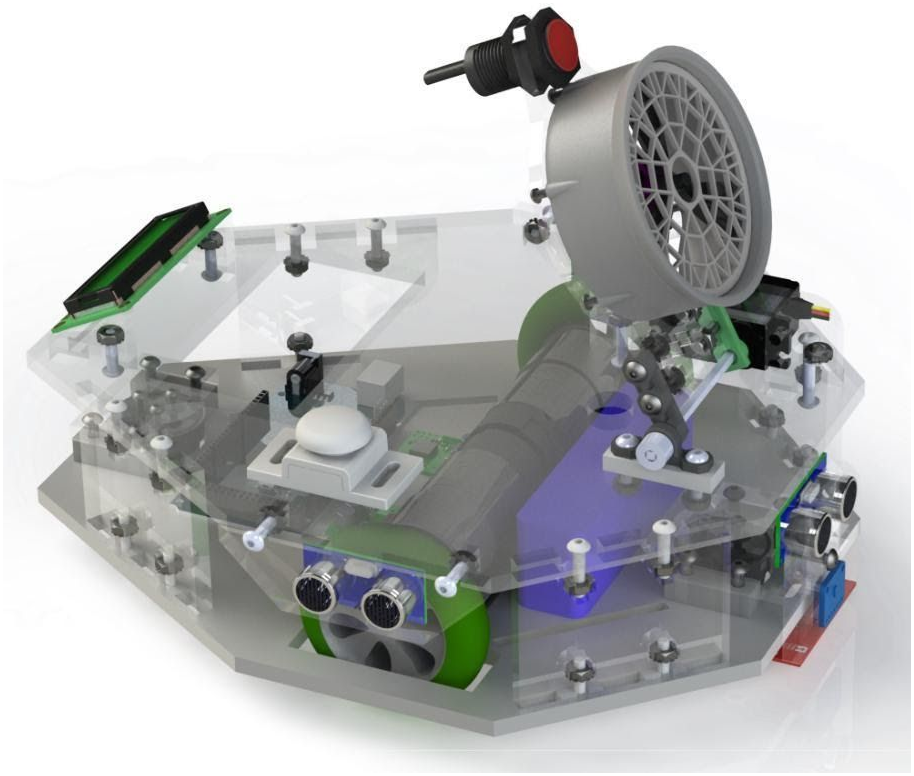
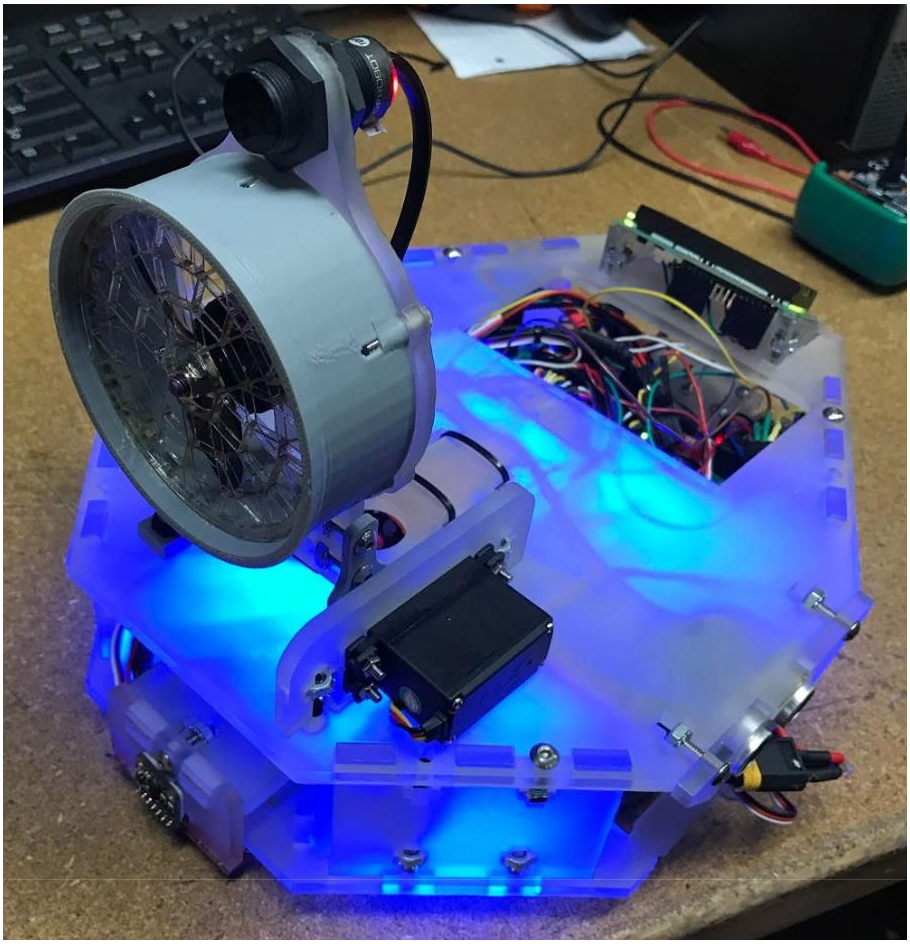
Work Sample

