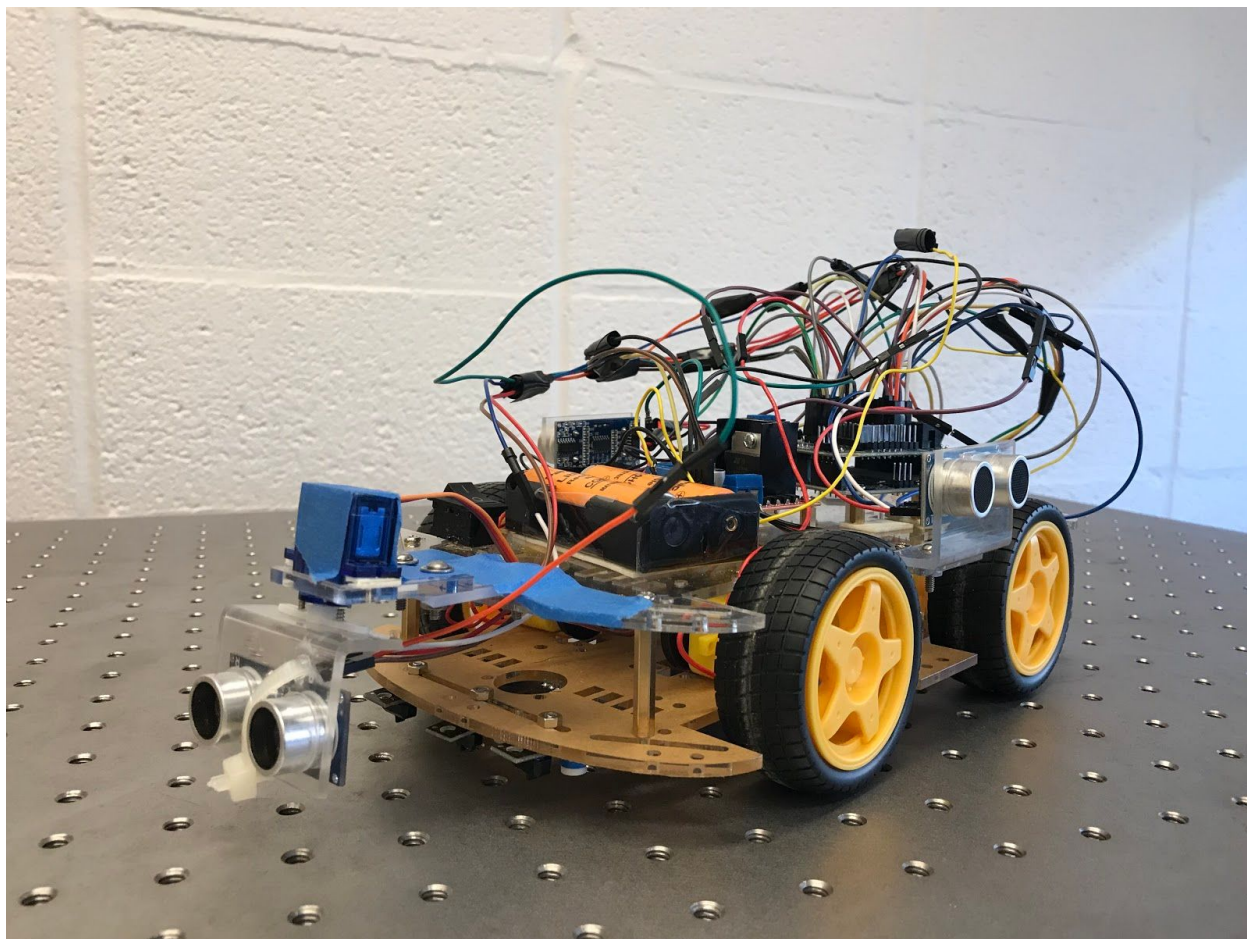


Team “Grad Students Suck”

Members:

Will Thatcher
Andrew Paliotta
Ganzorig Batbold
Ian MacMillan
Anthony Lioon
Roman Kosarzycki
Kysten Small

Project: “Dan’s Dad” Arduino-based Robotic Car



Development Timeline:

