ECE 100: Presentation 1

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Problem Statement

Build a robot that will follow a white tape path on a black background in the minimum amount of time.

Success criteria:

- The robot will reach the end of the path in less than 60 seconds.
- The robot must not move more than 4 inches away from the path.

Constraints:

- Materials provided are a box of Legos, two motors, and two light sensors.

Research & Investigation: Braitenberg Vehicles
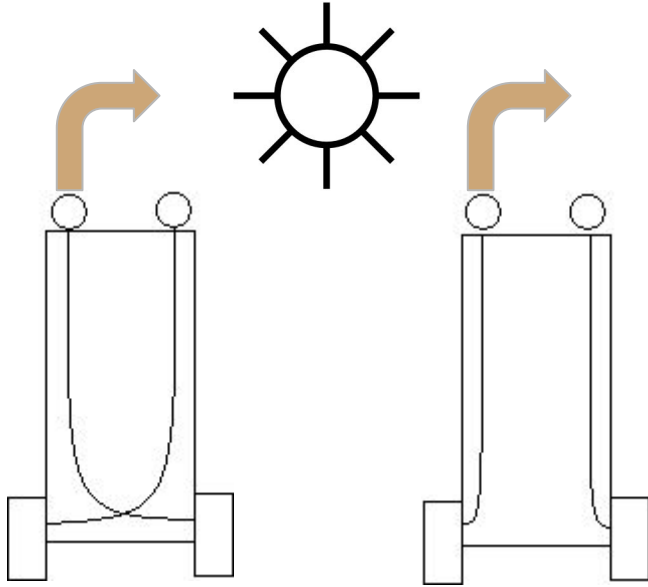
The sensor closer to the light source will detect more light and make the motor connected to it turn faster.

Motors need to be connected to the opposite motor, as in vehicle 2B.

More light on the right sensor makes the left motor turn faster. Then the robot turns right, towards the light.

Vehicle 2B
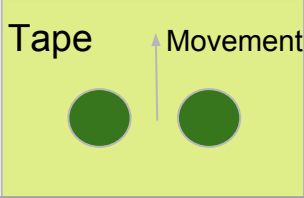
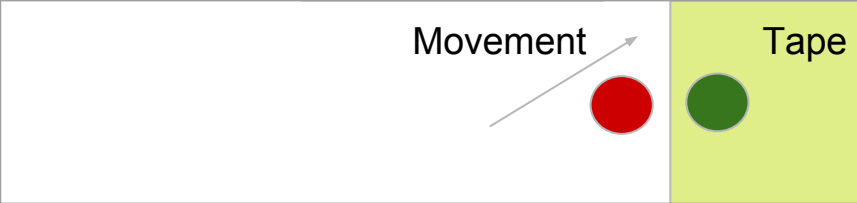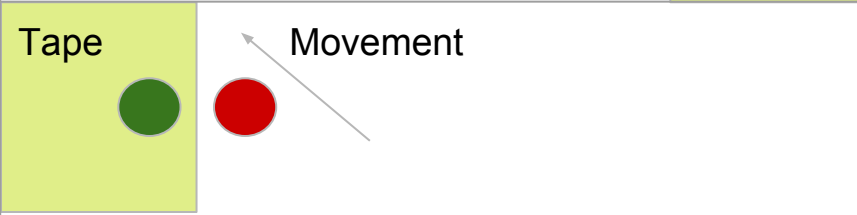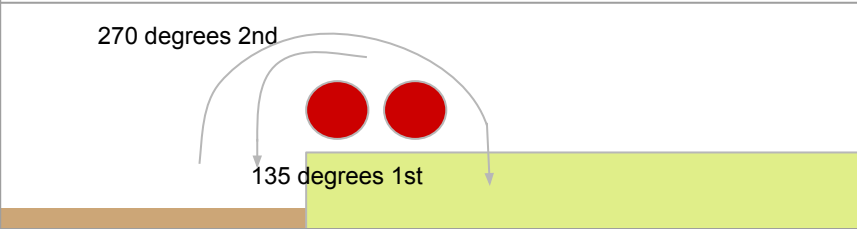Vehicle 2A

Alternative Solutions

1. Normalize Program
- Motors' power dependent on reading from light sensors.

2. Light Sensor Truth Table

- Utilizes truth table to determine actions.
- Sensors are determined to be "Light" or "Dark" depending on if the surpass a threshold reading from the light sensors (190 on left, 180 on right).

