Zach Wilson

Senior at George Fox University

Electrical Engineering

GEORGE FOX
UNIVERSITY

Engineering Projects Portfolio

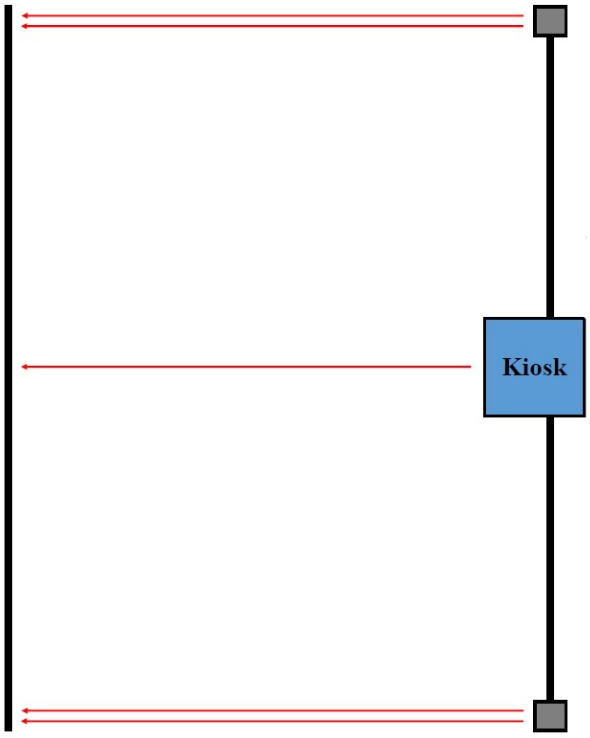
Access Solutions: Automated FME Boundary

ACCESS SOLUTIONS

Senior Design Project

Team Position: Technical Manager

-Still In Progress-

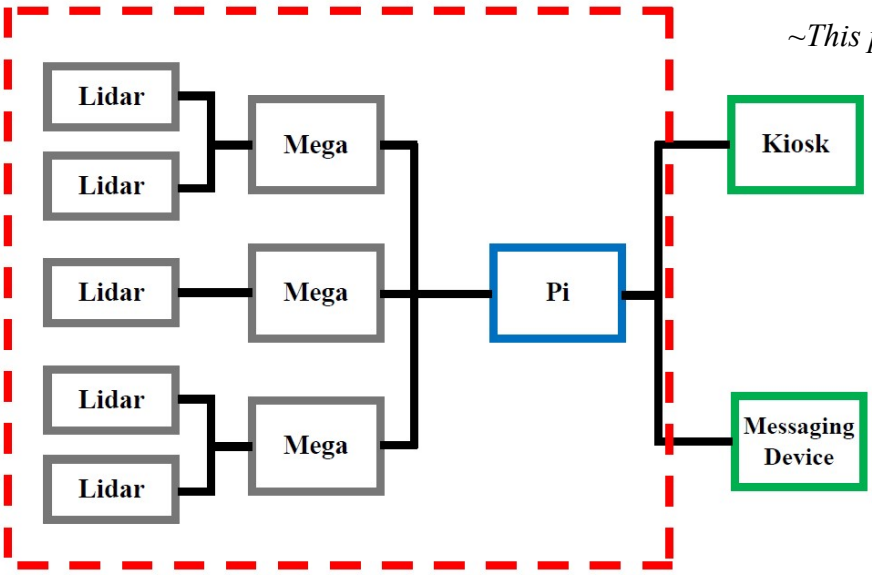


Access Solutions is an Oregon based company in the business of "FME" or Foreign Material Exclusion. They are sub-contracted onto turbine repair/maintenance projects across the country. They monitor and take detailed documentation of all tools and material entering the turbine pit. If so much as a screw is missing, the work must stop and the screw must be found. This is vital for liability reasons and overall safety precautions when it comes to nuclear reactors and fossil fuel based generators.

Access Systems partnered with my group in order to automate a component of this process. We are challenged with creating an automated boundary that monitors all activity at the entrance and exit to the "gate", in order to determine if the integrity of the FME boundary is kept.

Using a Lidar based system, we can determine the direction, speed, and path of workers through the gateway. If an anomaly is detected, the supervisor is notified.

~This project will be completed by December 8.