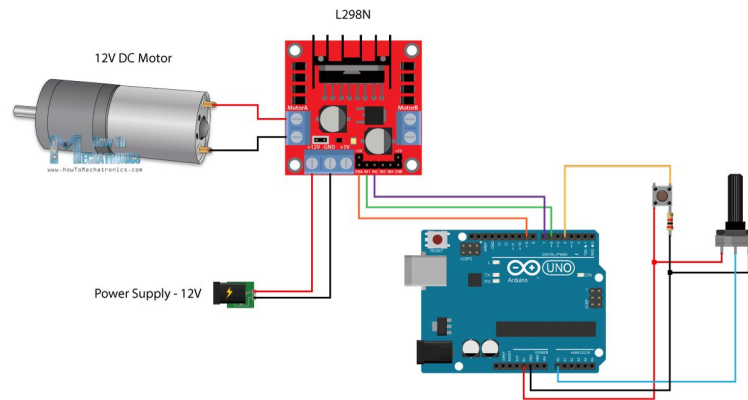
Monday, November 26, 2018 - Classroom

- Split into two teams
 - Software
 - Hardware
- Use video (<https://www.youtube.com/watch?v=uW8YVcBjPGU>) to begin assembly:

- Attach encoder disk to yellow motors.
- Attach motors to bottom acrylic body
- Attach spacers to bottom acrylic body
- Attach top acrylic body
- Attach wheels

Wednesday, November 28, 2018 - Lab

- Team Hardware
 - Remove wheels
 - Remove top acrylic body
 - Attach battery pack
 - Tested two batteries. Working Voltage = >8V
 - Solder wires to positive and negative on motors
 - Twist and solder positive to positive and negative to negative on right and left side of the car
 - Results in four total leads (two positive, two negative)
 - Reattach top acrylic body
 - Mount Dual H Bridge Motor Driver Module to top acrylic body
 - Attach motors to motor driver using following diagram:



- Team Software
 - Design algorithm for how to get through the obstacle course
 - Researched codes that might be viable for our project
 - Began formulating design for car to best accomplish challenges

Thursday, November 29, 2018 - Lab

- Goals of the day:
 - Get the car moving
 - Come up with parts list
 - X1 Micro Servo 9g (SG90)
 - X3 Ultrasonic Sensor Bracket
 - X1

- Progress
 - Team Hardware
 - Attach wheels
 - Attach
 - Mount Arduino to top acrylic body
 - Connect arduino to motor driver and battery pack
 - Team software
 - Program arduino to move car for 1 second at top speed
 - Team Parallel Parking:
 - Create algorithm to parallel park
 - General Idea:
 - Define the start point of double lines as $x = 0$
 - Search to find the block of cars by using the Ultra Sonic Sensor pointed right of the car (90 to right) to find the block of cars
 - Use comparison of depth values
 - Turn and travel close to the block of cars
 - Do another search almost the exact same as step 2 to find the largest spot
 - Park the car
 - Yes, let's get this bread

Friday, November 30, 2018 - Lab

- Goals of the day:
 - Get the car driving
 - Further the code for obstacle avoidance and parallel parking
 - Initialize IR sensors to correct distance
- Progress
 - Team Hardware
 - Attached a common ground lead to the battery back that connects to ground on the arduino
 - Attach Arduino chip and battery packs
 - Accidentally start some wires on fire (almost)
 - Establish where ultrasonic sensors will be mounted
 - The ones on the front and back will reside on servo motors going through the center cavity
 - Team Software
 - Program the arduino to go forward one second and then turn in place for one second

