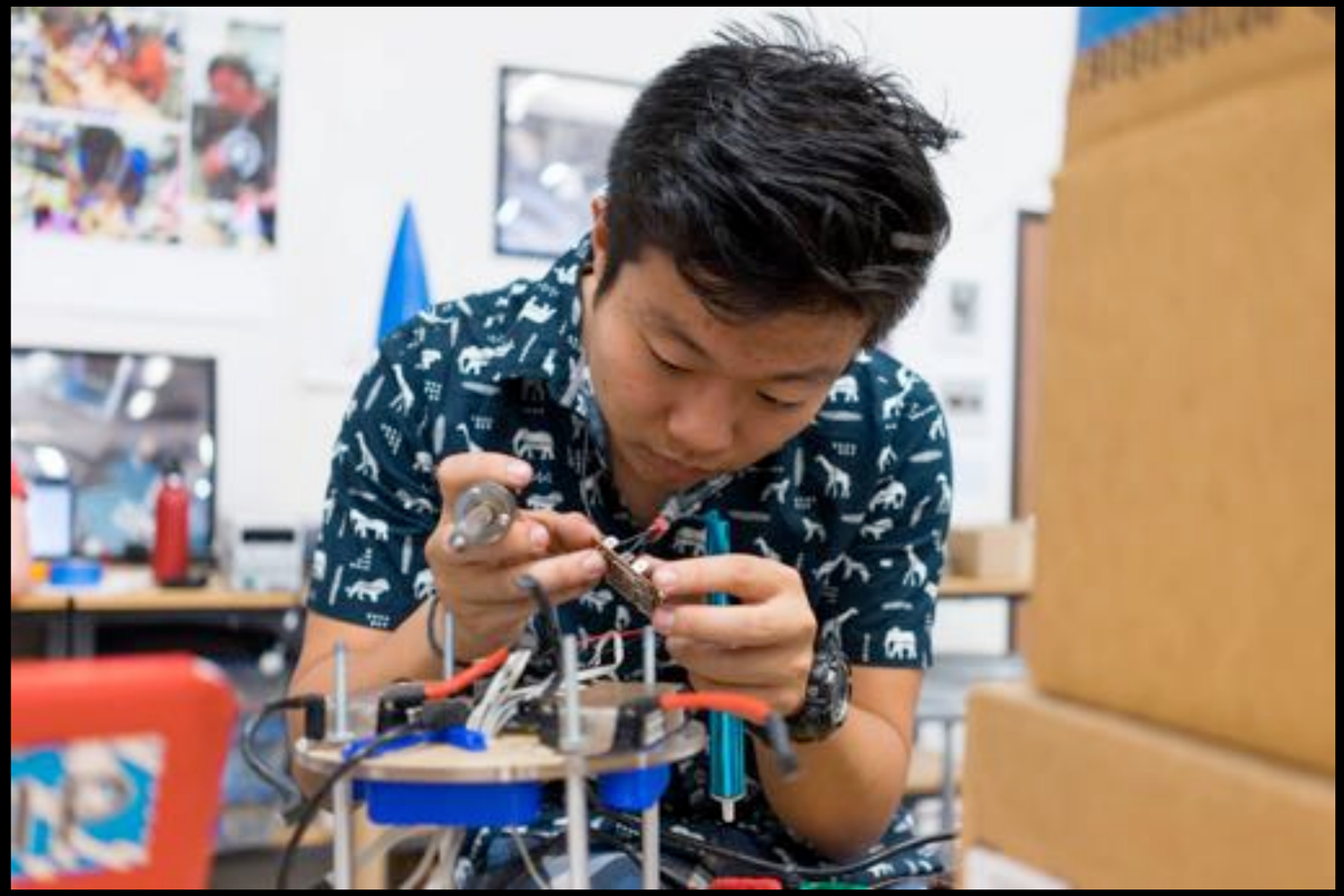
Dennis Ren
Engineering Portfolio

*Not including projects at Apple, Amazon and Tesla due to NDA



Chronology

11,000 Hours towards Mastery

2018	FociMap	24 hr
	Amazon Go Internship	660 hr
	Colossus SFS	2000 hr
	Squrell - RMDBS	40 hr
	DLSR Hack	10 hr
	Janktop, Laptop Hack	30 hr
2017	Self Driving Car	30 hr
	Temporal Behavior Experiment	250 hr
	Apple Internship	660 hr
	Digimom, IoT Tasks	80 hr
	Miniture EEG AFE	40 hr
2016	Tesla Internship	660 hr
	Vulcan - 1	800 hr
	Apolloptics Designs	200 hr
	Robot "John Cena"	25 hr
2015	Tesla Coil Transmission	80 hr
	Micromouse	200 hr
	Static Fire System	300 hr
2014	Enrolled at UCSD	
	Electric Skateboard	150 hr
	VEX Robotics	1800 hr
	Remote Light System	30 hr
2013	Radio Telescope	40 hr
	LC Meter	20 hr
	Portable Headphone Amp	8 hr
	Subwoofer Amp	5 hr
	4-Stage Coil Gun	50 hr
2012	SG3525 Class E Amp	35 hr
	Spary Bottle Tesla Coil	30 hr
	High Heat Disipation Full Bridge	80 hr
	Dual Resonance Solid State Tesla Coil	2500 hr
	SMPS Design	230 hr

2016-2018
2,000 Hours

Project Colossus
Cryogenic Bi-Propellant Liquid Engine Test Stand

Chief Engineer/ Project Manager

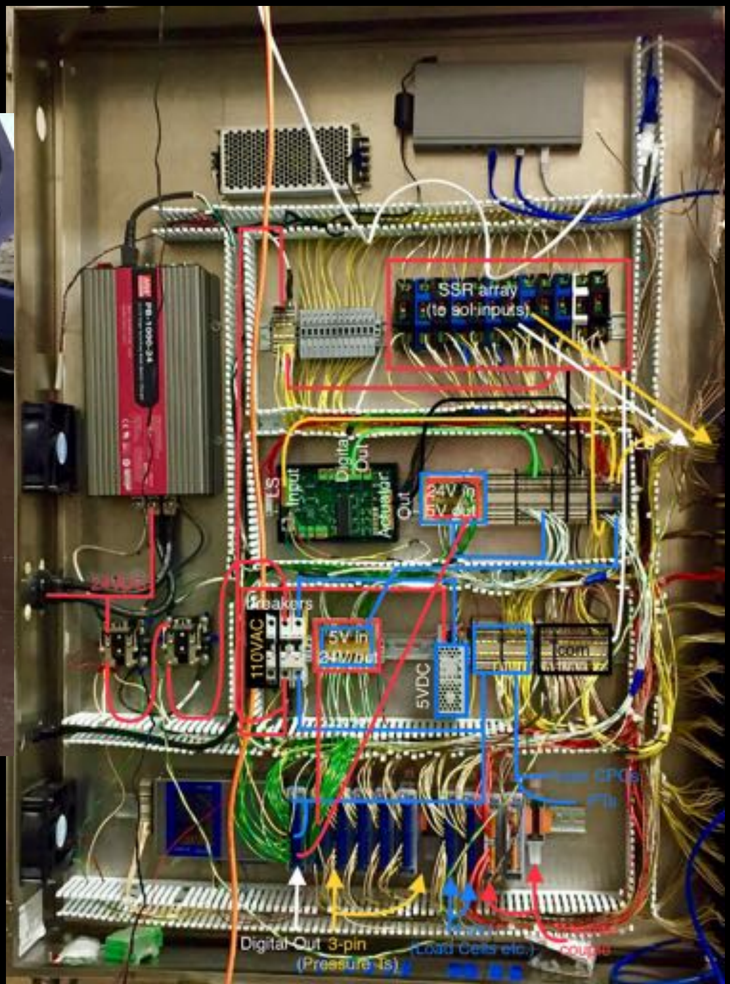
- Set to disrupt the propulsion development community by offering an affordable testing solution without sacrificing capabilities
- Raised more than $330,000 worth of project funding through sponsorship, in-kind donation, and research grants
- Managed a diverse team of 30 engineering students, designing and constructing a NASA Sponsored, 5000 lbs trust-capable rocket engine test trailer
- Hosted 4 Technical Interchange Meetings and 2 Design Reviews from NASA's MSFC and SSC team of experts

Project Colossus Electrical System

Chief Engineer

2016-2018
2,000 Hours

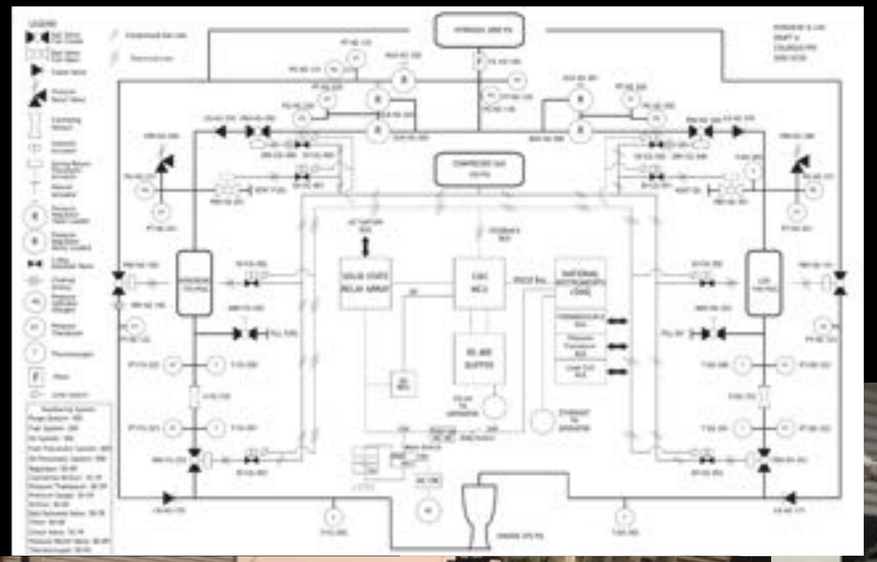
- Designed the custom command and control PCB with embedded microcontroller
- Directed the design and layout of the electrical panel
- Lead the build and bring up of the entire electrical system



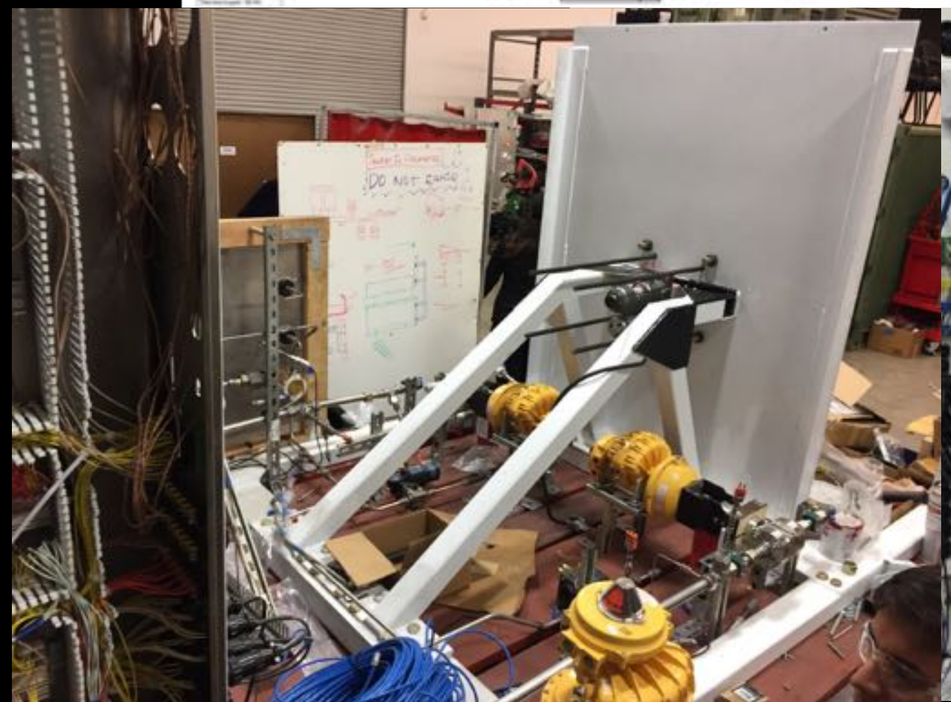
Project Colossus
Mechanical Systems

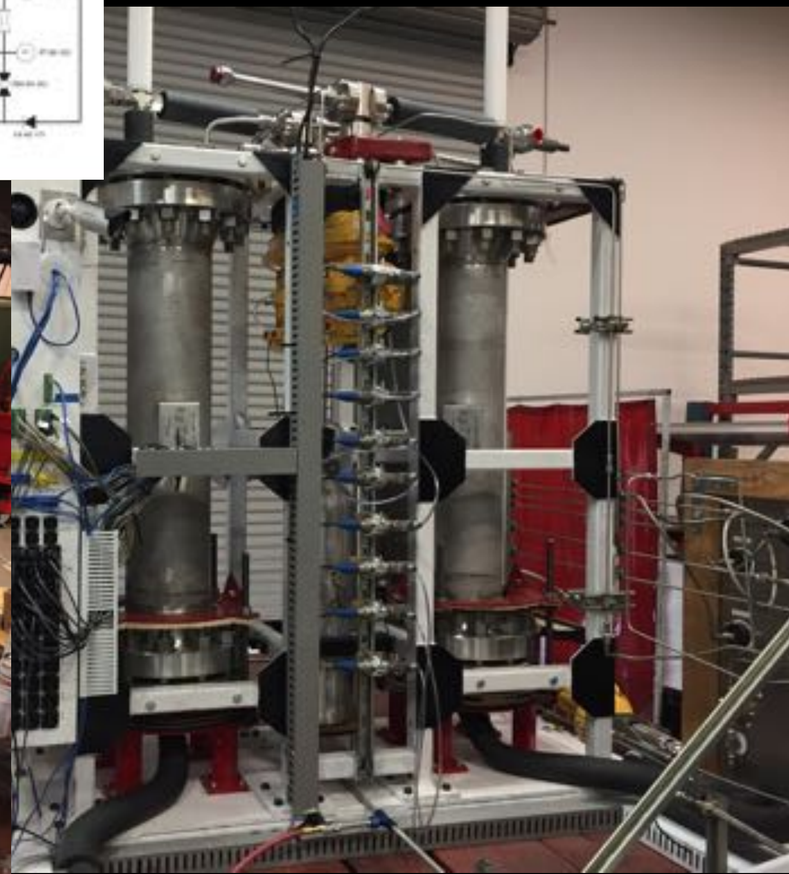
Chief Engineer

2016-2018
2,000 Hours



- Lead the design of the structural and fluid portions of Colossus
- Conducted FEA and CFD analysis to meet design requirements
- Created and executed the fabrication plan that lasted a year