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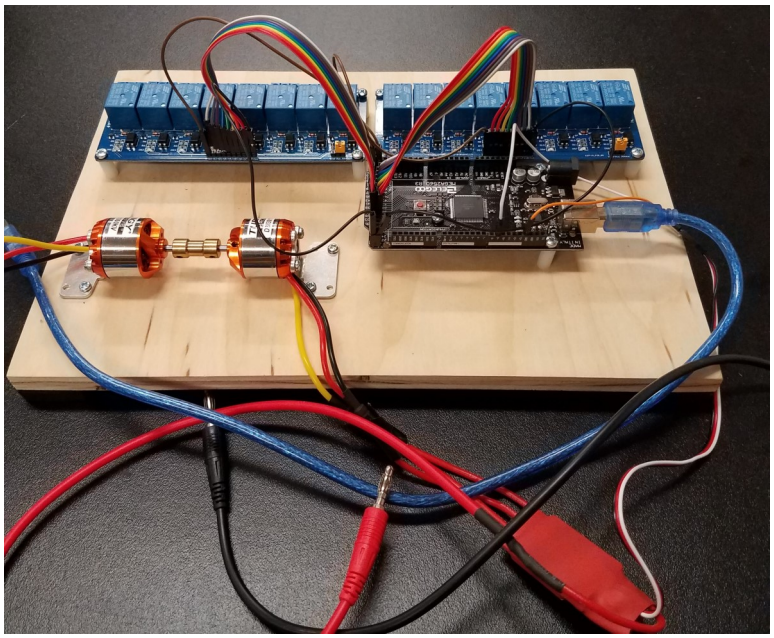
Micro Grid Challenge



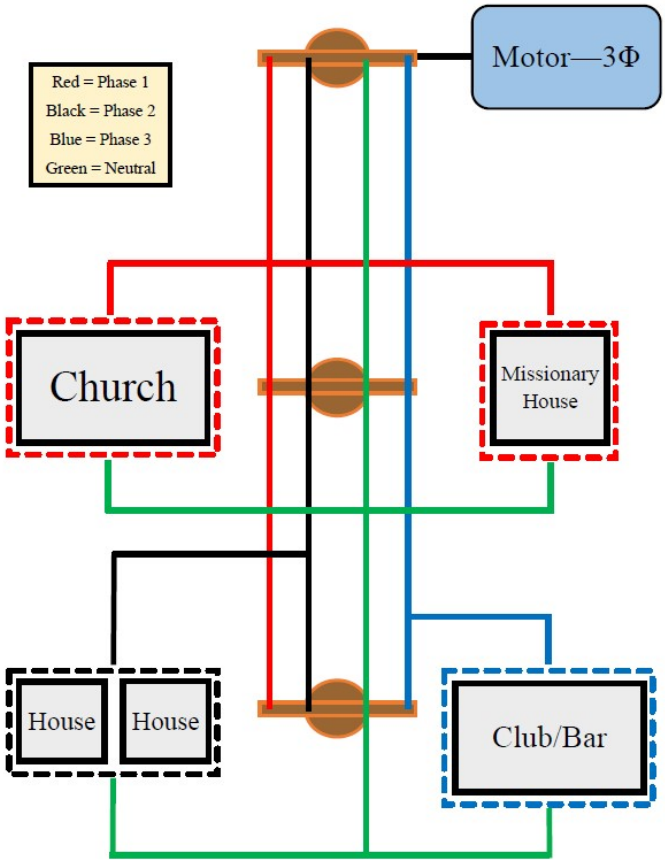
Class: Power Systems

-Still In Progress-

The IEEE has been pushing for rapid development of standards for micro grids in third world countries. For this class project, I was put in a group of three people and we were tasked with developing a small scaled model of a micro grid for an African village.

We were given a three phase, five volt, one amp generator setup which is to provide power to the scaled grid. The village must be laid out in a way that satisfies a mandatory power factor of 95 %.

An Arduino Mega is connected to eight single pole, double throw relays in order to simulate protective relay schemes, phase load balancing, and different loads for different times of days. Since the motor is a non-synchronous machine, different resistive, capacitive, and inductive banks are included in order to balance sudden changes in the load during different times of the day.



