CSC615 Term Project

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Group Info

Group Members: Christopher Ling, Jess Hollingsworth, Jesse Henrick, Tony Huang, Igor Tsygankov, Willi Vargas

Prime Github: jesshollingsworth
https://github.com/CSC615-2022-Fall/csc615-term-project-jesshollingsworth

Task Description

The task for this assignment is to build a car that would automatically move forward by following a blackline while avoiding obstacles on the track.

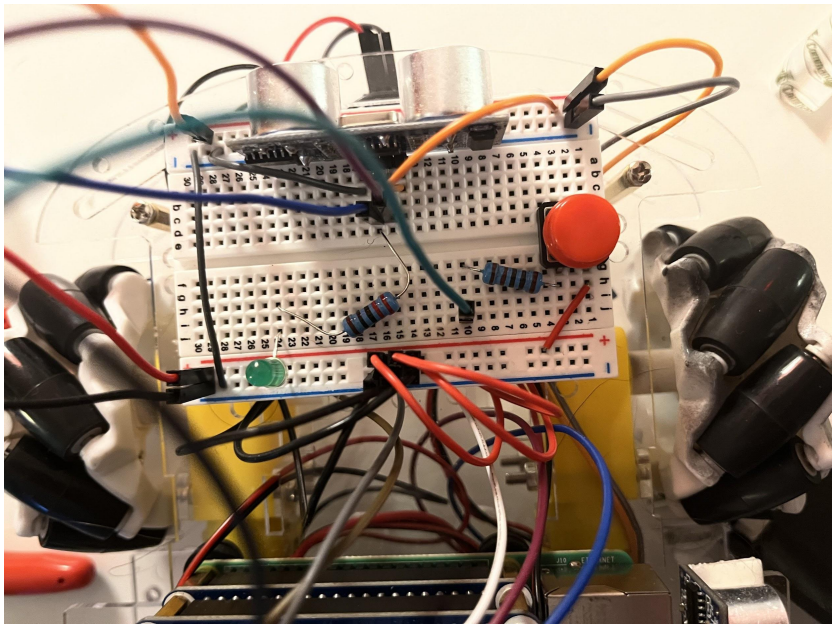
Individual Task Breakdown

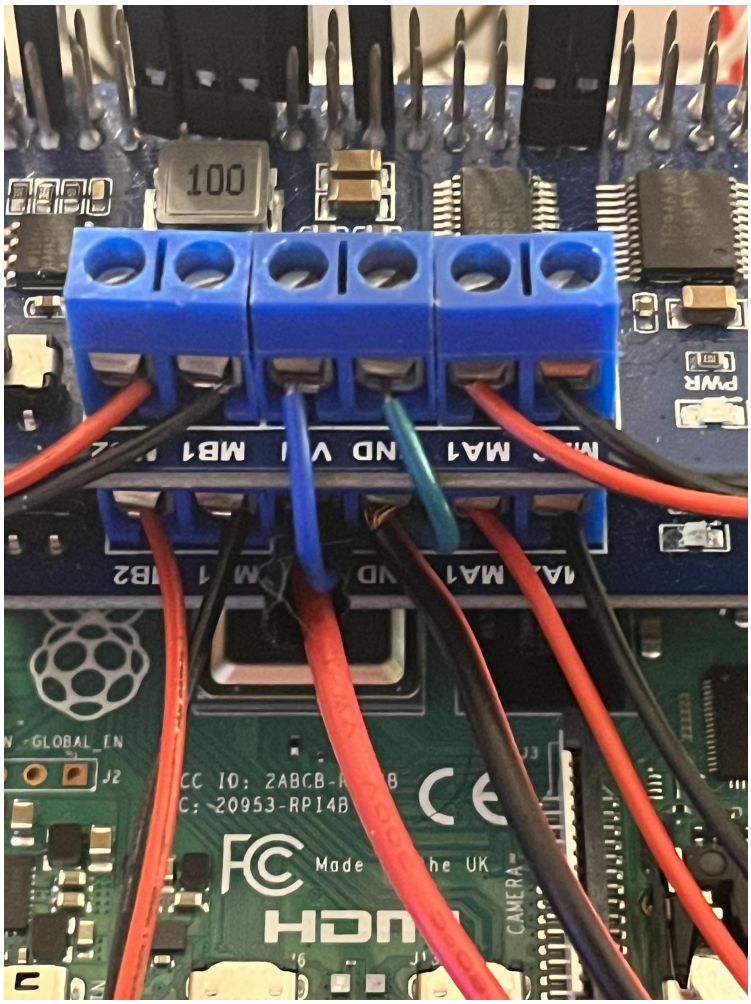
1. Test the individual parts (such as motors) to make sure they are working
2. Made sure daisy chained motor hats worked together
3. Building the car to house our components
4. Tested the omni-directional wheels
5. Tested the follow the line sensors
6. Tested the follow the line algorithm to make sure the car stayed on the line
6. Tested the echo sensor
7. Tested the obstacle avoidance algorithm with the follow the follow the line algorithm
8. Added on extra sensors for obstacle avoidance algorithm robustness
9. Tested/Fine tuned for final run