Project Colossus Publicity

2016-2018
2,000 Hours

- Presented Colossus at
  - International Space Development Conference 2018
  - RRS Rocket and Science Symposium 2017, 2018
  - SpaceVision 2016

- **Jeff Bezos checking out Colossus**

Featured in:

THE PLANETARY SOCIETY

UC San Diego
JACOBS SCHOOL OF ENGINEERING

3kW, Dual Resonance Solid State Musical Tesla Coil

Hobby

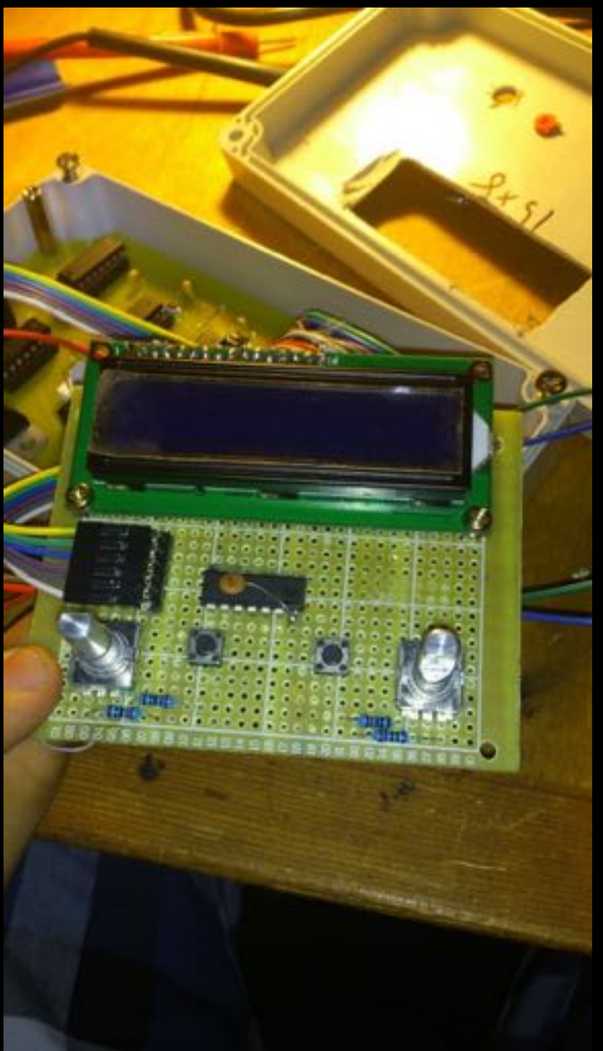
2011 -2012
2,500 Hours

- Individually designed and built as a hobby
- Operates at 75kHz
- Musically Modulated
- Featured in Chinese **National TV**

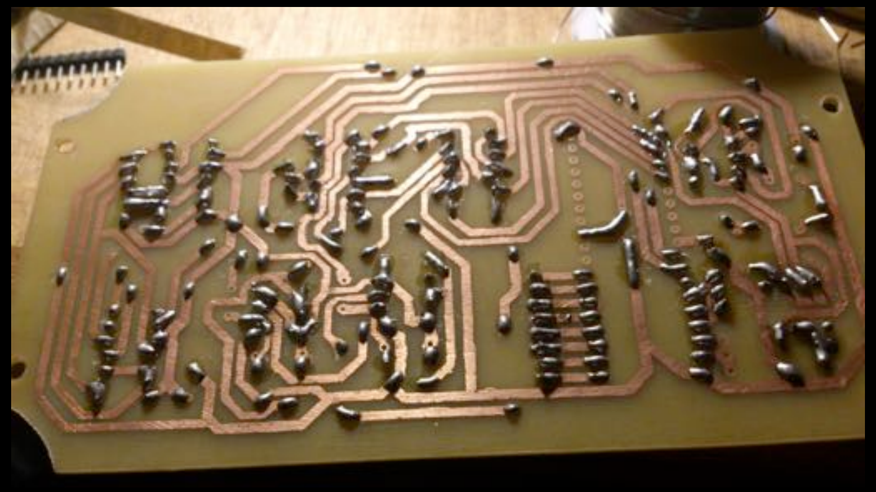
3kW, Dual Resonance Solid State Musical Tesla Coil Control Interface

2011 -2012
2,500 Hours

Hobby



- Custom made control box with encoder input and LCD display
- Multi-level menu UI on control box
- Hand made PCB via toner transfer
- Fiber optics cable coupling between control box to the driver

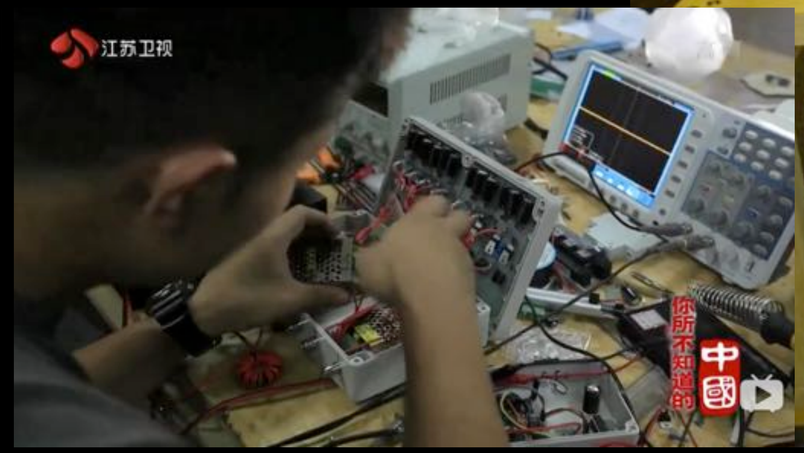


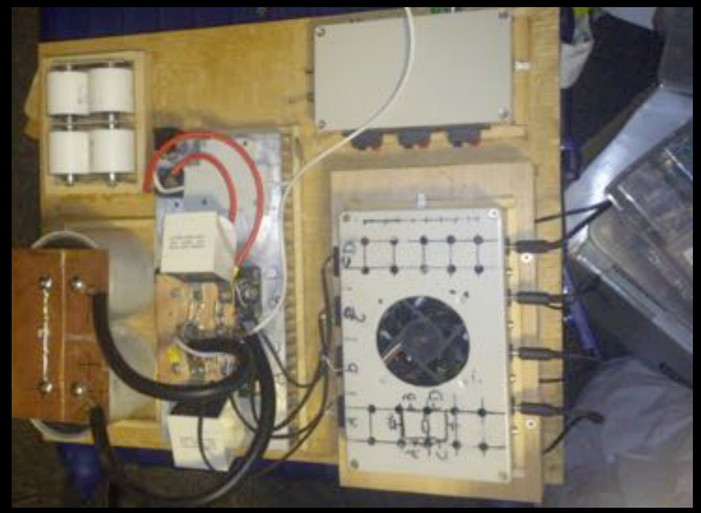
3kW, Dual Resonance Solid State Musical Tesla Coil Tank Circuit and Driver

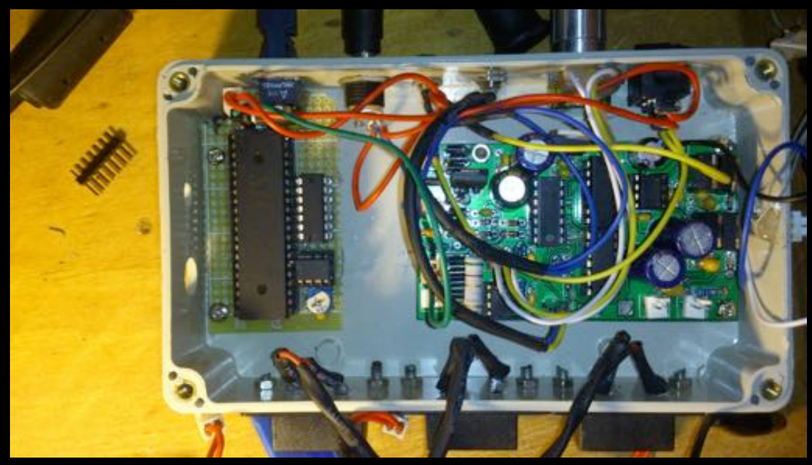
2011 -2012
2,500 Hours

Hobby

- 4 channel isolated floating IGBT drivers, custom designed, hand fab'd PCBs
- Full bridge with two-CM300 IGBT Modules
- All custom designed and hand built







Vulcan-1 Liquid Rocket

2015 -2016
800 Hours

Electronics Systems Lead

- First university team that flew a 3D printed rocket engine
- Bi-propellant sounding rocket powered by an additively manufactured engine (Inconel 718)
- Reached apogee of 10,000 ft
- Designed and constructed the Avionics, Ground System, Ignition System, and Wireless Arming System

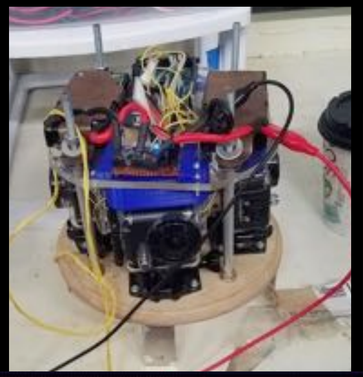
Featured in: POPULAR SCIENCE Bloomberg IFLSCIENCE! SPACE.COM

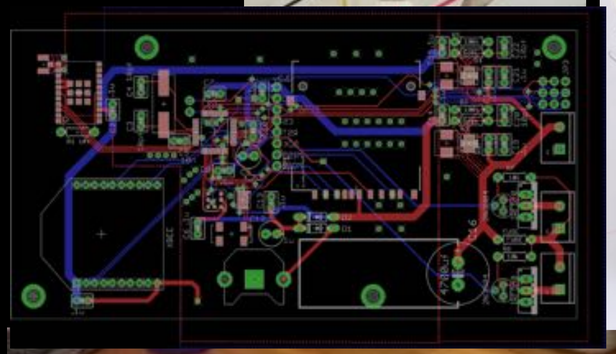
Vulcan-1 Avionics (ARM, 8051)

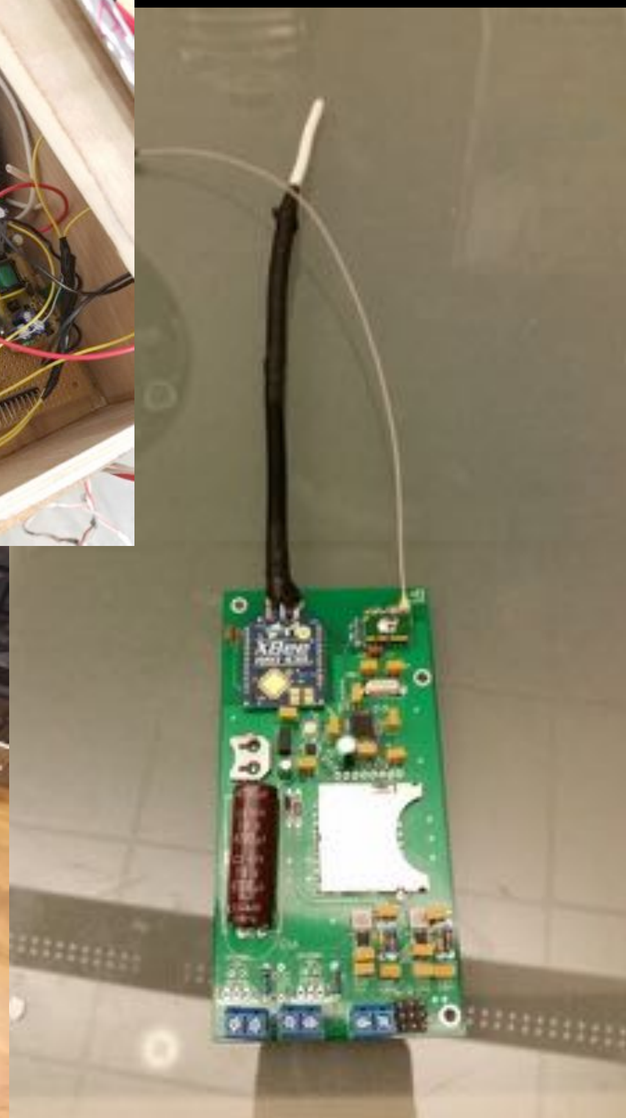
2015 -2016
800 Hours

Electronics Systems Lead

- Main Avionics Board powered by an ARM Cortex-M3 MCU, features a barometer, a GPS unit, two ch of pyro control, and an XBee radio
- Broadcasts rocket's GPS coordinate for recovery
- Deploys parachutes according to pressure, acceleration, and software timeout
- Toggled between stand-by and operational by the Wireless Arming System
- Automatically turns on hacked cameras before flight





