



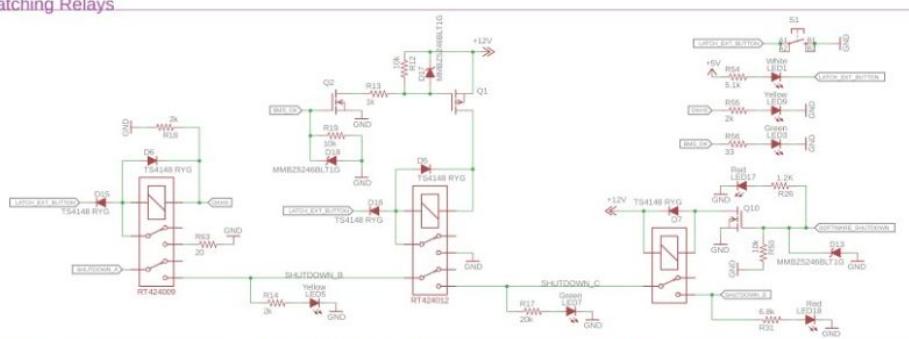
HyTech Racing Electrical Team

2019-2020

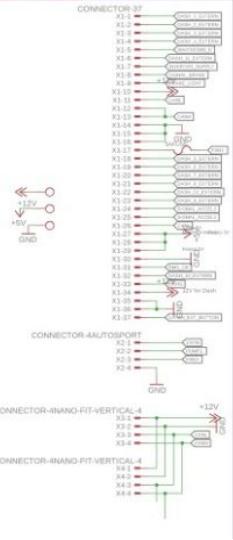
Low Voltage Controls

Dean Plaskon

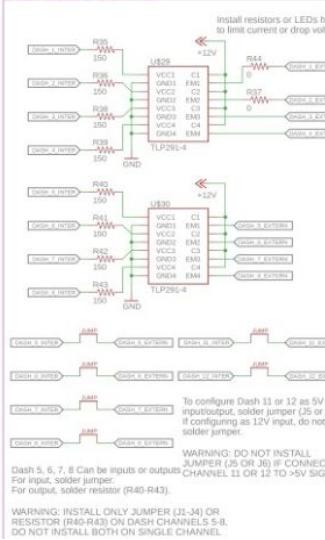
Latching Relays



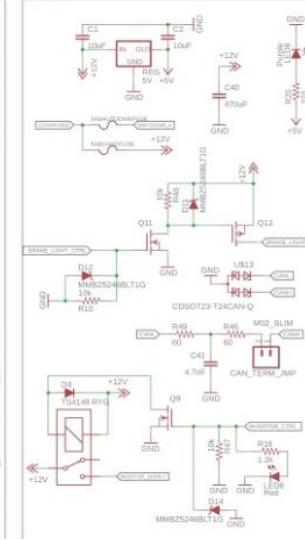
Connectors



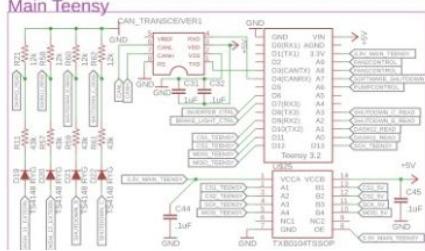
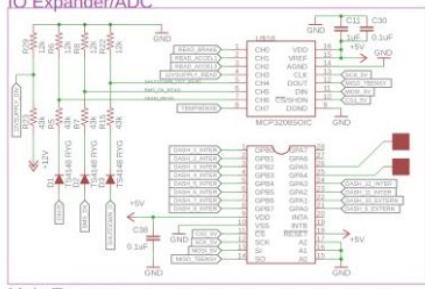
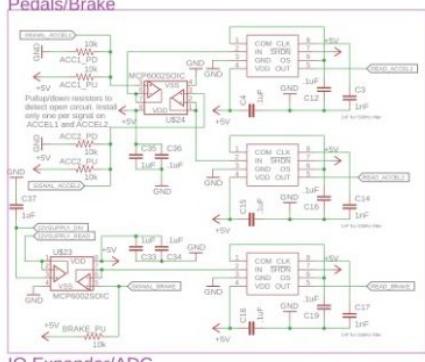
Dashboard Control