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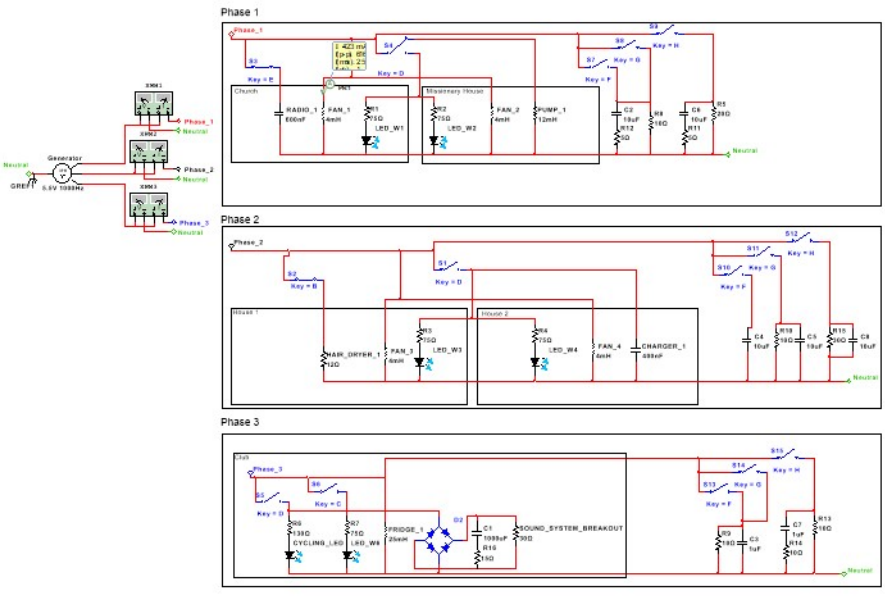
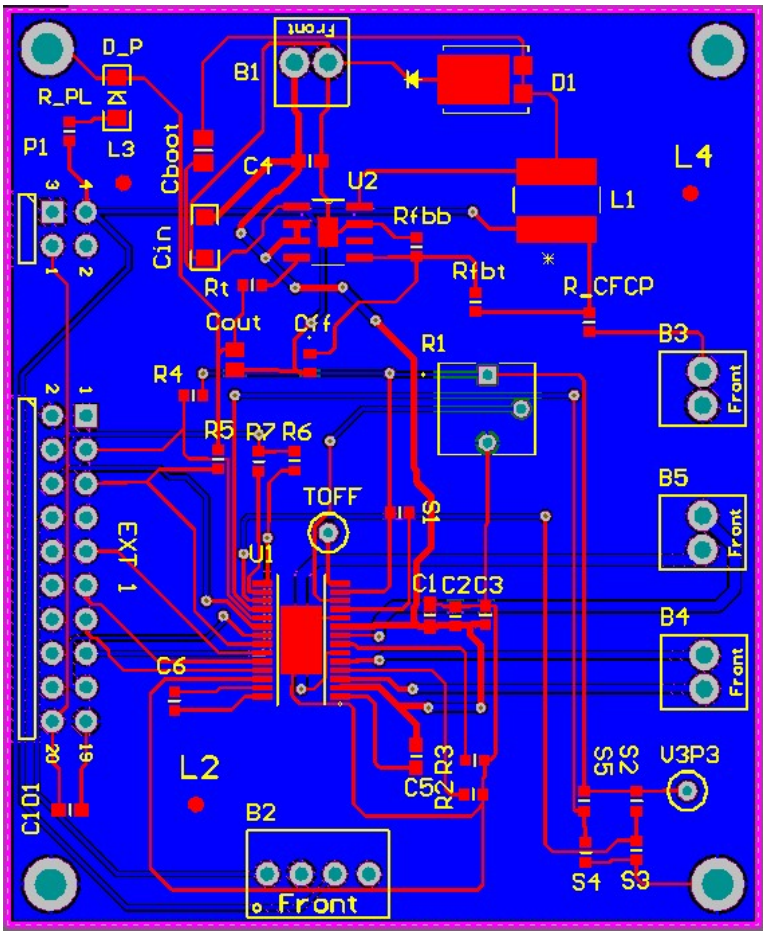
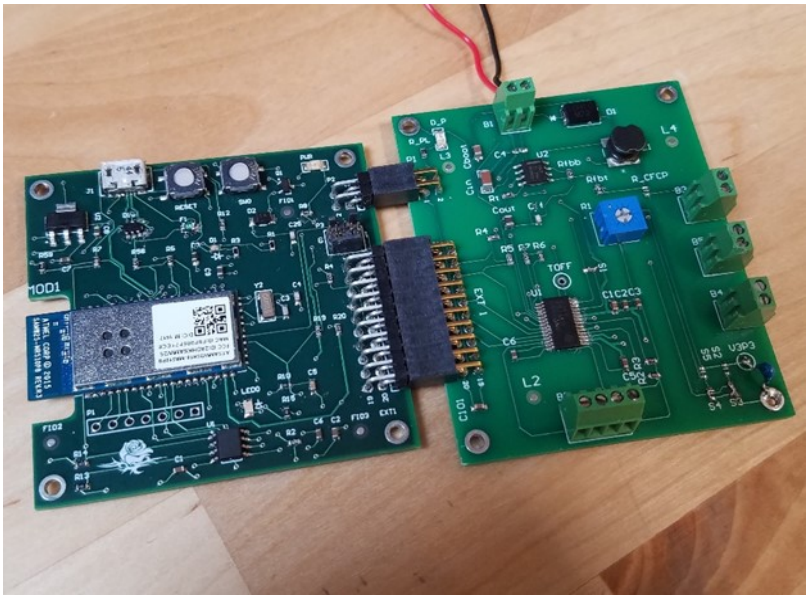