Unified Robotics II: Sensing - WPI, Spring 2018

This course had a term long project which, in summary, was to have an autonomous robot navigate a randomly made course, and locate a “fire” represented by a candle. Once the candle was located, it was put out, and the position of the candle, X,Y, & Z, in reference to the starting position of the robot.



This robot was fully designed in SolidWorks, and then some components, which are clear in the render, were laser cut out of acrylic, and some components, like the fan shroud and protective grate were 3D printed. This robot was well thought out, and went through numerous iterations to get to a point it was suitable to be manufactured.



This image is of the final robot, which had numerous sensors integrated to allow for autonomous navigation and candle flame position locating. There was an infrared camera on top of the fan to detect the flame, the two drive motors had built in quadrature encoders that were utilized for determining distance traveled. On the front bottom of the robot, there is a time of flight sensor to determine the distance from the candle, and below the time of flight sensor is an array of line sensors, which we used for cliff detection, in the same fashion that iRobot uses them on Roombas. Finally, there were ultrasonic sensors on each side of the robot that were used for determining the distance the robot was from walls on the left and right side.

Major Qualifying Project - WPI, August 2019 – May 2020

A Major Qualifying Project is a capstone project at WPI completed during one's senior year, and is a major specific project. My project is titled Self-Driving RC Car, and in summary, my team and I are taking work done in previous years, and implementing it into our complete project. The goal by May 2020 is to have a modular package, where we can take our sensors and camera, and strap them onto any scale RC car and then have the car be able to drive itself around a track. We are a team of 4 students working on this project, and specifically, I worked through designing the housing that will contain the two Raspberry Pi's and one Arduino Mega, as well as a temperature sensor and an IMU. The box is designed with a top shell and a bottom shell that are held together with a dovetail on the back side of the box, and the red "key" seen on the front corner of the box.

In addition to the sensor box, our MQP team is working closely with another MQP team being advised by our professor to help them design test fixtures for components of 1:10 scale RC cars that they are building. Hundreds of hours of CAD work was done to fully integrate this sensor box onto the car. As a double major having extensively used SolidWorks in the past, I assisted the other team on some aspects of their project as well. Below is a render of the final version of our car.

The project required many design requirements, the most challenging being that the car was fully 3D printable. The only metal components besides the fasteners were in the suspension system. Unfortunately, a final version of this car was never fully produced because of COVID-19 closing our campus for the semester.

Computer Aided Manufacturing - WPI, Fall 2017

This course took a hands-on approach to learning manufacturing processes from stock selection all the way to finishing processes. The machine shop the class utilized was equipped with both HAAS milling machines and lathes. The work completed in class started basic, and worked up to machining a functional stirling engine. For the stirling engine to be manufactured, it was necessary to maintain tight tolerances as well as to complete the tool passes to ensure appropriate tolerances are met.

Seen above is a stirling engine built in said course, the base plate and Y-arm holding the tube were both machined on a milling machine, and the brass component which interfaces the stand and tube was turned on a lathe from brass stock.