Final Project: Line Following Robot

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**Introduction:**

The goal of this lab was to create a line following robot which would follow a standard black electrical tape on a white poster board. The challenge was to not use any microcontrollers or digital components and only use analog components.

**Description of Operation:**

Our Line Following Robot starts when the jumper wire which is connected to the 12 voltage battery pack is connected to the positive and negative sides of the breadboard. After this, the voltage passes through the breadboard which powers two motors connected to two wheels which move the robot. The breadboard also has two LEDs which are facing the bottom side of the robot, so they will bounce the light off the ground as it moves. The sensors are sensitive to light, so they are much closer to the ground. Due to this, when the light bounces off the ground, the sensors will know whether to keep the motor running or not. When the sensors catch the black light, the motors will not operate as opposed to the sensors operating when the sensors catch the white light.

**Description of Construction:**

In the making of the line following robot, the materials needed were a breadboard, two wheels with gearbox motors, 8 AA batteries, a battery holder, wires, resistors, potentiometers, transistors, light dependent resistors, LEDs, LM358N, soldering iron, solder, black electrical tape, white paper, and a box to hold the breadboard. The LEDs were connected to VCC(12V) and placed in series with a 1k ohm resistor which was connected to ground. In parallel to the LEDs were potentiometers that were connected to VCC, GND, and then the output went to the negative input of the LM358N. Also in parallel to the potentiometers were the Light Dependent Resistors(LDR) which were connected to the positive input of the LM358N, VCC, and in series with 10k resistors connected to ground. The LM358N was connected to VCC, GND, and the two outputs were fed into a 1k ohm resistor which then entered the base of the transistors. The emitters were connected to ground and the collectors were in parallel to the motors. Also in parallel to the collectors of the two transistors were diodes that were reversed biased to eliminate the negative voltages produced by the back EMF of the motors. The wheels were attached to the gearbox motors and were taped to the bottom of a project box. The battery holder containing the 8 AA batteries was taped to the back of the project box. A charger was placed underneath the box to allow the robot to roll smoothly. The LDRs and the LEDs were taped at the front of the box facing down so that the LDRs can detect the reflected light from the LEDs.

**Description of Calculations:**

To know the value of Vin, the following calculation needs to be performed: Vin = v+ - v-. To find vout: Vout = Av(v+ - v-) => Av(Vin). Because the motors were operating too fast, we added resistors between VCC and the motor. We tried 100 ohms and found it was too slow. Another value tried was two 47k resistors in series to create 94 ohms which was too fast. Therefore we put an 80 ohm and 15 ohm resistor in series to create a 95 ohm resistance.

**Conclusion:**

Increasing the 94 ohms by 1 ohm surprisingly fixed the issue. The robot now moves slow enough to make the turns although at some points it stops or travels too slow. If we did not have any other finals or were given more time, we would have experimented with other resistor values to get the perfect speed for the robot to be able to turn without skipping over the black line. If that was the case, the potentiometers would need to be fixed in order for the wheels to turn at the right speed. Another change we would have made is probably decorate the robot and make it look cleaner. As of now, there are too many wires sticking out.

**Schematic:**

12v