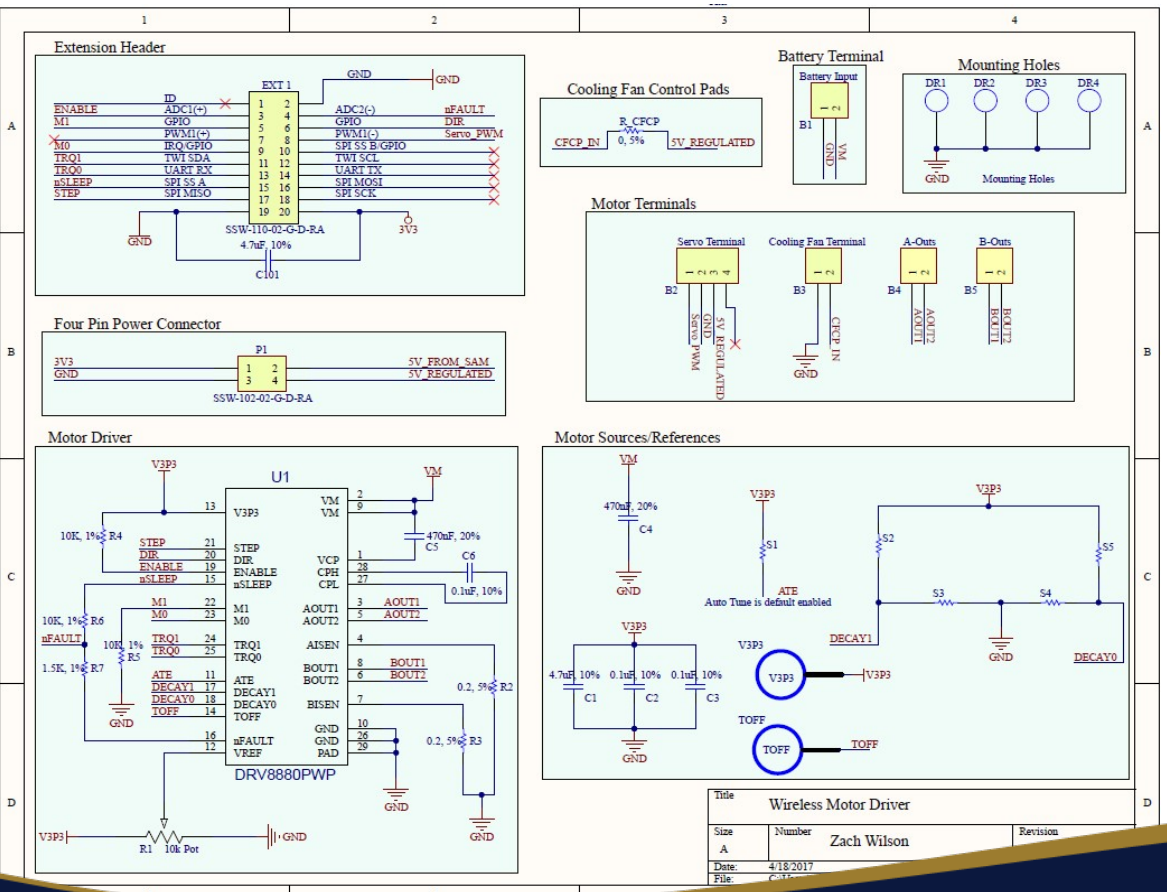
Wireless Motor Driver



Class: Application of Electronic Devices

The Wireless Motor Driver is an all purpose motor driver capable of driving stepper, servo, brushed, and non brushed motors. It boasts a wide range of acceptable voltages into its input, from 6 volt batteries to 45 volts.