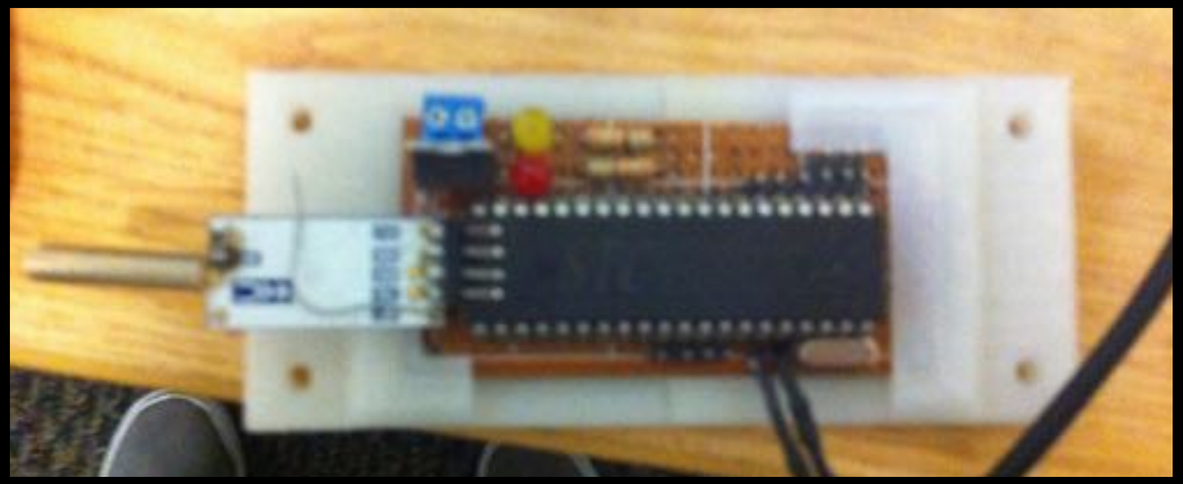


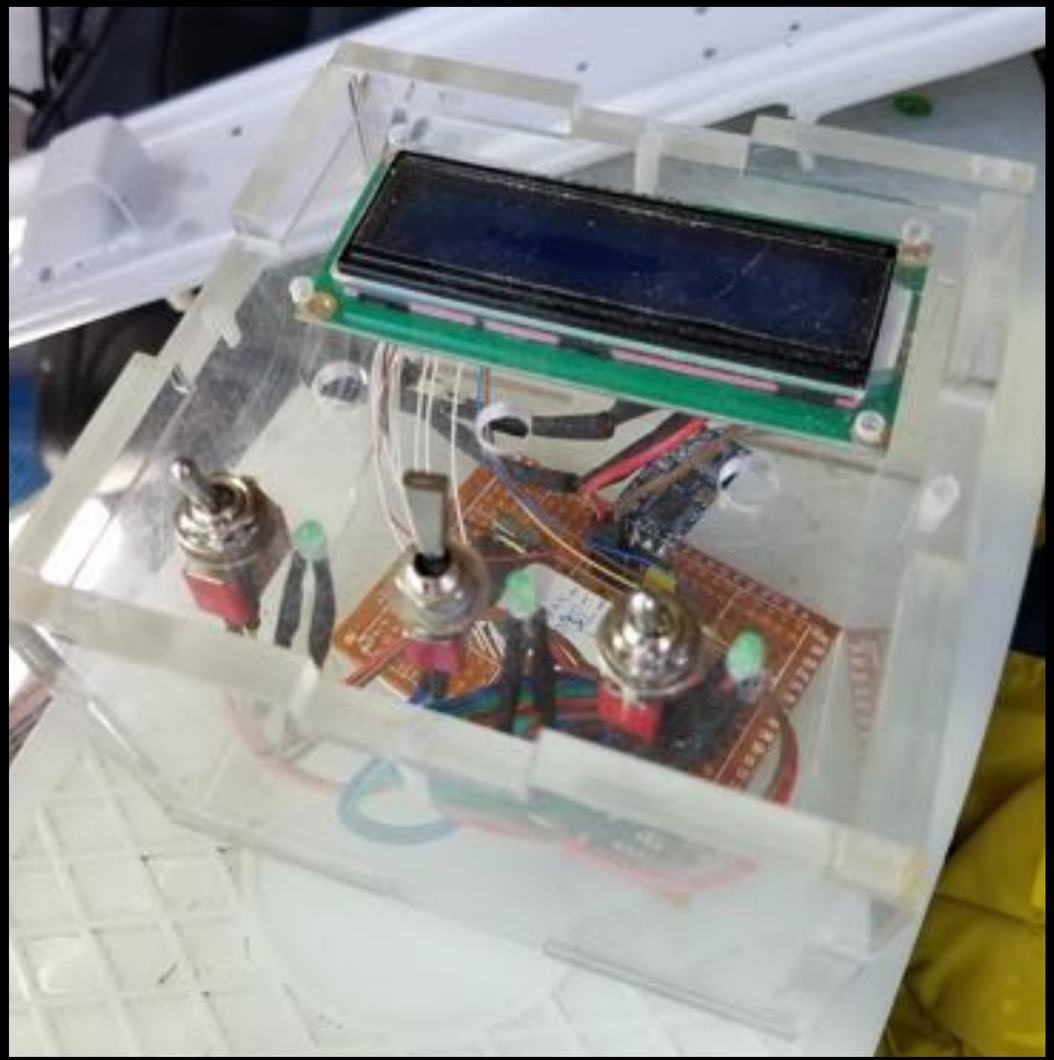
Vulcan-1 Wireless Arming (8051)

2015 -2016
800 Hours

Electronics Systems Lead

- System annexed to avionics as a safety redundancy
- Manages the power supply to the avionics bay
- Wireless half-duplex communication via UART-over-the-air
- LCD user interface provides real-time system status report



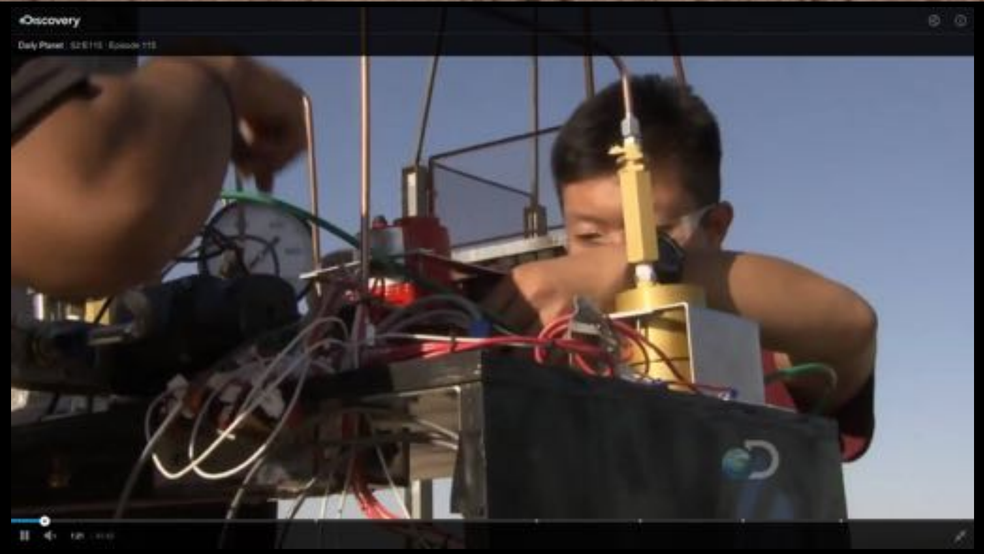


Static Fire System (2015)

2016
300 Hours

Electronics and Sensors Lead

- A rocket engine testing system capable of withstanding 1,000 lbf of thrust and 1000 psi in the propellant tanks
- System equipped with pressure transducers, thermocouples, and load cell sensors
- Successfully tested Vulcan, a 750 lbf 3D printed rocket injector + chamber assembly on April 18, 2015
- Featured on Discovery Channel's Daily Planet

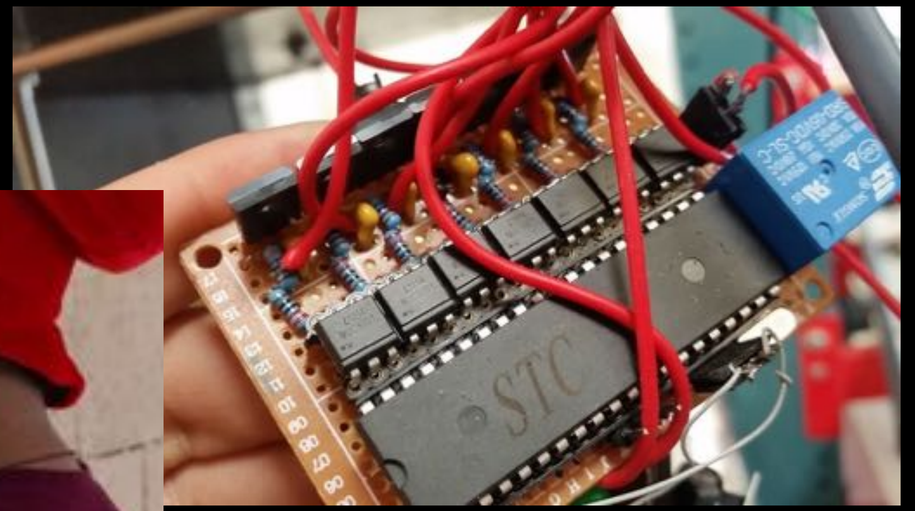


Static Fire System Command & Control (8051)

2016
300 Hours

Electronics and Sensors Lead

- Used RS-232 protocol to remotely control the rocket engine test stand.
- Utilized AT89C51 series MCU at both user and instruments end
- Actuated solenoids by an array of triac + optocoupler solid state switches
-

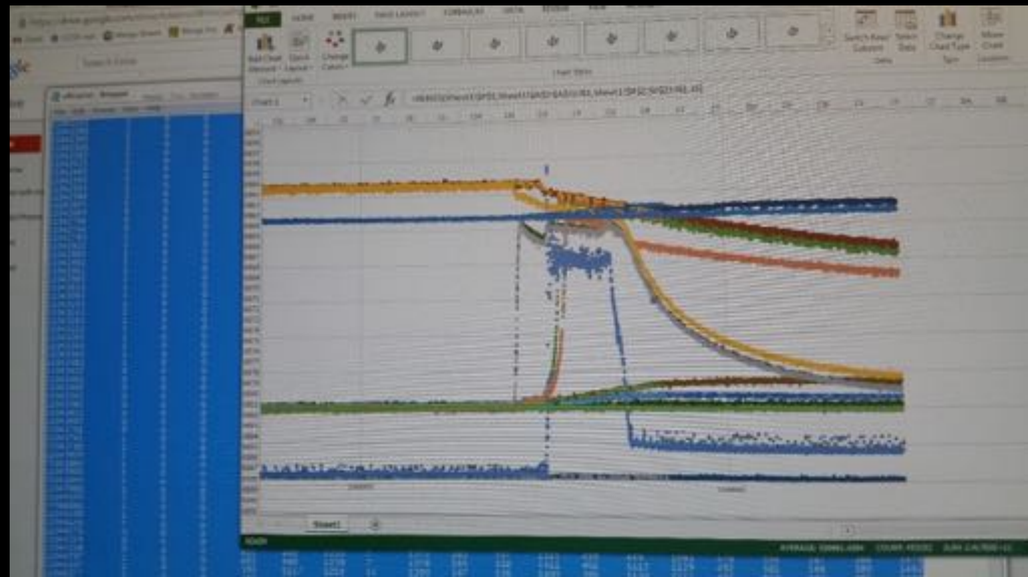


Static Fire System
DAQ Rev1 (ARM)