Building the Car

Design

When it came to designing our self driving car we began discussing as a group all of the obstacles that we would run into so that we could plan ahead. We also looked at all the parts that we had at our disposal and we chose to use omni-directional wheels instead of the regular wheels provided. One of the first issues we noticed was when we were gonna run into a problem with sharp turns and how we were going to handle avoiding course obstacles with the car. We ended up landing on a design that utilizes two ultrasonic sensors one to detect an initial object in front of our car which is used to move horizontally until the car has cleared the obstacle ahead then the car would move forward until our second ultrasonic sensor detects that we have passed the obstacle moving forwards so our car can finally move horizontally back onto the track.




100
GLOBAL_EN
Made
HDMI
CAMERA

Parts / Sensors Used

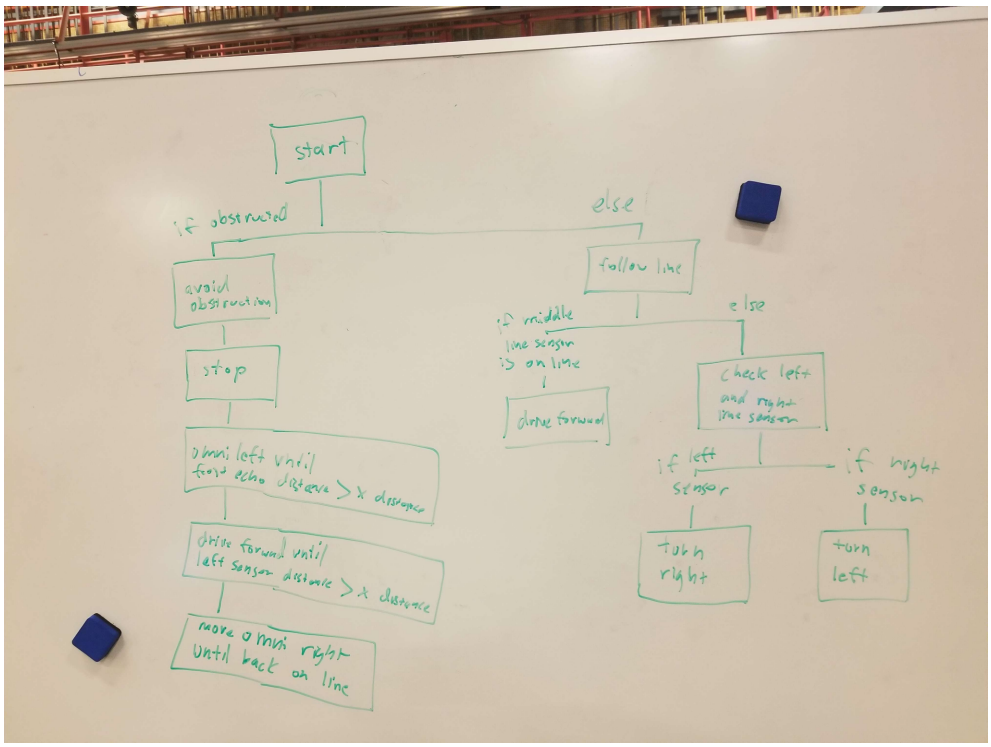
- 1x Raspberry Pi 4
- 2x Ultrasonic Sensors (HC-SR04)
- 3 Line Sensors (TCRT5000 Reflective Optical Sensor)
- 1x Button
- 4x Omni-directional Wheels
- 4x Motors
- 2x Motor Hats
- 1k Ohm Resistor
- 225 OhmResistor
- 1x Battery Pack
- 1x Power Connector
- 3x Eilong Batteries (Yellow 18650 3.7V Li-ion Batteries)
- 1x Battery Case
- 2x Frames