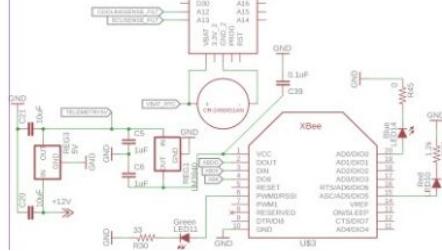
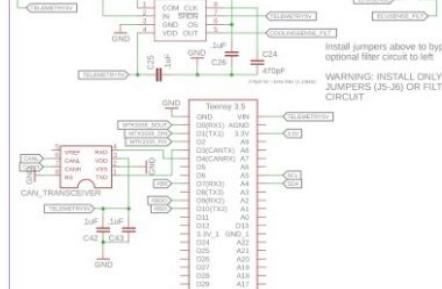
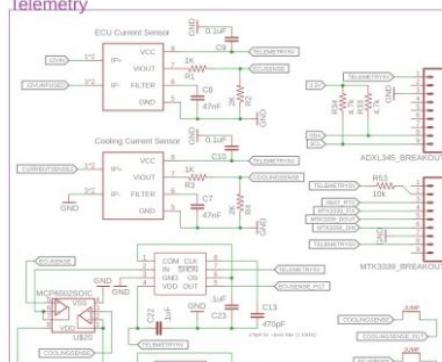
Power



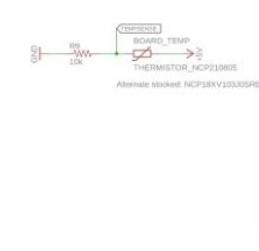
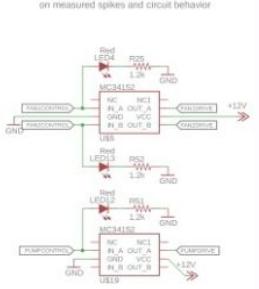
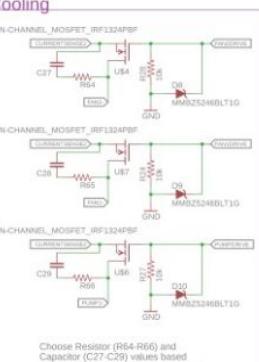
Pedals/Brake