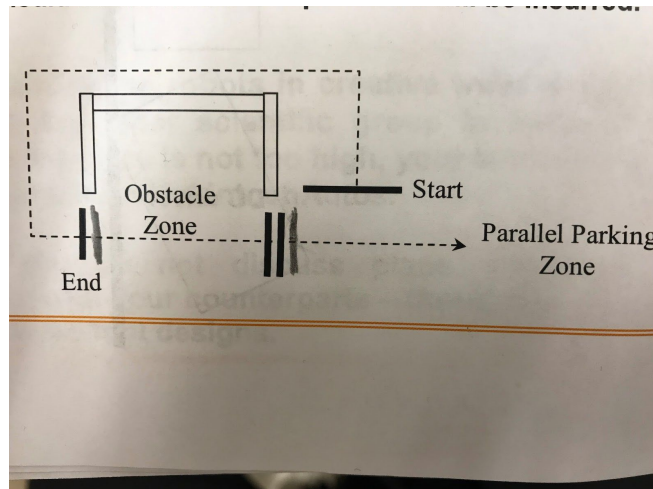
Sunday, December 2, 2018 - Lab

- Progress
 - Mount IR sensors to bottom of car
 - Solder power and ground wire to IR Sensors

- Began testing of line following capabilities
- Mount Ultrasonic Sensor and servo on car

Monday, December 3, 2018 - Lab

- Success!
 - The car follows lines, although it doesn't turn as much as it should
- Announcement
 - There is a change in the line system for the course:
 - Starts by crossing 1 line then enters obstacle zone over 2 lines then enters parallel parking zone over 3 lines



- Progress
 - Remove the 9V battery pack but continue to use the leads to connect the arduino to power (Battery pack)
- Testing
 - Fine tuning the line following
 - Need Gyroturning badly (will do wednesday)

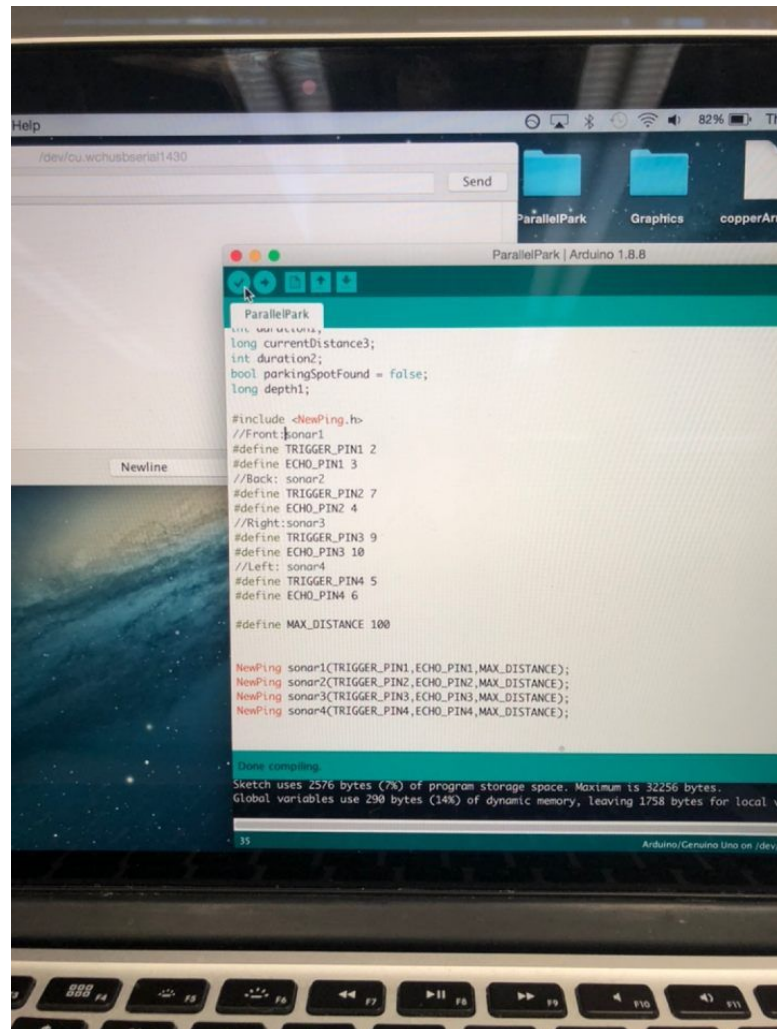
Wednesday, December 5, 2018 - Lab

- Announcement:
 - We now have the official tape for the race
 - Mandatory to complete Course Eval
- Progress
 - Begin testing parking lot sensing capabilities
- Setback
 - One of the wheels is slow
 - Fixed by Team Hardware