Truth Table

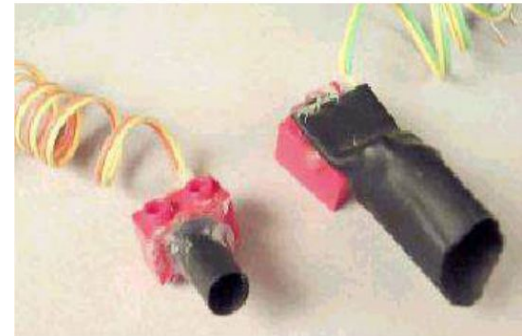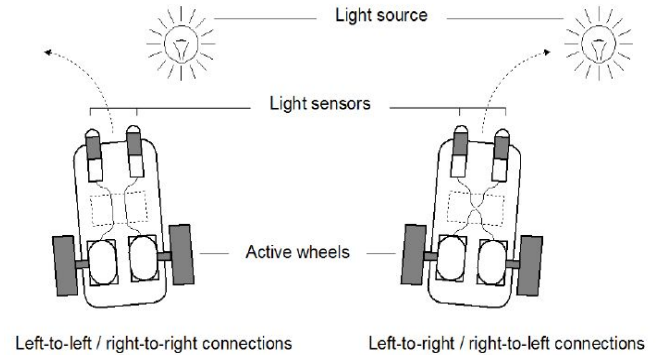| Sensor Status? On = Light Off = Dark	Action	Illustration
Left **On** | Right **On**	Maneuver forward	Tape ↑ Movement
Left **Off** | Right **On**	Turn Right (Towards the tape)	Movement ↗ Tape
Left **On** | Right **Off**	Turn left (towards the tape)	Tape ↖ Movement
Left **Off** | Right **Off**	Seek out tape on the left side (135 degree left turn), then seek out right side if no tape is found on left side (270 degree right turn)	270 degrees 2nd 135 degrees 1st

Optimum Solution

Using a threshold is a better solution.

1. Light and dark sensor values not different enough
2. Speed

Construction & Implementation

- Two possible ways to connect the sensors to the motors.

- Build optical shield to limit the amount of ambient light that is able to fall on the sensor.

- Software consists of three phases:
  1. Align
  2. Turn
  3. Calibration

Light source

Light sensors

Active wheels

Left-to-left / right-to-right connections   Left-to-right / right-to-left connections

Analysis & Testing

- Orientation of the Handy Bug before executing the actual program.

- Calibration of the light sensors was a major issue.

- The robot got stuck in a sharp angled-corner because of the improper positioning of the two sensors.
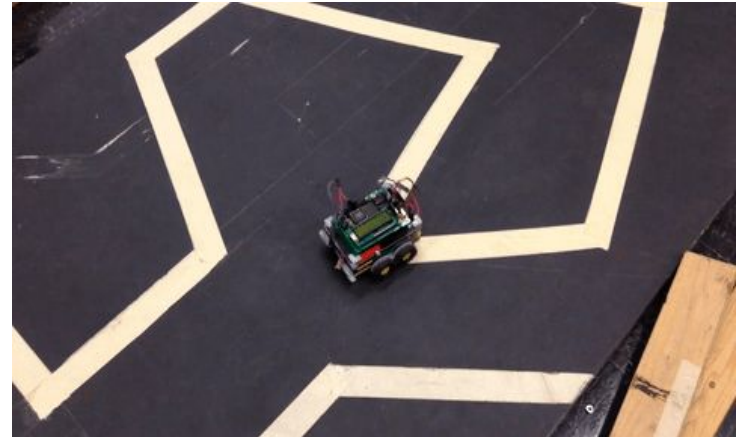
Final Evaluation & Conclusion

Final time: 69 seconds

Performance:

1. Robot performed task given, but not in the given amount of time
2. Robot did not have fastest time

Things to improve on:

1. Speed
2. Randomness to choose turning directions
3. A different chassis with less LEGO pieces

Thank you!