Telemetry



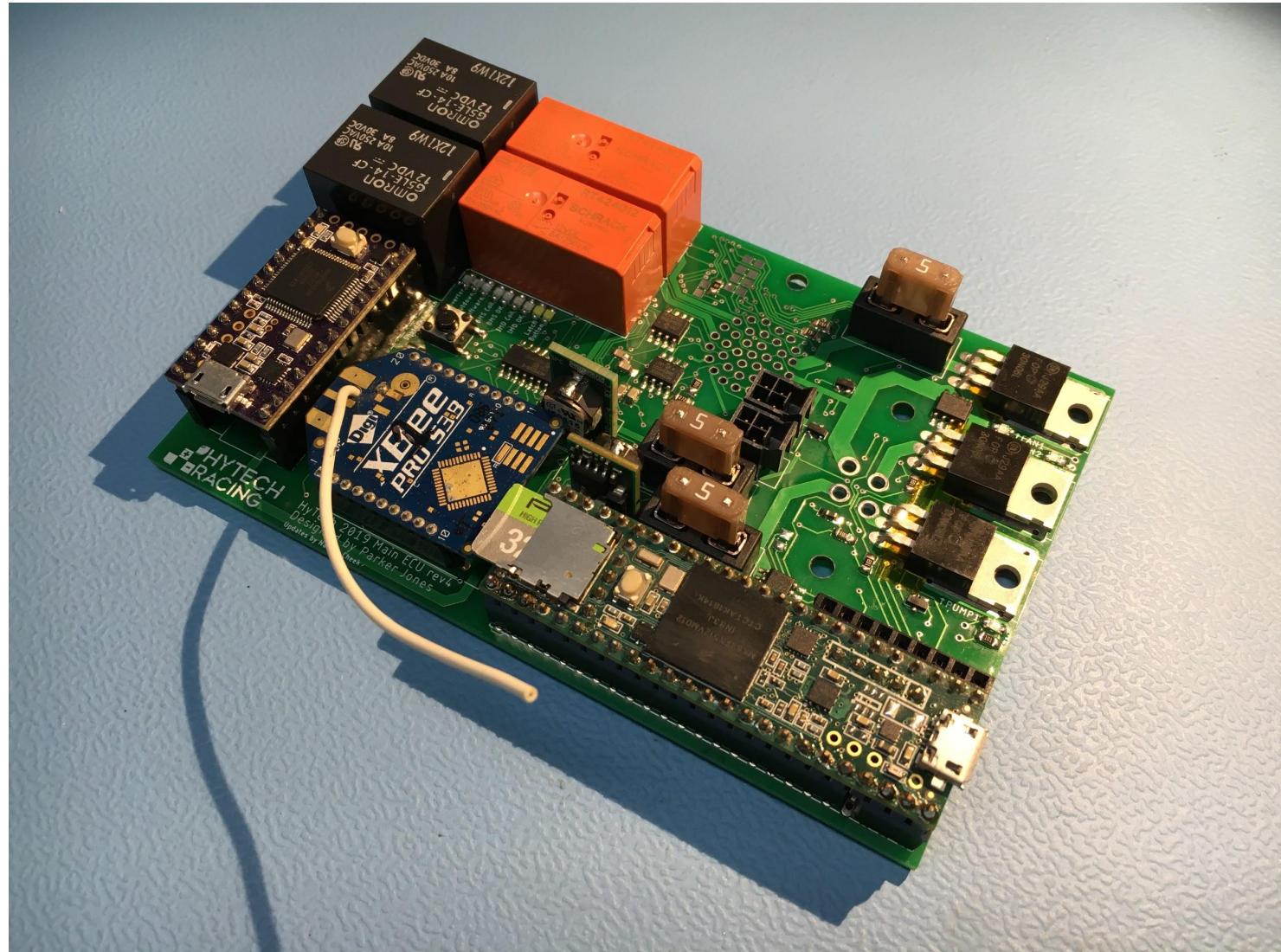
Cooling



Main ECU



- Current Features:
 - Vehicle controls (Teensy 3.2)
 - Data logging and communications (Teensy 3.5 + XBee LTE)
 - Cooling controls and monitoring
 - Shutdown circuit monitoring
- Future Projects:
 - New microcontroller (Teensy 4.0)
 - BSPD circuitry
 - Noise elimination
 - Traction control
 - Cooling controls optimisation
 - Multi-layer PCBs