2016
300 Hours

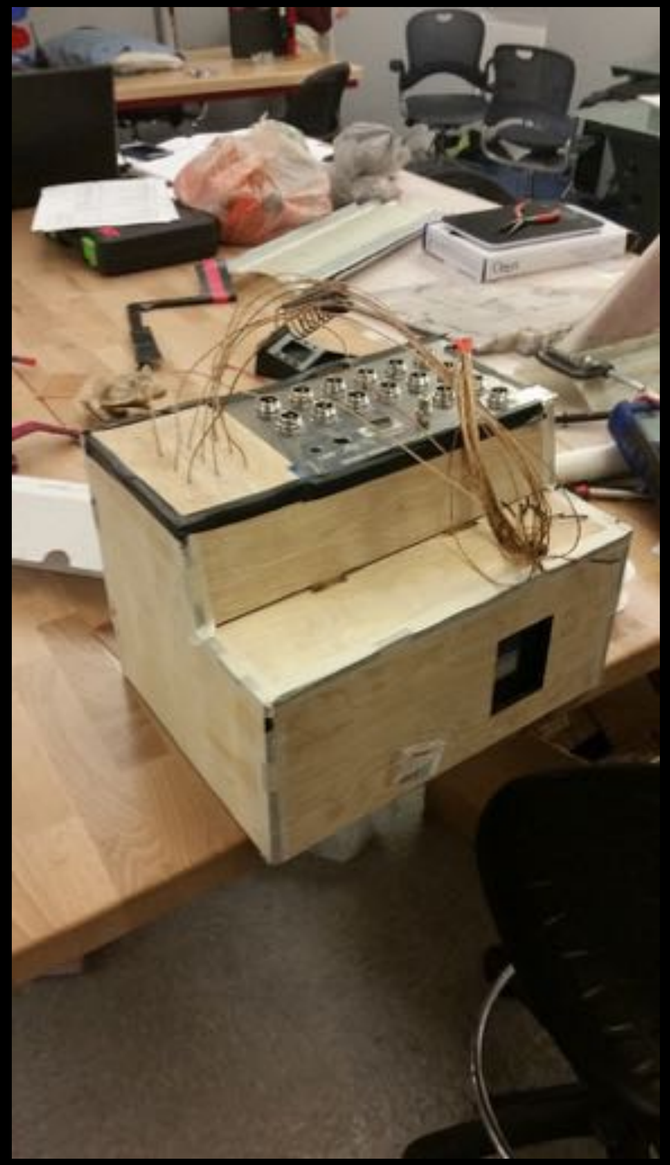
Electronics and Sensors Lead

- Designed the circuit, programed the MCU firmware, and fabricated the housing and panel
- Total of 22 Channels of data collected
- Project was built on a protoboard
- Utilized STM32f106 with custom written firmware
- Analog data is multiplexed then fed to internal ADC
- Used enhanced UART to transfer data to the computer logger



SFS- DAQ Rev 2

2015
10 Hours



- Utilized Gantner Instruments Commercial DAQ system
- 22 Channels of data collected
- Designed and built protective casing with user-friendly panel interface

Self Driving Car

Course Work

2018
30 Hours

- Powered by a raspberry pi with a single camera
- Utilized Keras And Donkey Python libraries
- Achieved self driving on a track taped on concrete after training

FociMap - 1 camera 3 dimensions

2018
24 Hours

SD Hacks

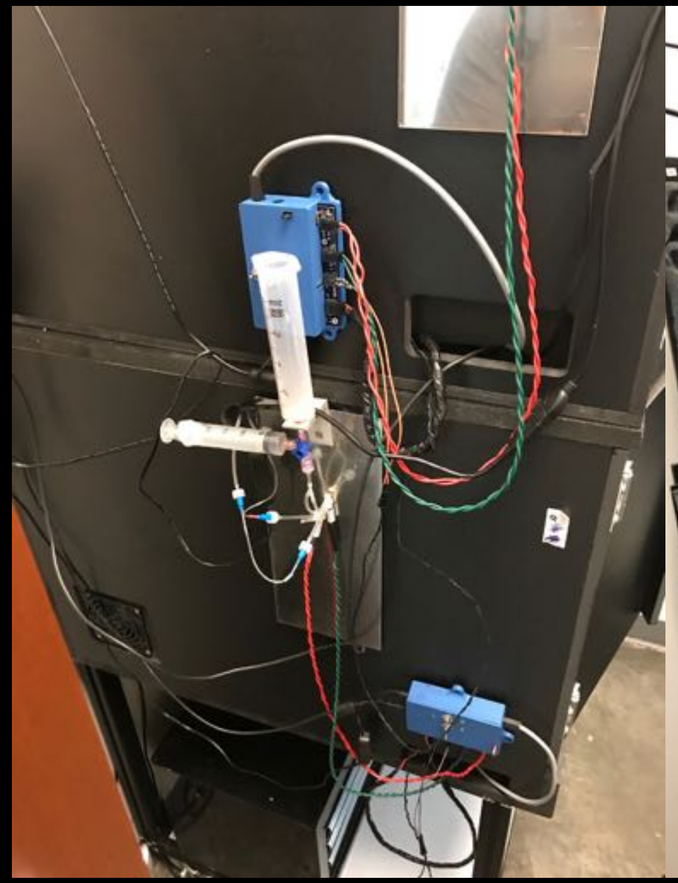
- Developed algorithm that turns image of different focus distance to a depth map
- Utilized OpenCV in C++ and Python
- Built custom iPhone app to capture images
- Depthmap generation takes place on a cloud compute server powered by node and Express

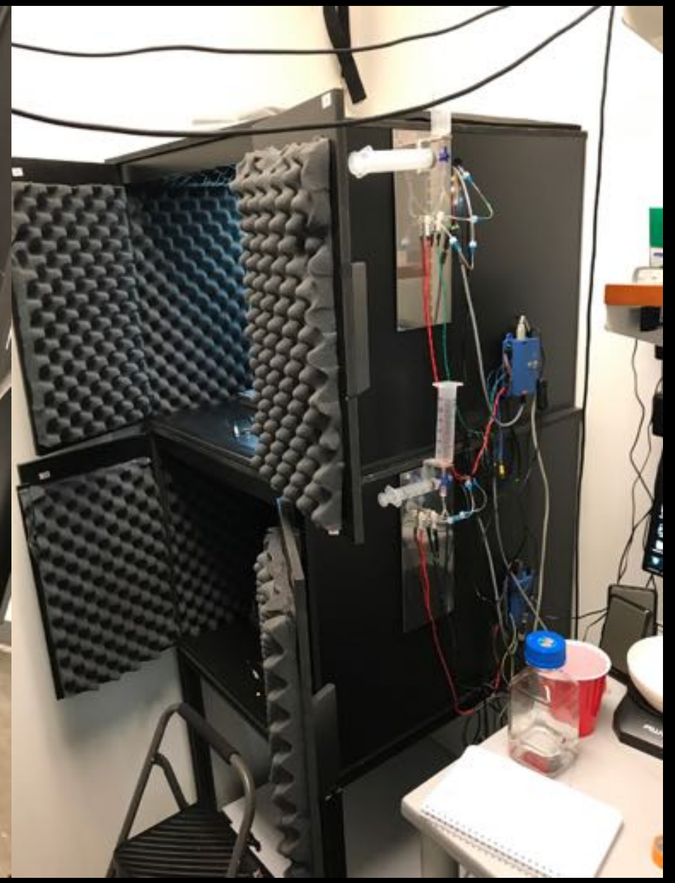
Mice Behavior Training System

2017
250 Hours

Salk Institute - Shtrahman Lab

- Designed a fully automated mice behavior training system by automating rewards for good behavior
- System includes
  - PCBA of audio driver, action detector, and solenoid driver
  - Qt GUI that displays training stats in real-time
  - Mechanical assembly of treadmill and reward fluids
- Preps subjects for brain imaging with the neuroscience team



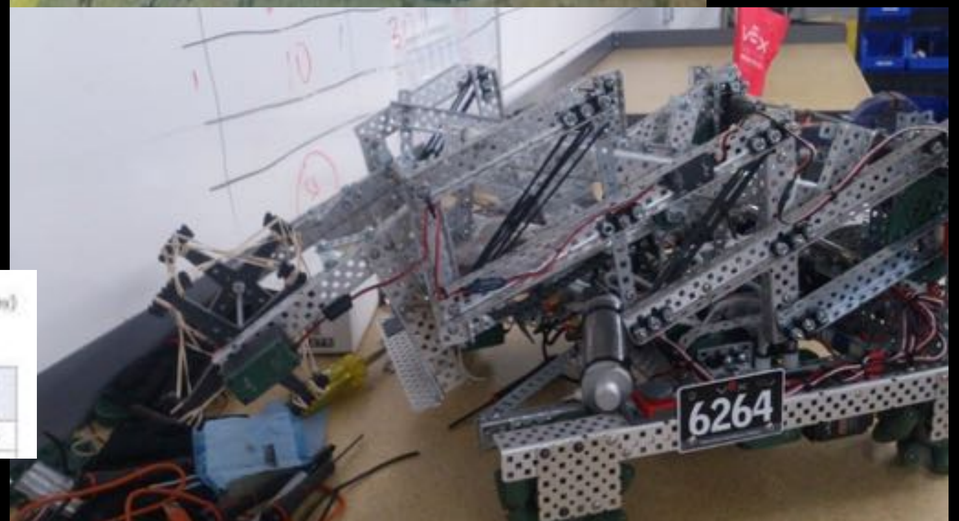


VEX Robotics

Founder, Caption, World Record

2012-2014
1,800 Hours

- Founding father and Captain of a team of 15 HS students
- World Record - Programming Skills of VEX Toss-up(out of 7,000 teams worldwide)
- Think Award at VEX World Championships for Programming Exellence
- Implemented control theory, closed loop feed-back, PID control



Programming Skills

green highlighted = Currently qualifies for World Championship (if the season ended today)

Filter Results: 2013-2014 ▾ Select To Filter ▾ submit Clear

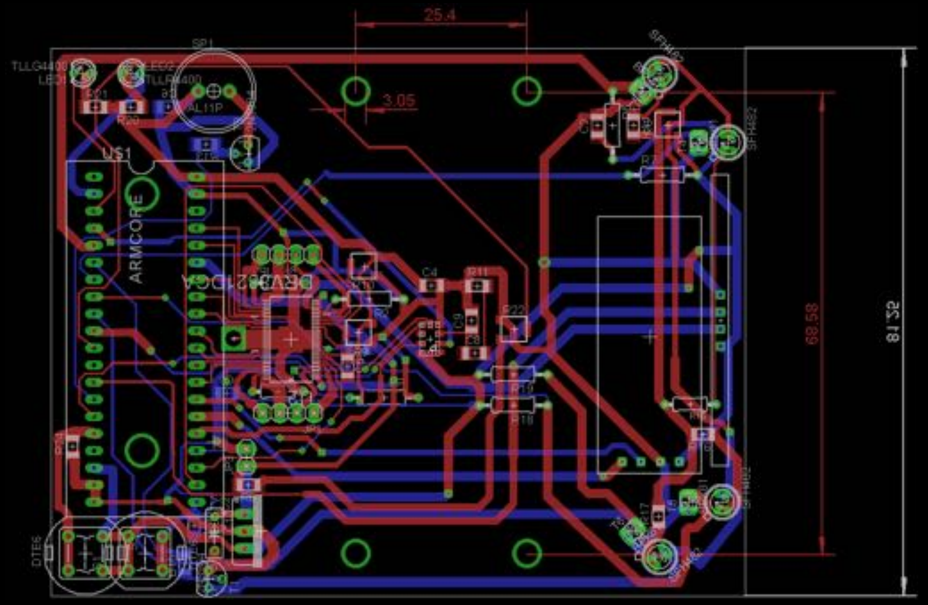
World Rank	Score	Team	Team Name	Team Organization	Team Location	Event	Date
1	86	6264	The Shavikbots Alpha	Shavnigan Lake School	British Columbia, Canada	British Columbia Provincial Championship	2/22/14

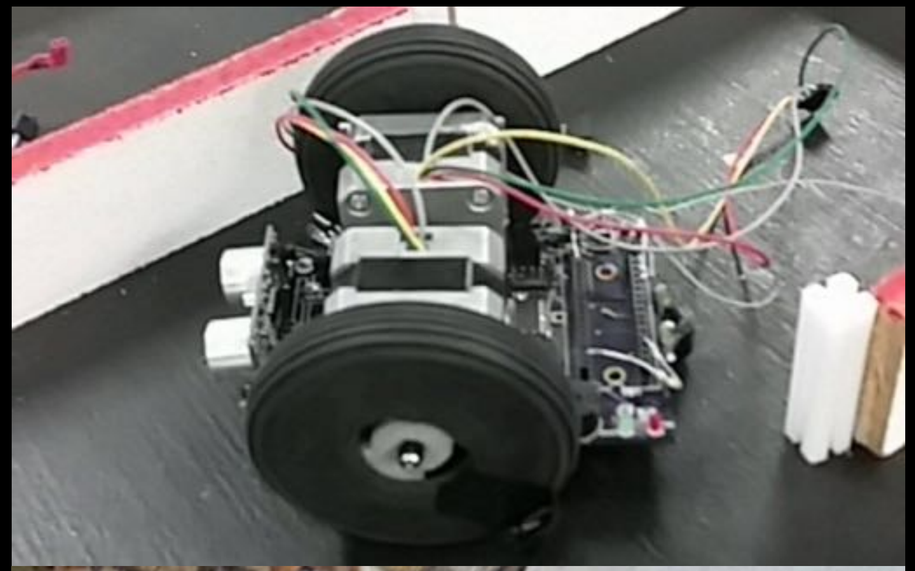
IEEE Micromouse (ARM Cotex M3,EDA)