I designed this project using Altium, then sent it to Sunstone to be fabricated, after which I personally assembled using a hot plate for the surface mounts and hand soldered any through hole components.

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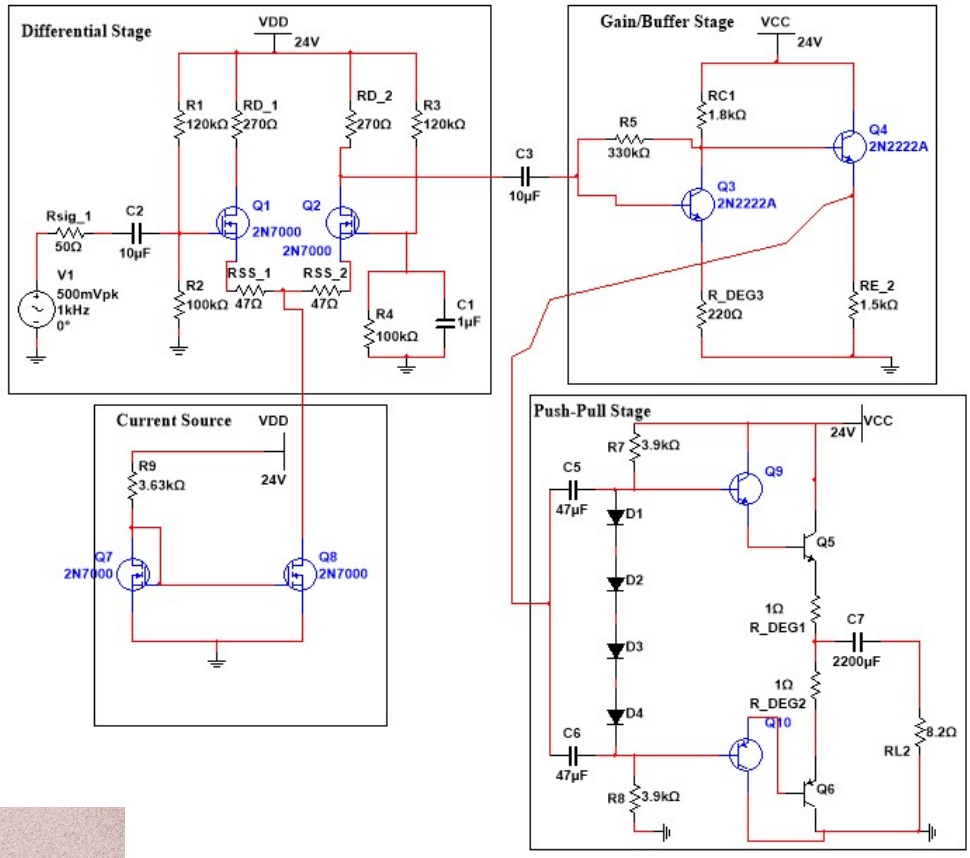
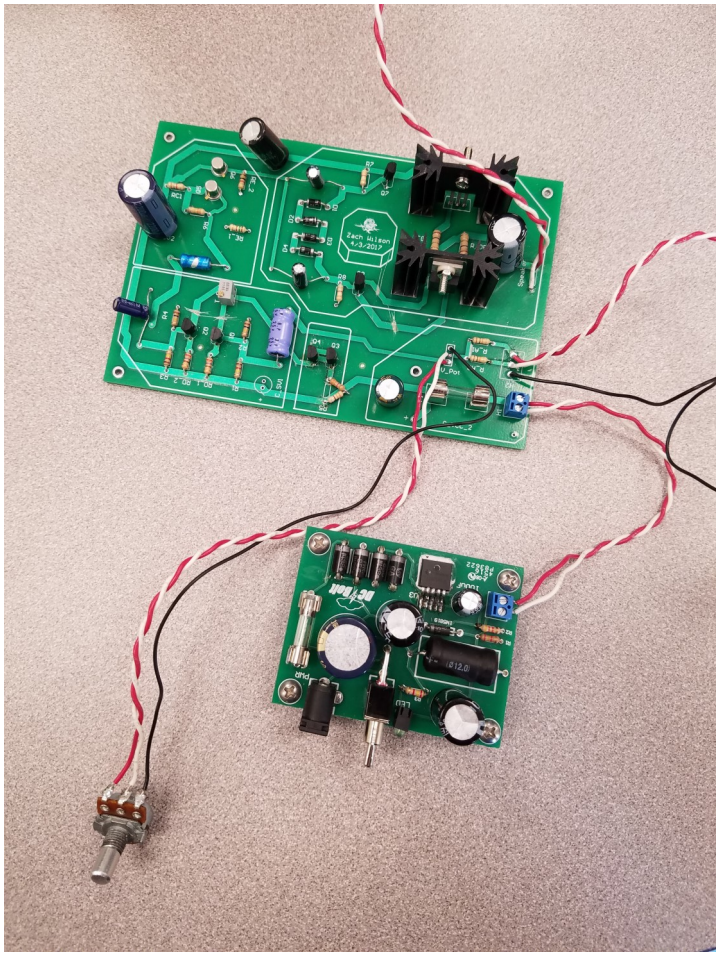
Audio Amplifier





