**Line Following Robot**

**Purpose:** The purpose of the lab was to create a line following robot (vehicle). It was to be able to follow a specifically designed course on the floor and complete it with relative ease. It was created using specific components; a breadboard, a series of chips wired to two sensors to detect whether or not the robot is following the marked path correctly. The chips were able to decide which wheels needed to be turned and when, so a turn could be made when necessary. The robot was meant to follow a black line.

**Theory of Operation (Description of the circuit):**

(A dark/black line on a white reflective surface): Using the two reflective sensors mounted below the breadboard, the colors/contents of the surface were detected. The sensor uses an LED, that uses its reflection to decide whether or not the surface is black or not. This is due to the fact that black absorbs light and cannot reflect it, using this information the sensor can determine whether or not it is on a black surface.

When the sensor is on a black coloured surface, it makes pin 1 to close the circuit, thus the current is closed and it does not proceed. The current travels down the breadboard based on the method used to set up the circuit and chip being used (The SN74LS245 or PICAXE 28x1). So normally if the left sensor detects black, it causes the right motor to turn on. So in turn, if the right sensor is the one detecting black, it will cause the left motor to turn on. Finally, if the sensor detects its own reflection it means the surface is no longer black but whiter. If this were to occur, the both sensors would turn off, in turn causing both motors to also turn off. This usually takes place at one sensor at a time, so the robot could carefully adjust its course (it will turn the sensors on and off until the robot is back on course – it’s turning slowly). This explanation of the circuit function is concurrent with the SN74LS2405 chip used alongside the SN74LS40 inverter.

(A white reflective line on a dark/black surface): If the purpose of the robot was to follow a white line rather than black line the surface it is tested on must be black or extremely dark. Again the sensor with the LED within, it again uses the reflection to determine the colour of the surface, to determine whether it is white or not. A white line will cause a reflection of the LED within the sensor and return a signal that allows the designated motor to move forward. If the left sensor happens to detect a white line, it will begin turning the right motor. Now if the right sensor happens to detect a white line, it will begin turning the left motor. Now if the sensors were to detect black, they would stop the motors from turning by closing the circuit. This usually happens once at each sensor until the robot has adjusted its course. This is the appropriate circuit analysis for the SN74LS2405 without the use of the inverter.

**Schematics:**

(INSERT SCHEMATICS HERE)

SN74LS245N

PICAXE 28x1

(INSERT PICTORIALS HERE)

SN74LS245N

PICAXE 28x1

**Materials & Pricing**

There were quite a few materials that were used to create this robot:

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| **Item** | **Image** | **Pricing ($ - CAD)** |
| USB Power Cable | Img01 | $1.00 |
| LED (1) | Img02 | $0.35 |
| Black Hook-Up Wire (1000 feet) | Img03 | $54.95 |
| Red Hook-Up Wire (1000 feet) | Img04 | $54.95 |
| Glue Gun | Img05 | $9.99 |
| Glue Gun Stick (1) | Img06 | $0.05 |
| Soldering Wire (1.00 LBS) | Img07 | $18.65 |
| Nose Needle Pliers | Img08 | $5.93 |
| Wire Stripper (Adjustable sizes) | Img09 | $9.85 |
| Heat Sink (Clip) | Img10 | $3.29 |
| Soldering Iron | Img11 | $6.35 ($0.99 for replacement tip) |
| Soldering Iron Stand | Img12 | $6.04 |
| 330 ohm resistors (2) | Img13 | $0.06 |
| 10k ohm resistors (2) | Img14 | $0.06 |
| Serial Port Connector  (Serial cable cut and stripped down) | Img15 | $8.02 |
| PICAXE 28x1 | Img16 | $12.05 |
| Breadboard | Img17 | $6.04 |
| 7805 Voltage Regulator (Clamp) | Img18 | $1.42 |
| Motors and Wheels (2 of each) | Img19 | $7.69 (Gear Motor)  $4.95 (Wheels) |
| QRD1114 Reflective Sensors (2) | Img20 | $2.19 |
| SN74LS240N | Img21 | $0.54 |
| SN74LS245 | Img22 | $0.54 |
| Masking Tape | Img23 | $0.99 |
| Electrical Tape | Img24 | $0.98 |