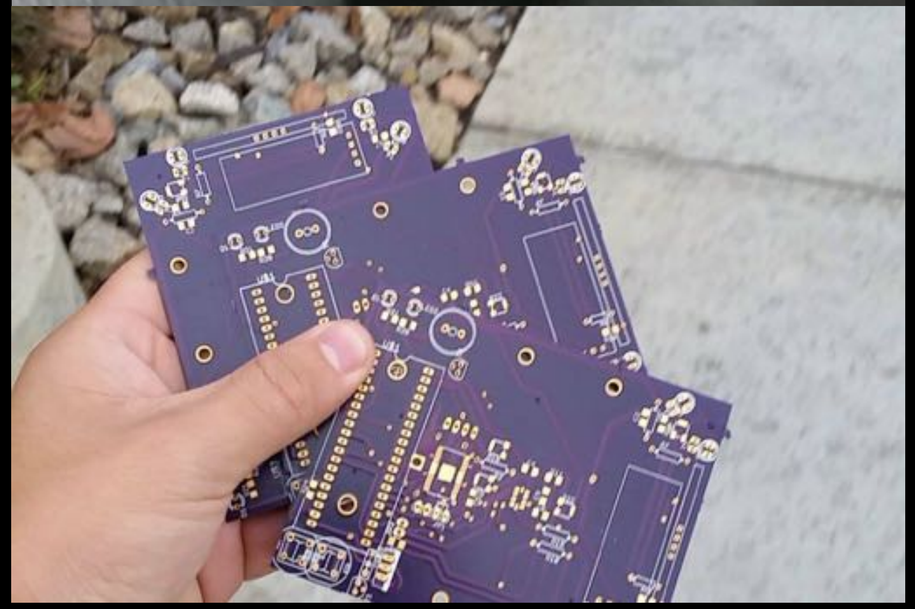
2014-2015
300 Hours

Team Lead

- Led a team of 6 entry level students
- Designed PCB in Eagle CAD
- Utilized STM32f106 with custom written firmware
- Has four IR proximity sensors onboard
- Capable of solving maze using flood-fill algorithm







Squrell - RMDBS implemented in C++

Course Work

- Able to interpret SQL commands and store data to a single file in binary format
- Utilized Chain of Responsibility, Factory, Facade, Singleton, and Visitor Design patterns
- Implanted linked list data structure to relate different data blocks

Digimom, a IoT To-do List

3rd place, Hard Hack

2015 -2016
80 Hours

- An IoT todo list that displayed a cloud-synced list of tasks managed by an android app
- Built in 24 hours during a Hackathon, used Atmel Xplained Pro with auxiliary custom 8051 LCD drivers
- Used PubNub as Data Stream Network
- Later refined to a acrylic box for better demonstration

Janktop, the Maciest PC

2017
30 Hours

Hobby

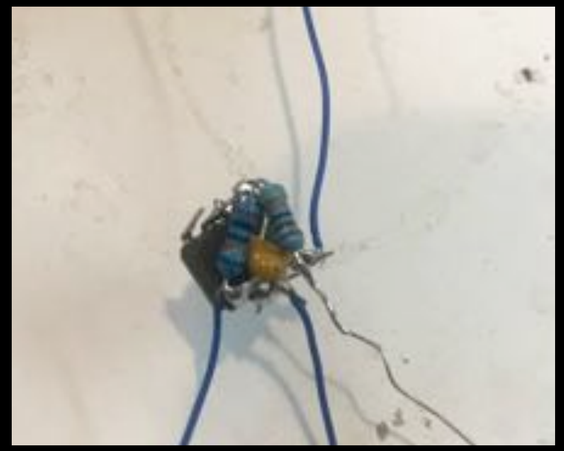
- Modded a Acer Swift 3 laptop to look and function like a MacBook
- Installed Apple OEM touch pad and enabled multitouch
- Replaced stock SD card reader and audio codec with USB connected replacements
- Added an additional USB hub to accommodate these additions
- All additions were trimmed to fit in the original shell
- Vinyl wrapped finishing

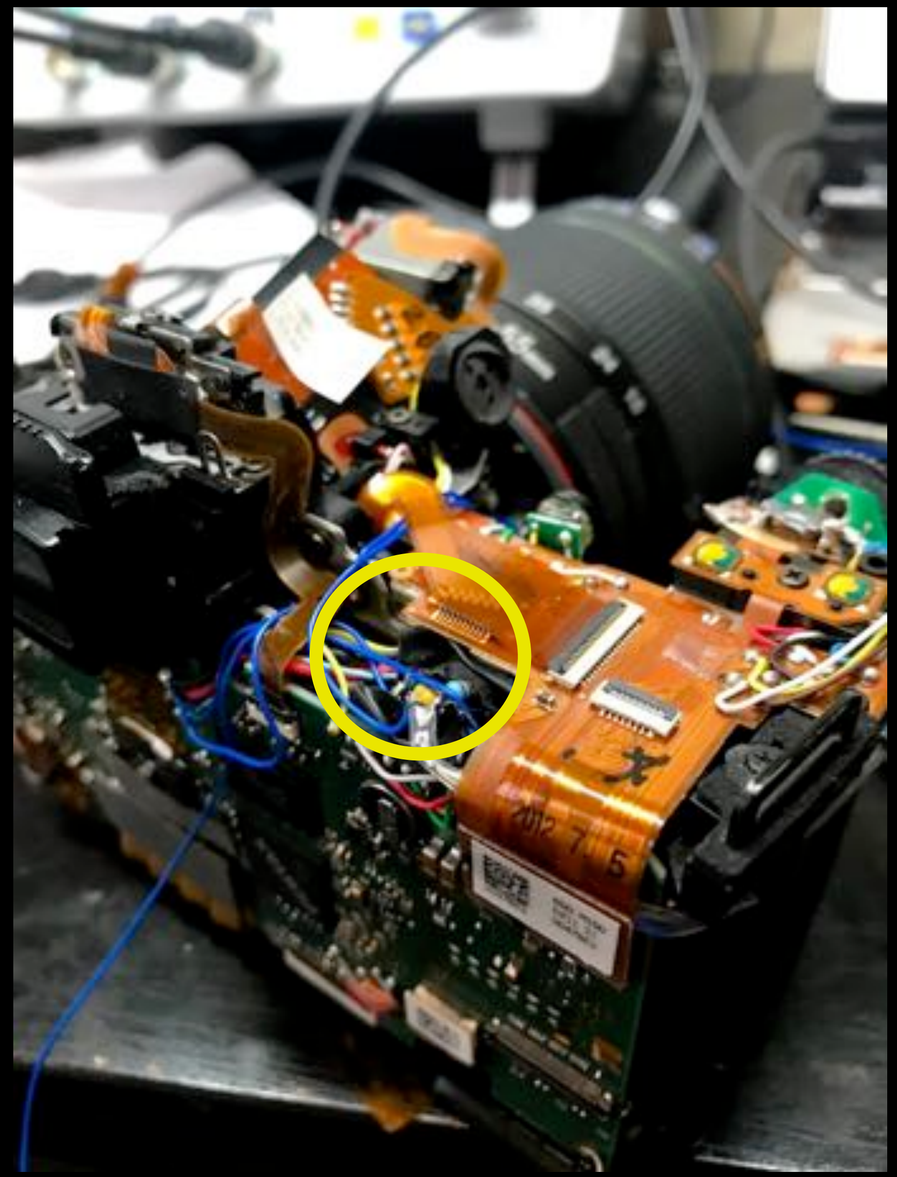
DSLR Hack

2018
10 Hours

Hobby

- DSLR ceased to work after falling into the ocean
- Diagnosed that the aperture control was shorted
- Replaced it with a timer circuit to couple the aperture reset to the shutter, fitted all mods under the shell
- Partially function now
- Takes great pictures

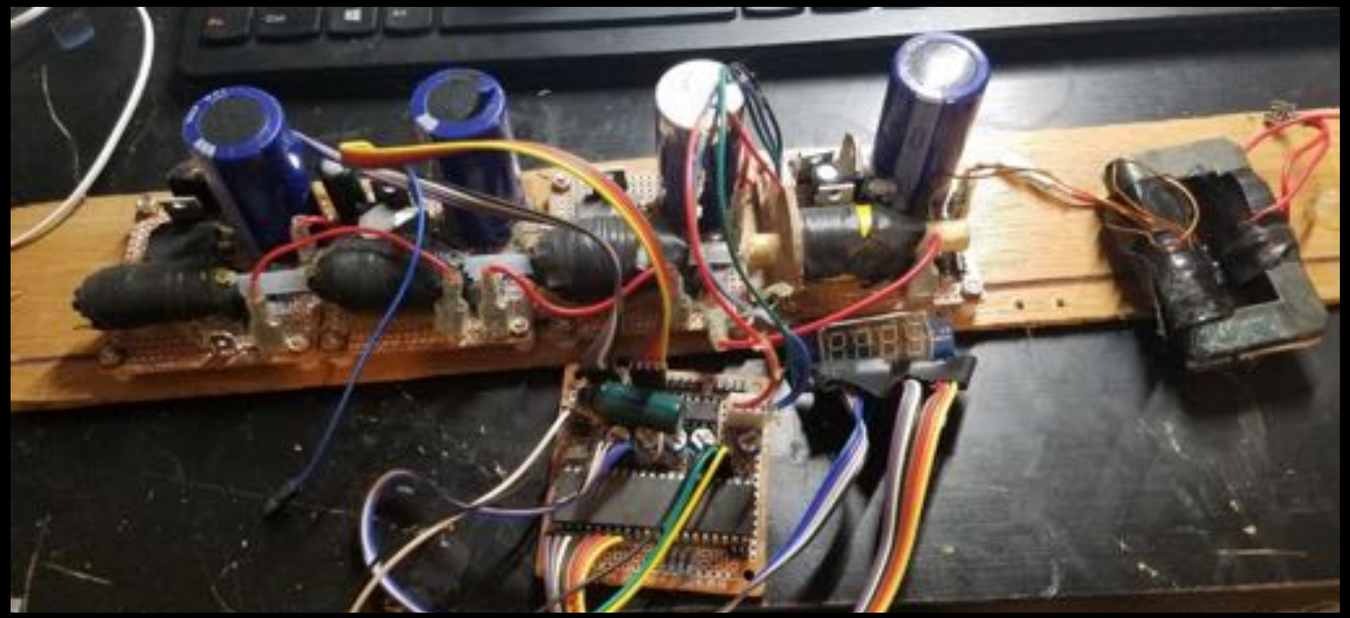




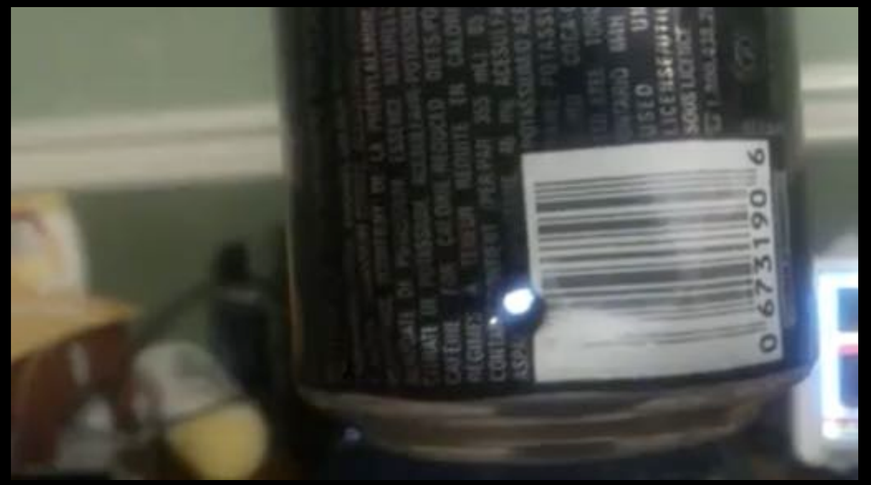
4-stage Magnetic Gun (8051 MCU)

2012
50 Hours

Hobby



- Accelerates magnetic objects by activating four consecutive coils
- Timing is controlled by thyristor switches, triggered by optical feedback
- Cascading capacitor bank to be charged to 450V by a ZVS step up transformer
- Can send bullets through coke/redbull cans