Class: Application of Electronic Devices

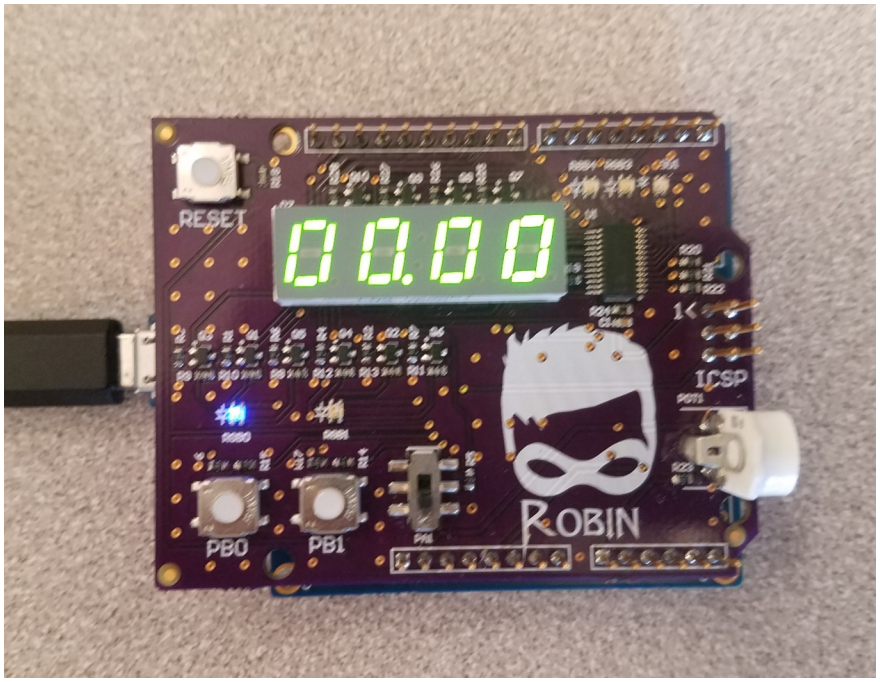
This is a self designed and self soldered discrete component amplifier. It consists of three main stages: The Differential with Current Source, the Gain and Buffer stage, and the Push-Pull Power stage.

I performed numerous hand calculations in order to gauge the beginning component values, and then moved into a simulating software called MultiSim in order to observe the frequency response of the theoretical values for the amplifier. These values were then adjusted in order to maximize gain and minimize harmonic distortions.

Once the final values were determined, the PCB was designed using Altium. The final board design was sent to Sunstone to be manufactured. Once the board was returned from manufacturing, I used a hot plate and solder paste to finish the assembly of the board.