Wiring Harness



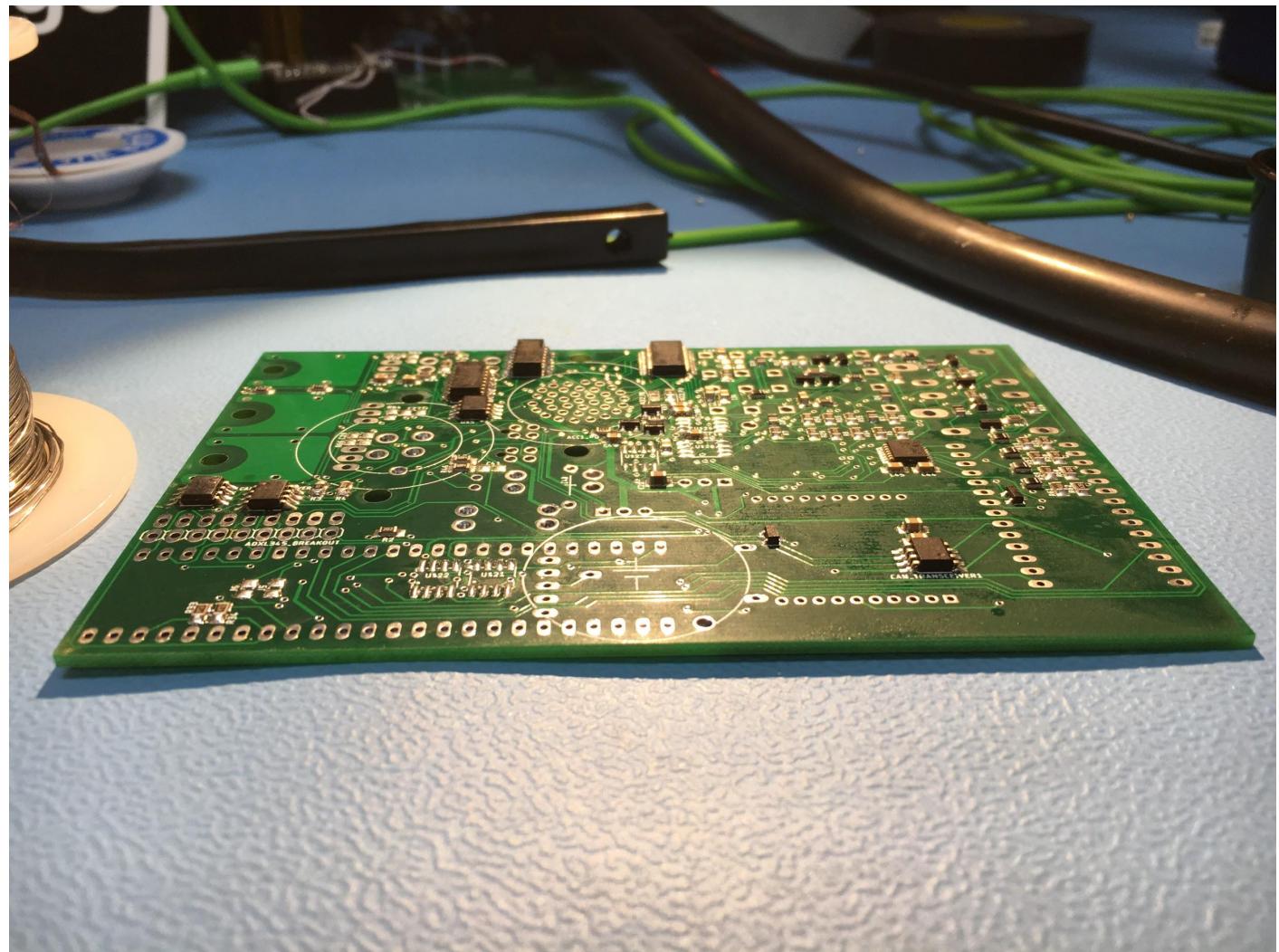
- Current Features:
 - Autosport connectors
 - 16 gauge for power and 18 gauge for signals
 - Raychem heat shrink for protection with heat shrink connector boots
- Future Projects:
 - Spec appropriate connectors
 - Test concentric twisting techniques
 - Improve strain relief
 - Improve manufacturing methodology
(build a wiring harness jig)