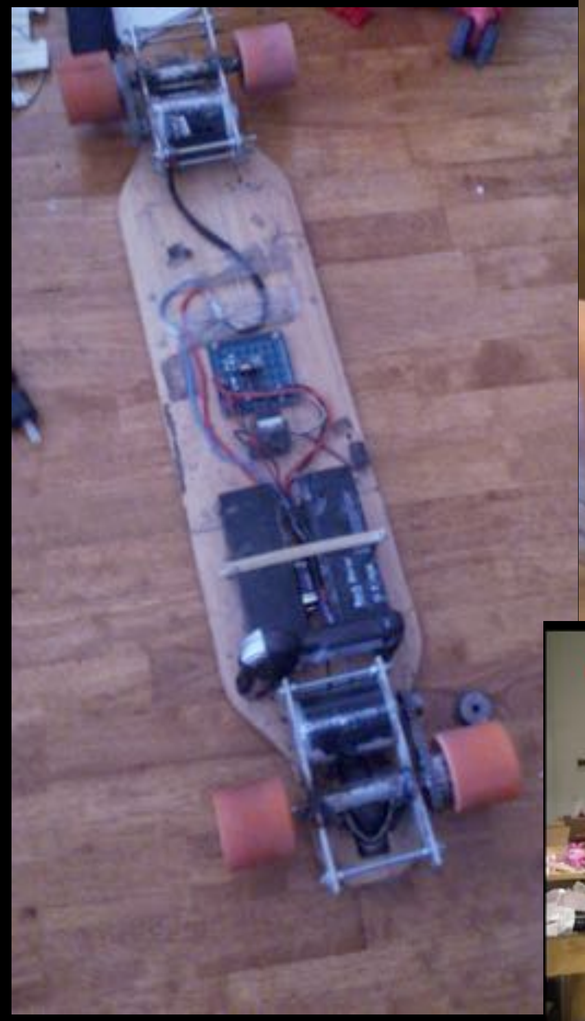


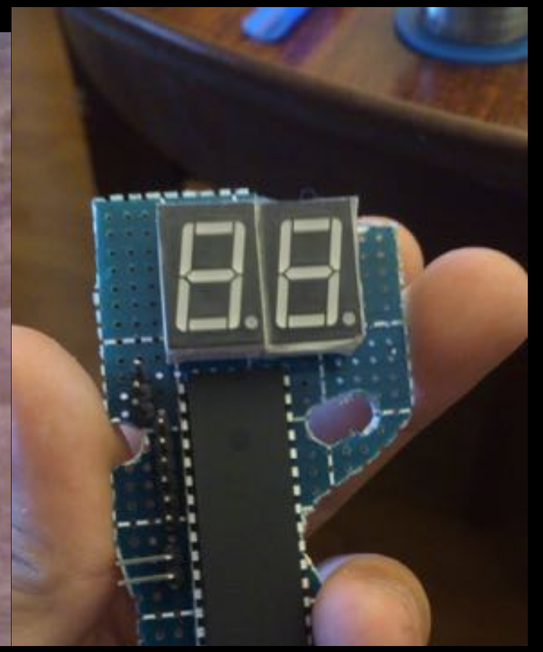
Electric Skateboard(8051 MCU)

2012,2013
150 Hours

Hobby

- Samples throttle potentiometer via an onboard ADC
- Control data is transferred via a pair of nRF24L01 modules
- PWM is reconstructed at the receiver, then fed to the motor controller. Receiver also provides battery voltage and speed feedback
- Featured on national TV



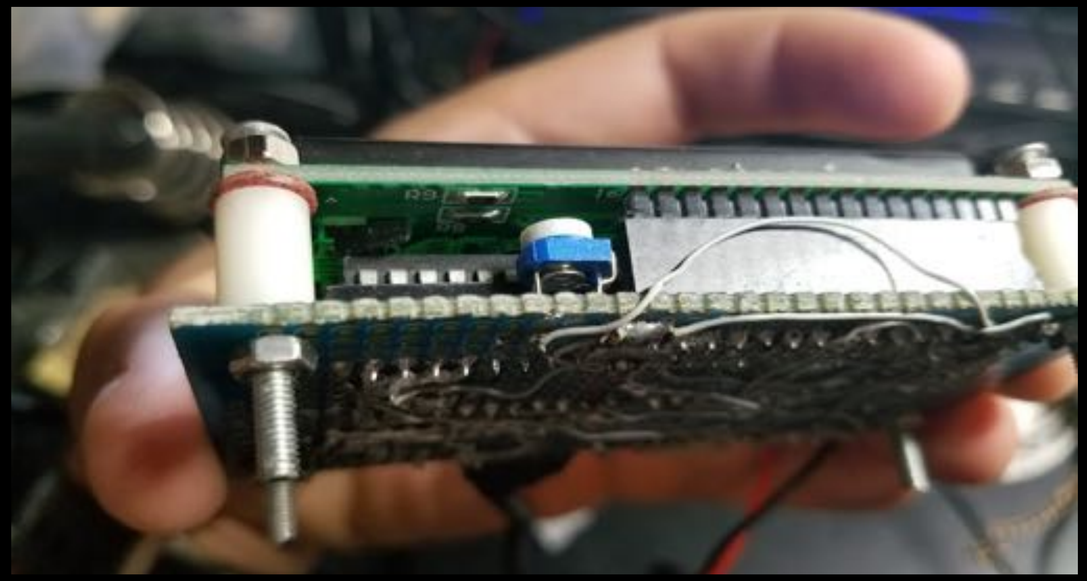


Innovative Simplified LC meter(8051 MCU)

2012
20 Hours

Hobby

- Uses a innovative single NE555 chip as resonator
- Resonance frequency is fed to a MCU then calculated to Inductance or Capacitance
- LCD value display

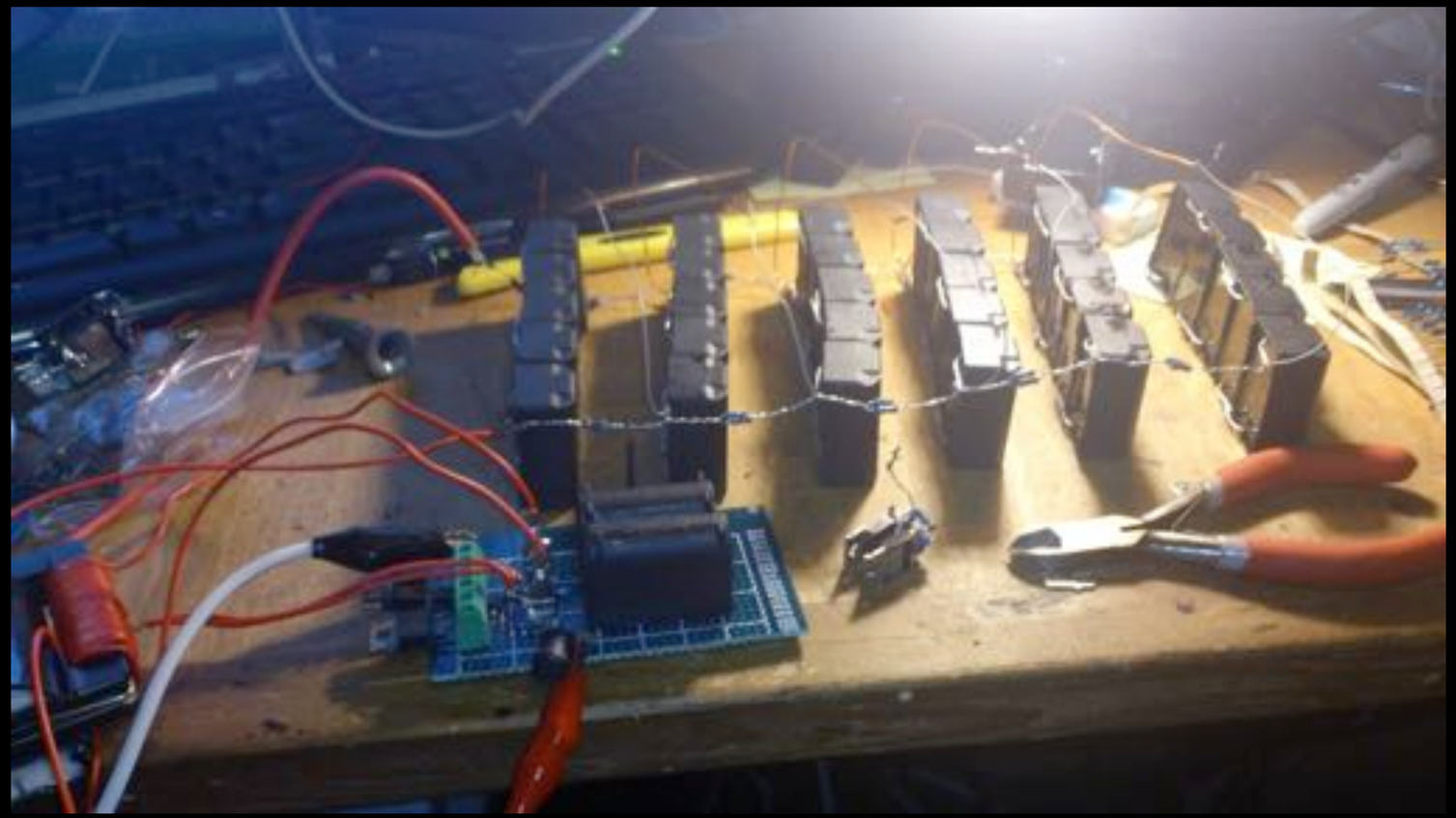


Marx Generator

2013
10 Hours

Hobby

- Generated 15cm periodic arcs
- Powered by a TV transformer with hand-wind primary, driven by a ZVS resonator

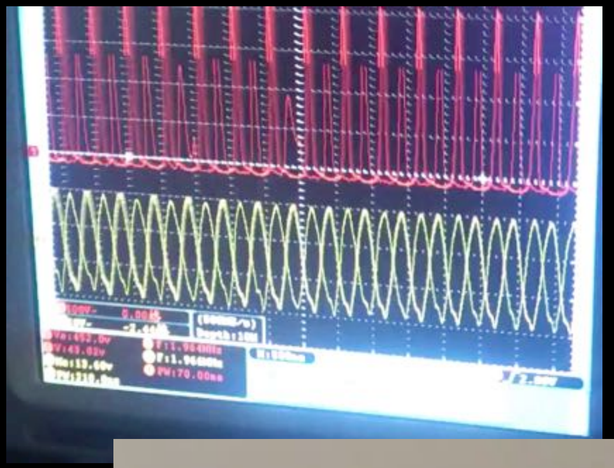


The Spray Bottle - 2MHz Tesla Coil

2013
30 Hours

Hobby

- Winded on a used spray bottle, 200 turns
- Frequency source is a 2MHz Crystal, excited by a inverter oscillator circuit
- Primary coil is driven fly-back style
- Operated at 40V before it burned out

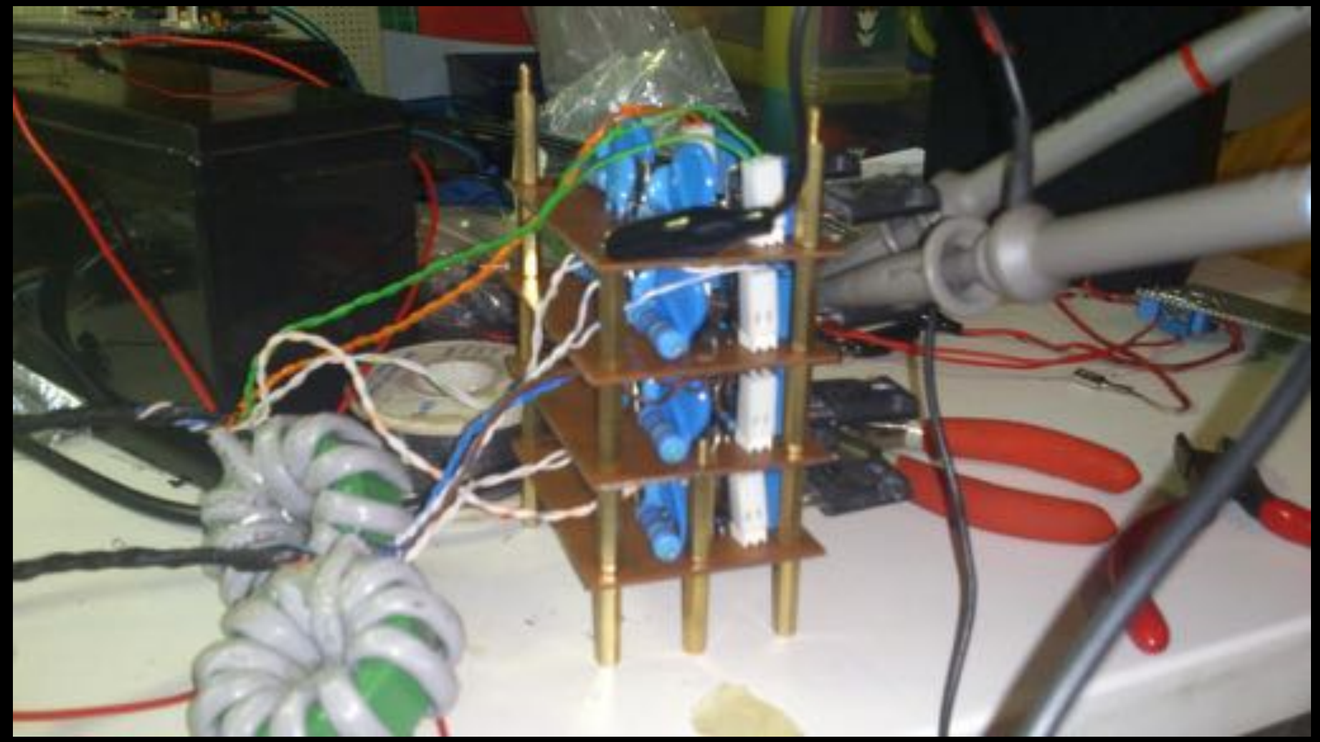


Innovative Design: High Heat Dissipation Rate Full Bridge Converter Using 8 FETs

2013
80 Hours

Hobby

- Optimized performance for high heat applications
- Allow extra recovery time for MOSFET’s body diodes
- Driven by two separate Gate Driving Transformers