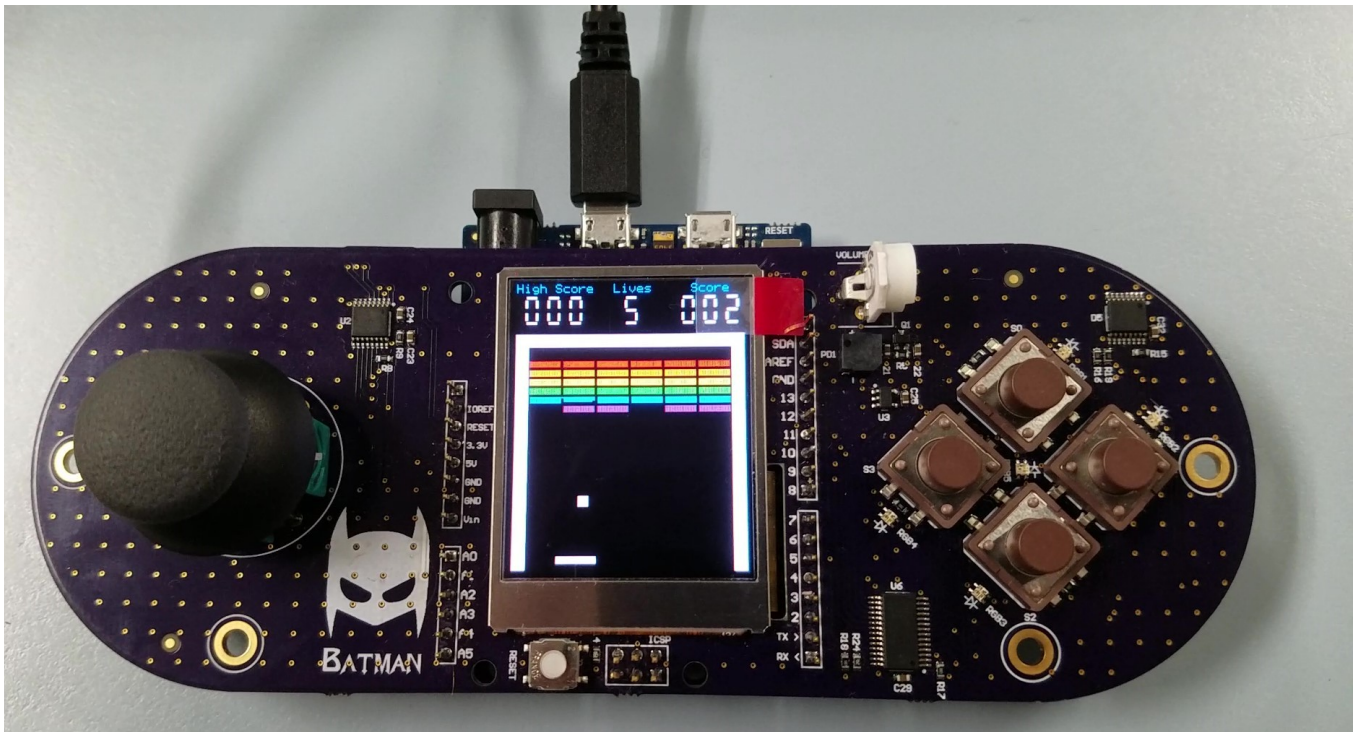
The speaker housing was created from a recycled wooden box from Good Will, The final result (with all but the input jack) can be seen on the left.

Programs in Assembly and C on The “Batman” and “Robin” Boards



Class: Micro Controller Architecture

In this class I learned how to program in Assembly and C. There were numerous notable projects from a system timer in Assembly to learn about operation delays, a Stop Watch, a Joystick position tracking systems with LEDs, as well as Atari Break out and Simon Says.



Maze Solving “Rescue” Robot

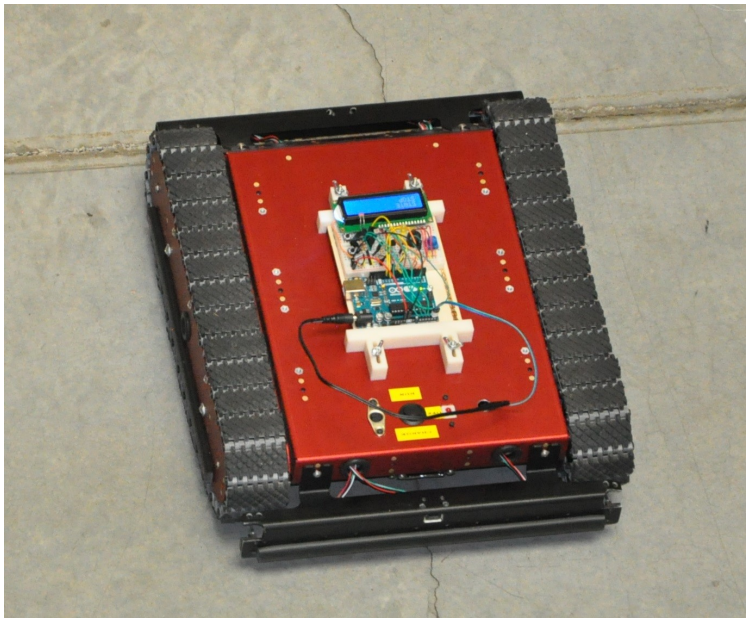
Class: Freshman Engineering Introduction