Thursday, December 6, 2018 - Lab

- Meeting

- Should we switch to a wall following mechanism to maneuver the first part of the course?
- We need three major functions in the final code: Line Following/Wall Following, Obstacle Avoidance, and parallel parking. These are to be punctuated by an algorithm that recognizes lines that we've gone over. (One, two or three)
- Progress
 - The parallel parking algorithm works in G's hands but not on the ground.
 - The Ultrasonic Sensors all work. Here's the pin list:



Friday, December 7, 2018 - Lab

- Progress
 - Team Hardware
 - Extended the front servo and ultrasonic sensor 3 inches from the edge

Saturday, December 8, 2018 - Lab

- Progress
 - Adjust length of pieced extending servo motor and ultrasonic sensor

- Tape down wires
- Work on parallel parking algorithm
- Work on obstacle avoidance with a simple obstacle course
- Solve some issues of line following using new batteries

Monday., December 10, 2018 - Lab

- Updated info
 - Instead of two lines and three lines to indicate changes, there will be large blobs of tape indicating a transition
- Progress
 - Fine tune parallel parking, seems to work in most scenarios (success)
 - Work on determining what IR sensors pick up and what they don't
 - Begin work with wall following (for when tape line is not present)
 - Develop idea to deal with updated info
 - When all 3 IR sensors go off, check again after some amount of time to see if they are all sensing
 - If they are, assume it is at a blob
 - Move to next section of code (line following to obstacle, obstacle to parallel parking)
 - Build a course connecting line following, obstacle course, and parallel parking
 - In order to have better control for line following, lessen speed and add delay for turns
 - 90 degree turns accomplished with repeatable results
 - Wall following when tape disappears works in most cases
 - Obstacle course code updated, improved
- Wiring changes
 - Unable to control motor speed, so switching them from analog to PWM pins on Arduino
 - Pin 11 unplugged (S, center IR, blue + blue wire)
 - Pin 10 unplugged (Echo, right ultrasonic, white + purple wire)
 - A4 to 11 (motor control switched over to PWM)
 - A5 to 10 (motor controls switched over to PWM)
 - 11 to A5 (S, center IR, blue + blue wire)
 - 10 to A4 (Echo, right ultrasonic, white + purple wire)
 - 9 to A4 (Trigger, right ultrasonic, grey + green + yellow wire)
 - A4 to 9 (Echo, right ultrasonic, white + purple wire)
 - Replaced all pins for "parallel park" to different, updated ones (see Pin List)
 - 140 speed now set to 255

"Race Day" Tuesday, December 11, 2018 - Lab

- Progress
 - Combined codes for each task into one, final code, "DansFather" which includes transitions

- Refined obstacle avoidance code
- Selected “All I Do is Win” to play after victory

Project Summary:

"Dan's Dad" Capabilities:

1. Sensing
 - a. Ultrasonic sensing in four directions
 - b. Infrared sensing underneath the front of vehicle
2. Task Implementation
 - a. Line following (using IR sensors)
 - b. Obstacle collision avoidance
 - c. Parallel parking
 - d. Wall following

Final Costs:

Research and Development.....	\$0
Materials.....	\$60
Making Friendships that Last a Lifetime.....	Priceless

Reflection:

Although our race through the obstacle course was a long and slow process, we are confident in our car's ability to implement each of the tasks listed above. However, we certainly had problems transitioning from one task to the other and detecting smaller obstacles. Given more time, we would perfect the turns on the obstacle avoidance code, and implement all of the tasks into the same section of code so that the car wouldn't need transitions to switch functions.

Resources:

<https://youtu.be/uW8YVcBjPGU?list=PLE7E5EMjOqkvYrAux8xluK6O7KuN0tzX5>

<https://youtu.be/kewza7RyKMQ?list=PLE7E5EMjOqkvYrAux8xluK6O7KuN0tzX5>

<https://youtu.be/EJwNwbXVTck?list=PLE7E5EMjOqkvYrAux8xluK6O7KuN0tzX5>

<https://howtomechatronics.com/tutorials/arduino/arduino-dc-motor-control-tutorial-l298n-pwm-h-bridge/>

<https://forum.arduino.cc/index.php?topic=141705.0>