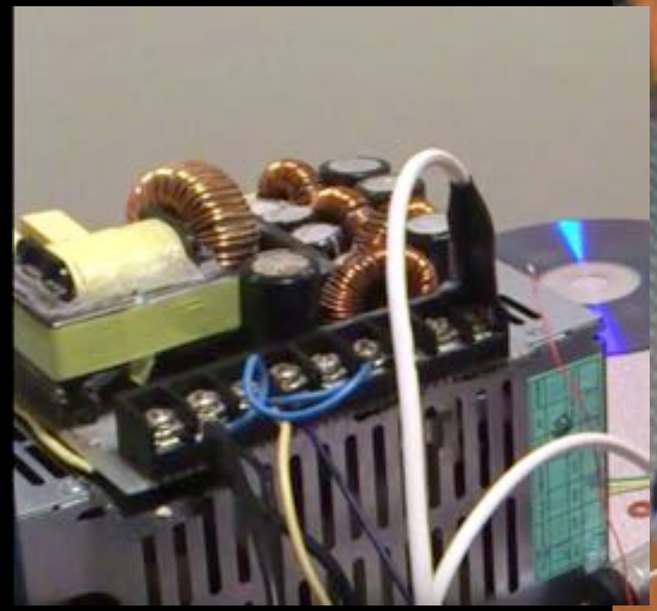


SMPS Design 1 - ZVS DC-DC converter

2012
80 Hours

Hobby

- Simple open loop converter with a ZVS resonator at the primary coil
- Hand wound EE Ferrite cored transformer
- Three stage LC filtering for to achieve optimal audio quality for powering amps
- Operates at 35kHz

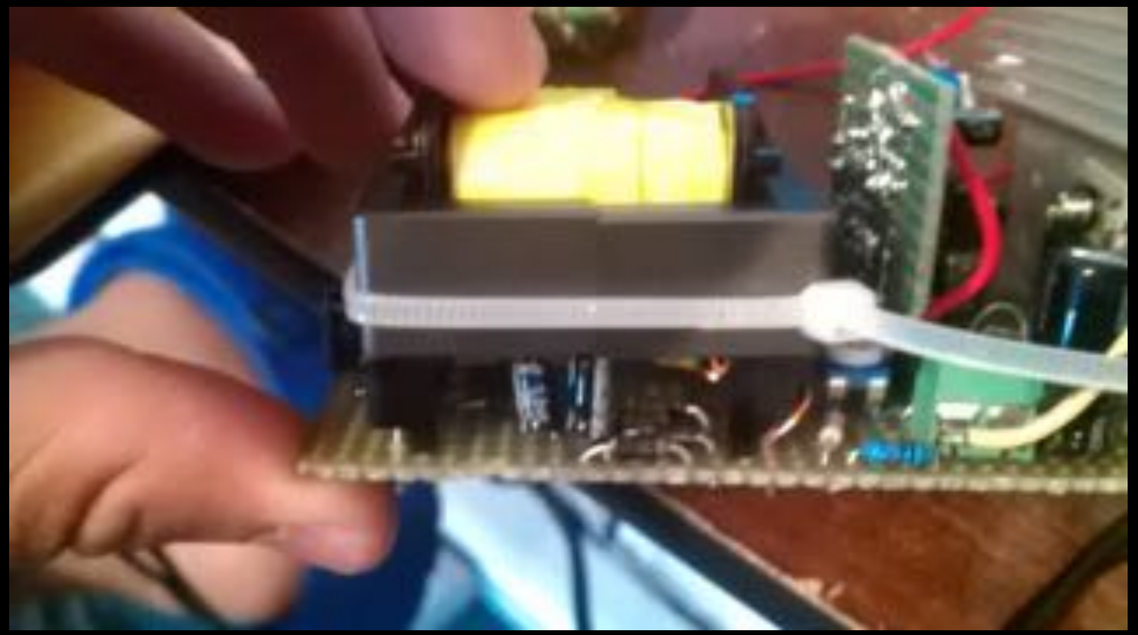


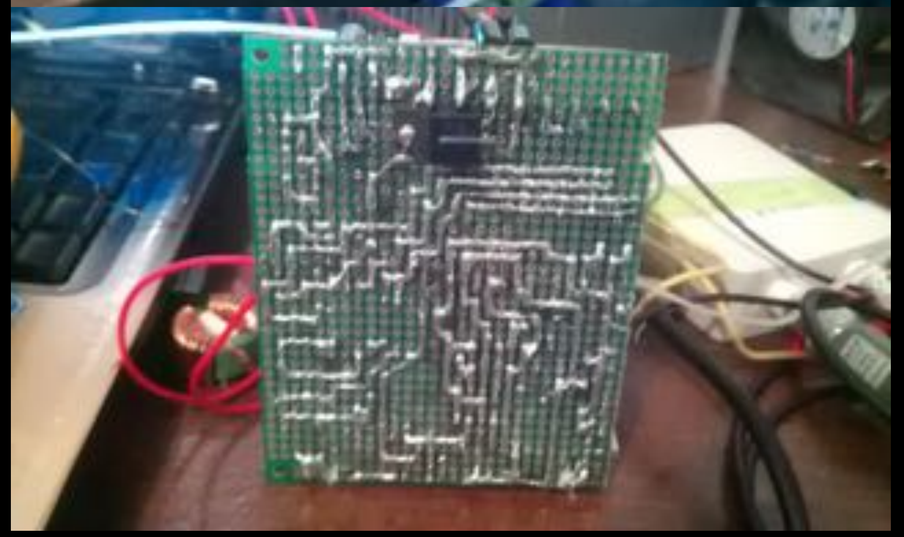
SMPS Design 2 SG3525 Closed-Loop DC-DC Converter

Hobby

2012
150 Hours

- Custom designed power supply to convert 12v DC to 19v DC and 5v DC
- Can charge laptops and phones
- Half-bridge topology



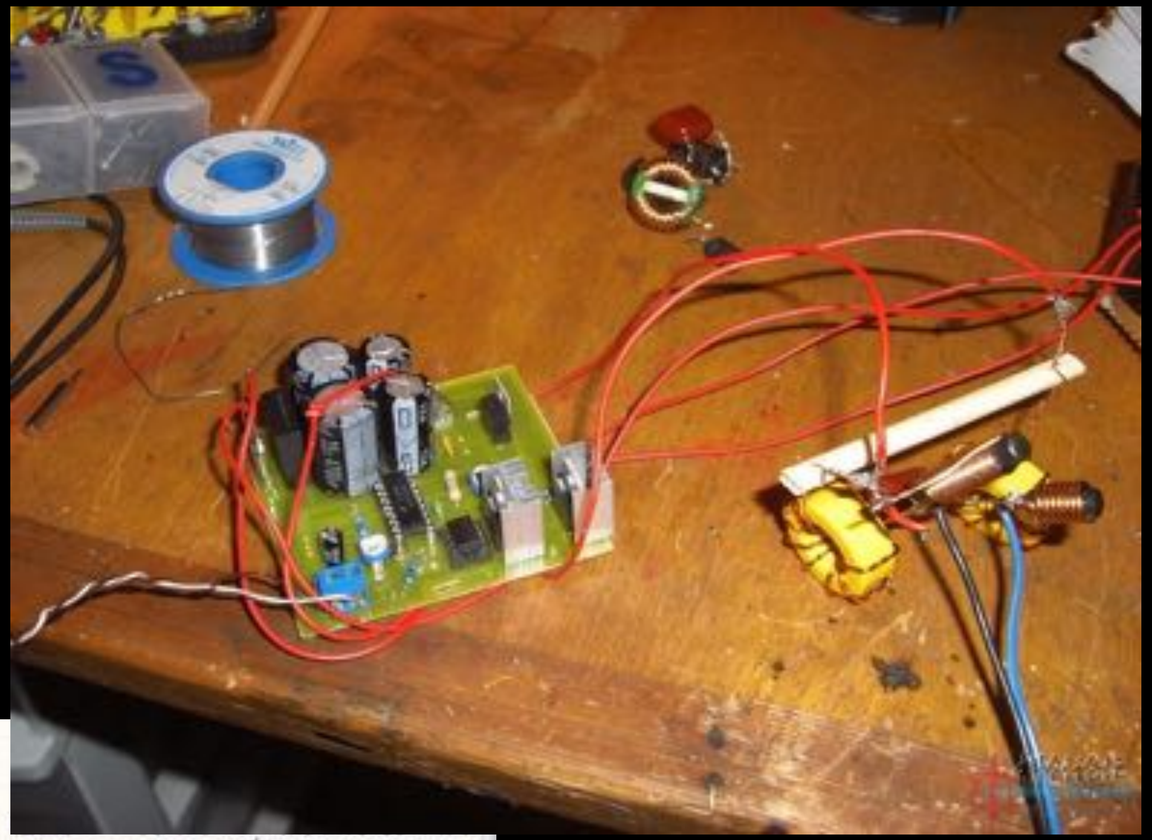


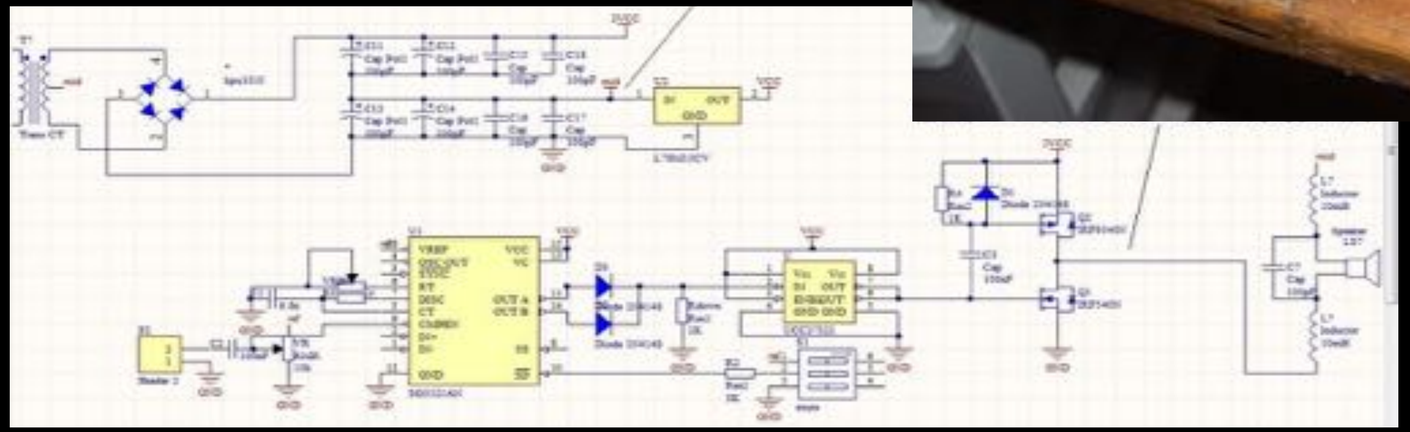
Innovative Design: E-class Audio Amplifier Using an SMPS IC

2012
35 Hours

Hobby

- Utilized the internal comparator and oscillator of SG3525 to achieve Class-E modulation
- PCB designed in Altium Designer
- PCB fabricated by hand using toner transfer method
- 15W of output power

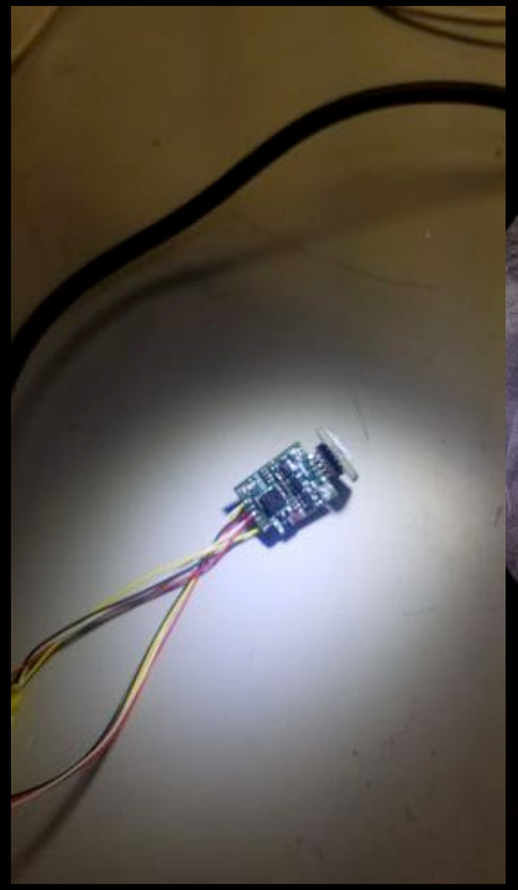




Miniture EEG Analog Frontend

Salk Institute - Shtrahman Lab

- Co-designed a 1.5 gram EEG analog frontend for mice applications
- ARM MCU controls TI ADS1298 dedicated EEG ADC, serializes data through UART, power and signal wires are coupled by a commutator on the subject's cage
- Provides all-day monitoring capability while mice is in home-cage
- Product footprint is 10mm x 15mm