Manufacturing



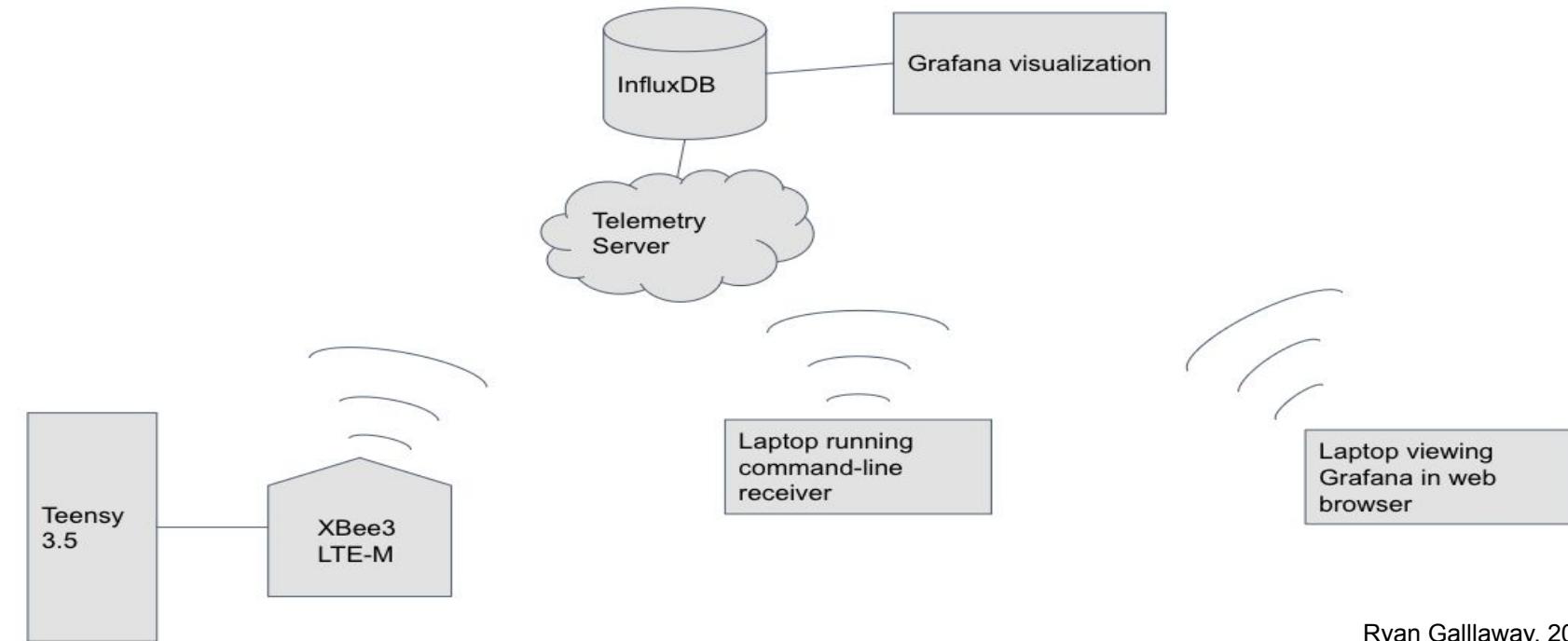
- Current Process:
 - Manual soldering using soldering iron and hot air station
 - SMD and through-hole components
- Future Projects:
 - Incorporate a reflow oven into the process
 - Use smaller SMD packages



Data Acquisition

Parker Jones and Shaan Dhawan

- Data Collection on the Car:
 - Sensors
 - SD card storage
 - CAN Bus logging
- Real Time data collection
 - LTE XBee
 - MicroPython
 - AWS server
 - Python
 - Database for storage
 - InfluxDB
 - Data Visualization
 - Grafana