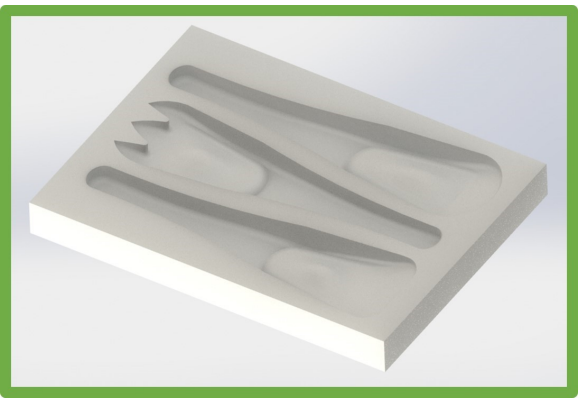
Using an Arduino Uno with Arduino C, I programmed a robot that would solve randomized maze configurations.

When it had made it through the maze, it then had to detect the presence of heat from heat guns to simulate that it had entered a burning building.

Once in the burning building, it would detect a light and follow it back to the source. Once at the source, it would detect a downward facing light and perform a “dance”, which consisted of spinning in circles and playing a song on a piezo speaker.

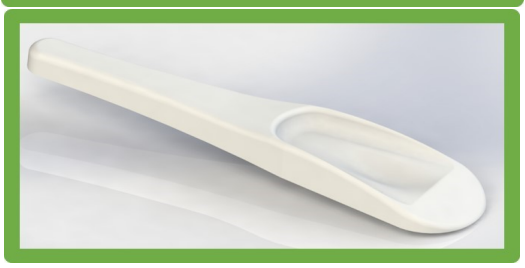
By this point, the “survivor had been rescued”, and the robot then had to back track its way out of the maze.





FoodWare

DIY Edible Cutlery



Class: Servant Engineering

Challenge: Eliminate Plastic Usage

Servant Engineering is a class designed to teach engineering skills with "Human Centered Design" principles. This means engineering with the user in mind. The focus of my class was to solve a world wide problem.

My group was challenged to eliminate plastic usage in our society. We focused in on single use plastics in the home.

Our solution was to create an organic replacement for disposable plastic cutlery. Our mold allows the user to create "Bread Spoons" from a few common household ingredients.

We won a grant from PSU's InventOR competition, sponsored by the Lemelson Foundation.

I gained a lot of experience in Human Centered Design, as well as formulating business models and market plans. I then had to learn the how to pitch a product as well as presentations to large audiences. We presented to a group of judges and over 300 people.

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Custom Electric Guitar

This was the first time I was first exposed to the concept of a design process

I learned the basic concepts of CAD work, soldering, wiring, and designing a project.

I had to research basic circuit principles to understand potentiometers as well as capacitors to understand their effects on the sounds, as well as how to avoid ground loops when wiring.

I had to present to a group of judges and present my newly acquired knowledge of magnetic effects of coils in producing different sounds as well as the resonant effects of different woods.

Pneumatic Oscillating “Wobbler” Engine

Class: Freshman Engineering Introduction

This was the first project of my college career for my Introduction to Engineering course.

I had to derive the necessary equations in order to design the values and lengths for each individual piece.

I learned the basics of SolidWorks modeling software in order to create a technical drawing and 3D model of the engine.

The next step was to learn the basics of machining. I used a vertical and horizontal band saw, three axis vertical mill, a drill press, and various other hand tools in order to make the physical working product seen below.

This project taught me a lot about proper design techniques, and the importance of knowing the difference between a design and reality.