Libraries / Software

PIGPIO was used in order to communicate with our sensors

PCA9685 was used in order to program our motors

Flowchart of your code



Pin Assignments you used

Line Sensors Pins

- Left Pin > 17
- Middle > 27
- Right > 22

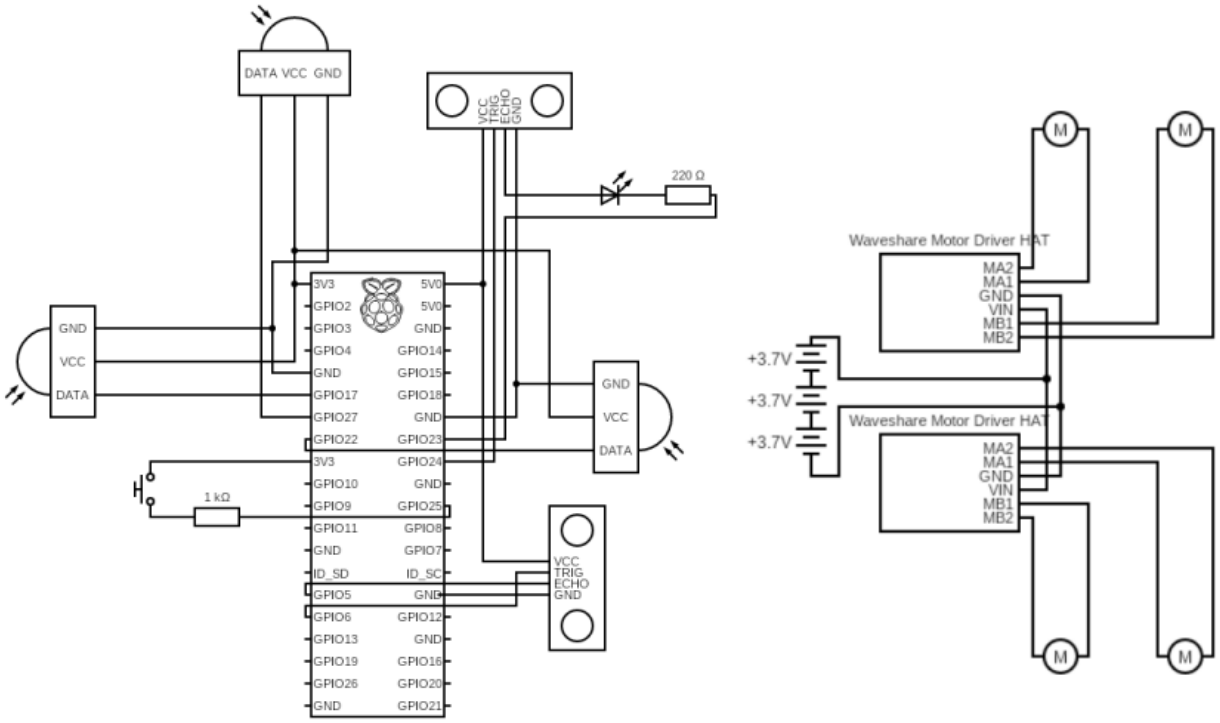
Ultrasonic Sensor Pins

- Front
  - Echo Pin > 23
  - Trig Pin > 24
- Right
  - Echo Pin > 5
  - Trig Pin > 6

Button Pin

- Button Pin > 25

Hardware Diagram



What worked well

For the most part everything that we wanted to do worked out. As a team we worked pretty well and were able to divide the work pretty evenly. The one thing that we wanted the most in our project was to use the omni-directional wheels in order to avoid obstacles. This was one of the most vital parts of our car which we were able to accomplish. In the end our car was able to maneuver the tracks and avoid obstacles.

What were issues

One of the biggest issues that we had was getting the line sensors calibrated to read black and white properly. Another issue that we had in the beginning was a hardware issue with our omni-directional wheel because the threading of where the motor went was stripped so one of our wheels would fall off. We also had a bit of trouble in the design phase of the project and agreeing on an initial design, but this allowed our discussions to bring new ideas to light which ultimately helped us in the end.