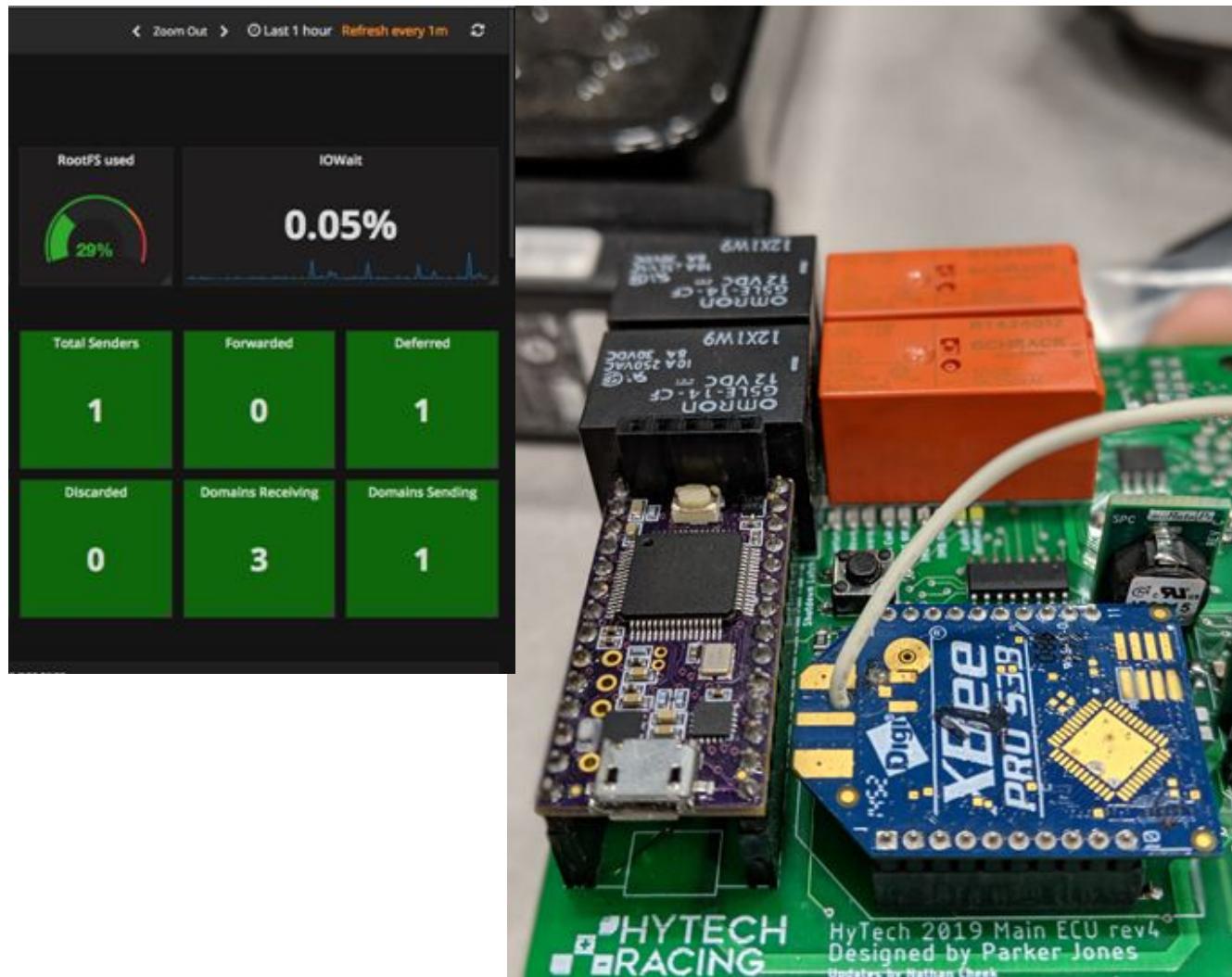
Ryan Gallaway, 2019

Semester Goals



- Implement data storage (InfluxDB) and visualization(Grafana)
- Expand the sensor network on the car
 - Wheel speed, suspension, chassis strain, etc.
 - Build hardware to allow for easy integration with new sensors
- Benchmark SD Card datalogging with Teensy