TDA 7294 Bass Amp

Hobby

2013
5 Hours

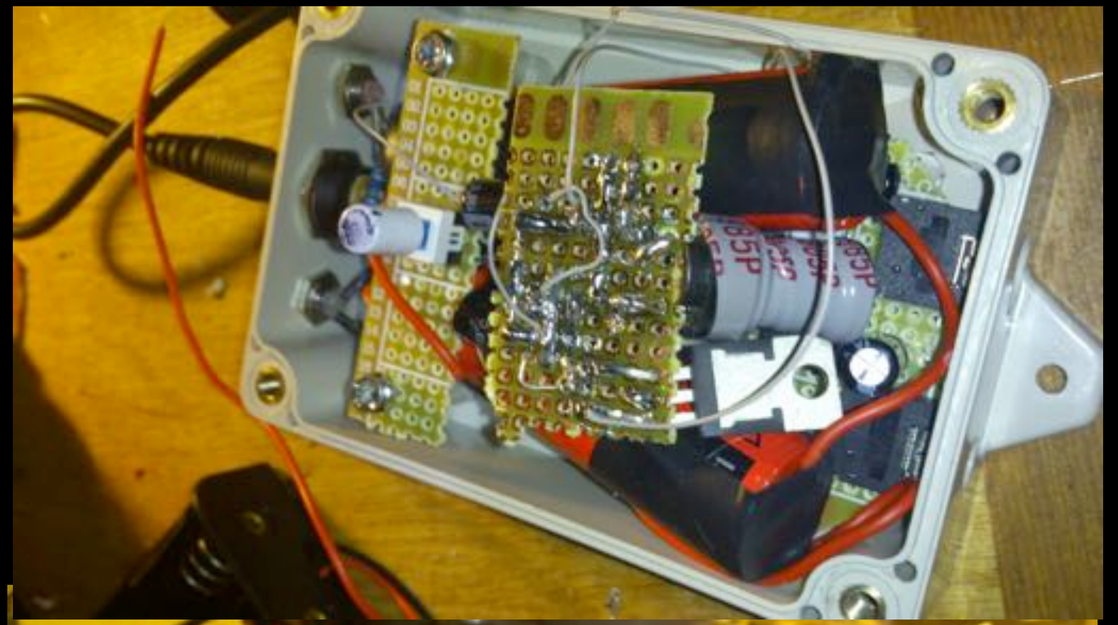
- Found a subwoofer in the trash, decided to bring it back to life
- Driven by TDA7294, 100W Class AB amplifier, large caps were used to ensure power source quality

Portable Headphone Amp

2013
8 Hours

Hobby

- 1 Unit sold for $50
- Two 18650 powers this amp directly
- Charged by a 9V power supply through a battery management IC



Tesla Coil Research Project

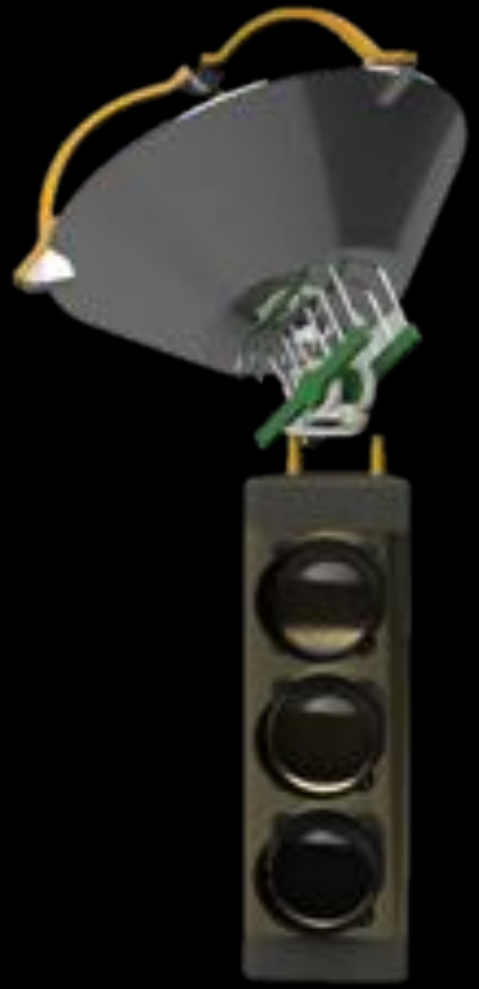
2014 -2015
80 Hours

Hobby

- Project dedicated to research the feasibility to transmit electric power via Tesla Coil's resonance mechanism
- Twin coil system to be constructed, one as transmitter, the other one as receiver
- Received $1000 dollar research grant from UCSD

Engineering Development for Innovative Ideas

2015-2016
200 Hours



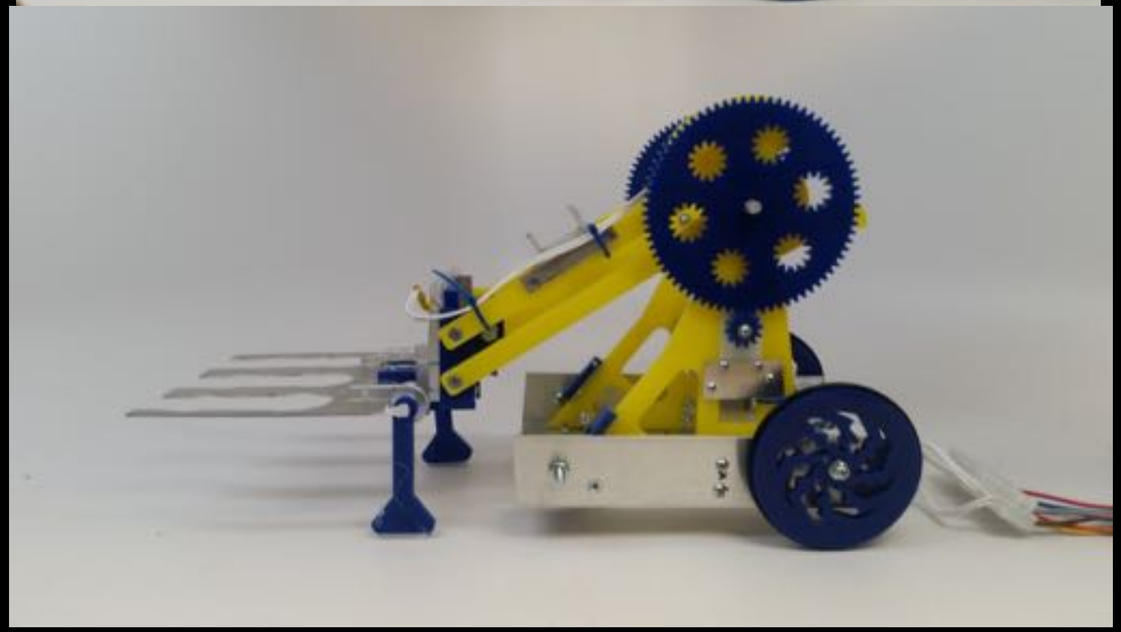
- CEO of a failed start up
- Obtained provisional patent
- Focus in renewable energy
- CAD modeled and prototyped different ideas using 3D printing

Acrylic Robot - “John”

2015-2016
25 Hours

Course Work

- Led a team of 4 in designing a robot for a class contest
- Fully modeled the system and performed simulation prior to construction
- Powered by four geared motors
- High Quality Design Feature Award energy
- CAD modeled and prototyped different ideas using 3D printing

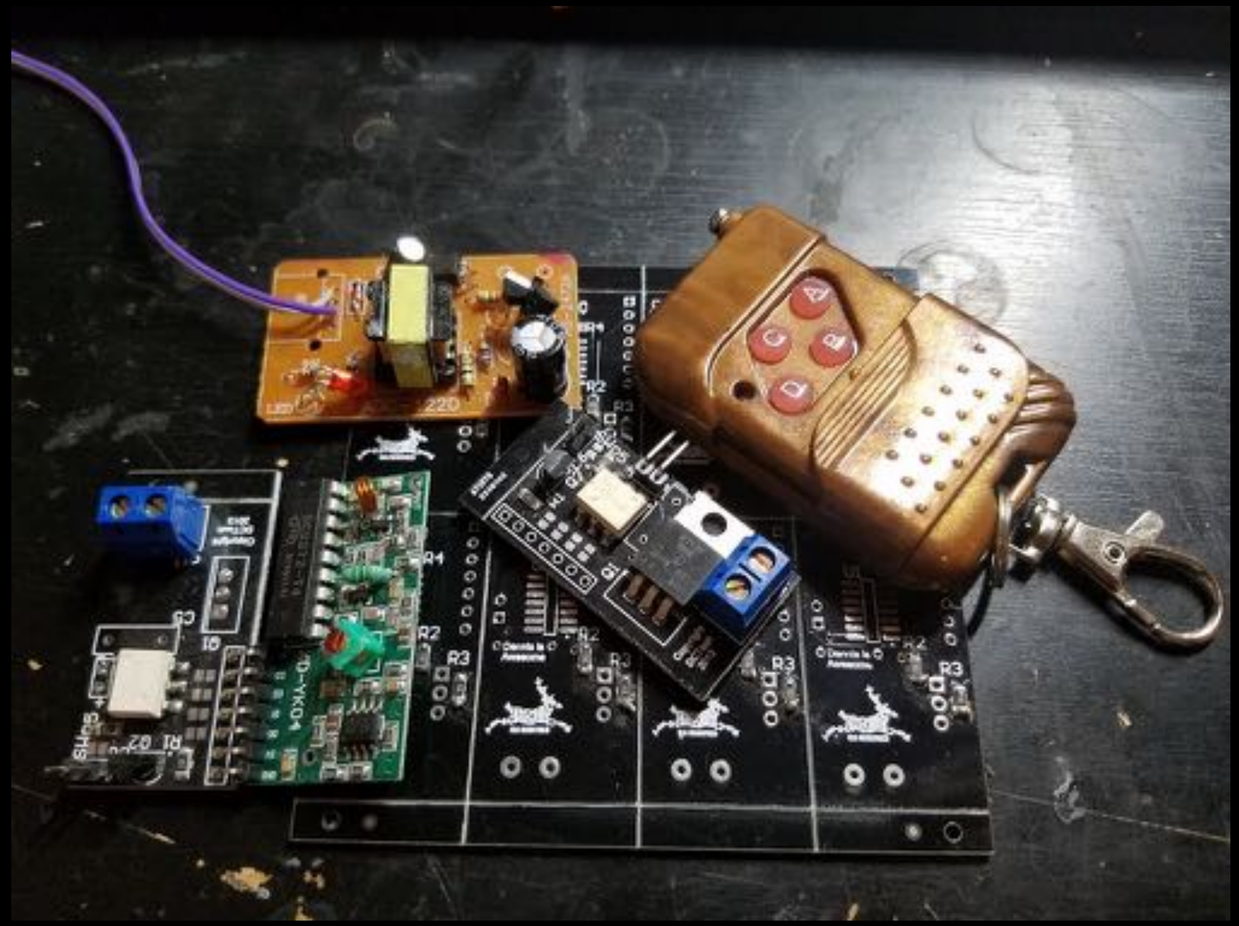


Remote Light Switch System (Altium)

2012
30 Hours

Hobby

- Designed in Altium Designer
- Relay + logic system to work in conjunction with commercial 900MHz radio remote and power supply
- Controls up to 4 lights per remote



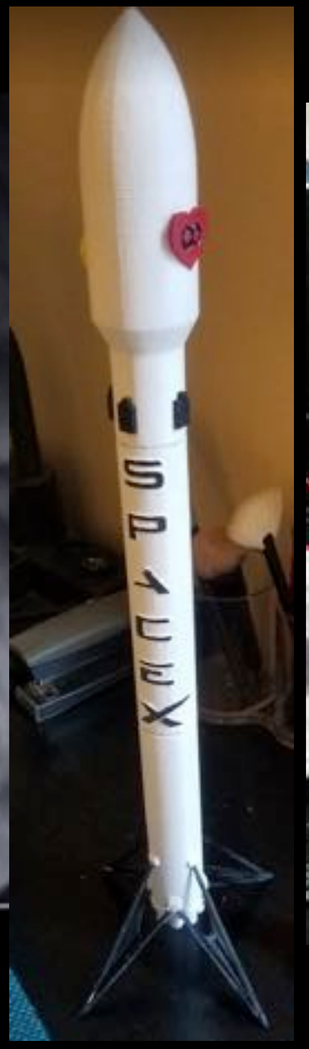
Solar Radio Telescope(8051 MCU)

2013
40 Hours

Hobby

- To detect the Radio interference between earth's ionosphere and solar ion radiation
- Loop Antenna designed to resonate at ULF band
- Resonance controlled by a variable capacitor
- Utilized a MCU and a LCD display to indicate the resonance frequency
- Structure is mounted on a StarChaser gimbal

Creative gifts



Carpentry, Woodworking