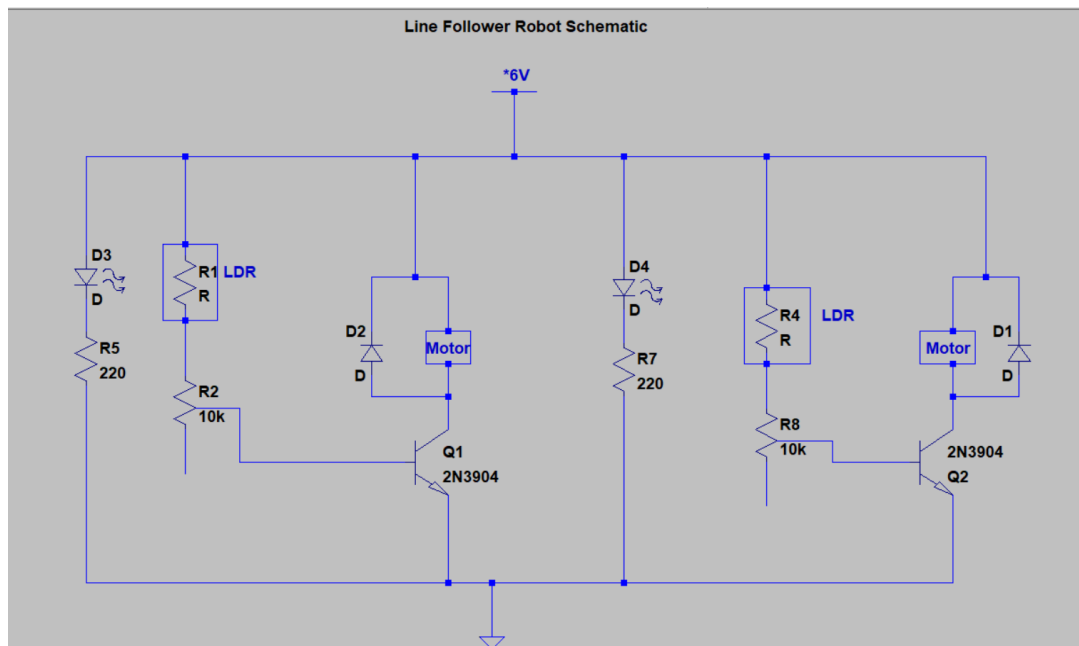
This project required several parts: a robot car chassis, two 3 to 6V DC motors, two robot car wheels, 4 AA batteries in a battery pack with a switch, two 10k potentiometers, two 220 ohm resistors, two 2n3904 NPN transistors, two 1n4401 diodes, two white LEDs, two 5549 photoresistors, and 3 breadboards. The breadboards can be any shape as long as they fit the chassis but for our project we used a basic breadboard and two mini breadboards for the sensors. As for the battery pack, we used one with a switch so that the batteries don't get constantly drained when we're not using the robot. On the main breadboard, we put the 10k potentiometers and the 2n3904 NPN transistors. It is also responsible for connecting and powering the sensors to the motors. We used transistors because the current going to the motor should be controlled by

the sensors. We connected the sensors to the base of the transistor and the motors to the collector part of the transistor. The motor will turn faster depending on how much light the photoresistor is receiving. Its speed can also be adjusted by modifying the resistor value on the potentiometer. Each motor is also parallel to a 1n4401 diode. The reason for this is because the DC motor can cause charges to build up, which can damage the circuit. The diode acts as a safe way to dissipate the energy inside the motor.

In each mini breadboard, there is a white LED, a 220 resistor, and a 5549 photoresistor. The photoresistor and white LED are parallel to each other. We purposefully put them close to each other on the breadboard because we wanted the photoresistor to detect the light from the LED as much as possible. We also wrapped them both in black electric tape so the light is more focused from the LED when it gets reflected on a surface. We also have a 220 resistor after the LED so that it doesn't get burnt out.

We placed the two mini breadboards upside down in front of the robot. The sensor should be 5 mm above the surface/floor. The distance between the sensors should be approximately 10cm.





Conclusion

The robot does move as intended, but it is quite inconsistent when it comes the speed of the motors. The wheels are not synchronized with each other. We adjusted the potentiometers accordingly to have them match as much as possible but it is very difficult so we just approximated it. If given more time, we'd test it more so that the motor speed is more accurate and in sync with each other. We would also want better sensors. We used a white LED and photoresistor because they were very simple but they're not as accurate compared to better made, more specific IR sensors. If we had better sensors our robot could have performed more smoothly. If we had more time we also would have soldered our connections instead of just using jumper wires. Another possibility would be different parts. We used 2n3904 instead of a mosfet because it was what we had available. If we had more time we would use mosfets instead. Overall, we learned how to use the components we were taught from lecture.