4.0



Electric Drives

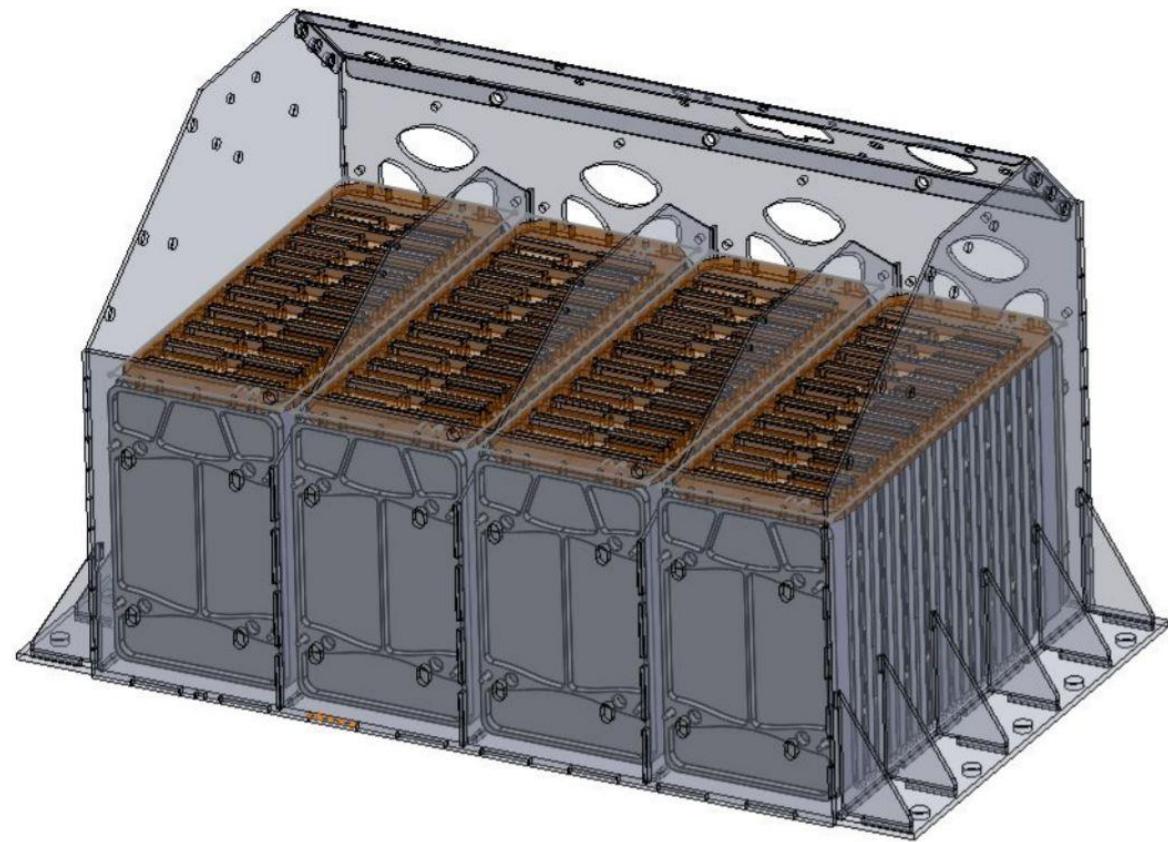
Anson Tsang



Accumulator Design and Analysis



- Current Design:
 - 300V nominal, 72 Lithium-Ion cells (3.7 V)
 - 4 segments; cells sandwiched between aluminum cooling plate and Bisco foam
 - Aluminum sheet metal housing
 - Formula Hybrid compliant
- Future Design:
 - FSAE compliance
 - Lighter structure
 - Thermal analysis (model and data validation) for cooling optimization
 - Data driven capacity optimization
 - Efficient state of charge estimation



Accumulator Manufacturing



- Current Process:
 - Manual assembly using custom high density polyethene (HDPE) jig
- Future Improvements:
 - Improve jig design for easier assembly
 - Segment, container weight reduction
 - Outsource busbar bending
 - High Voltage cable rewiring
 - Various packaging changes to accumulator



Cell Testing

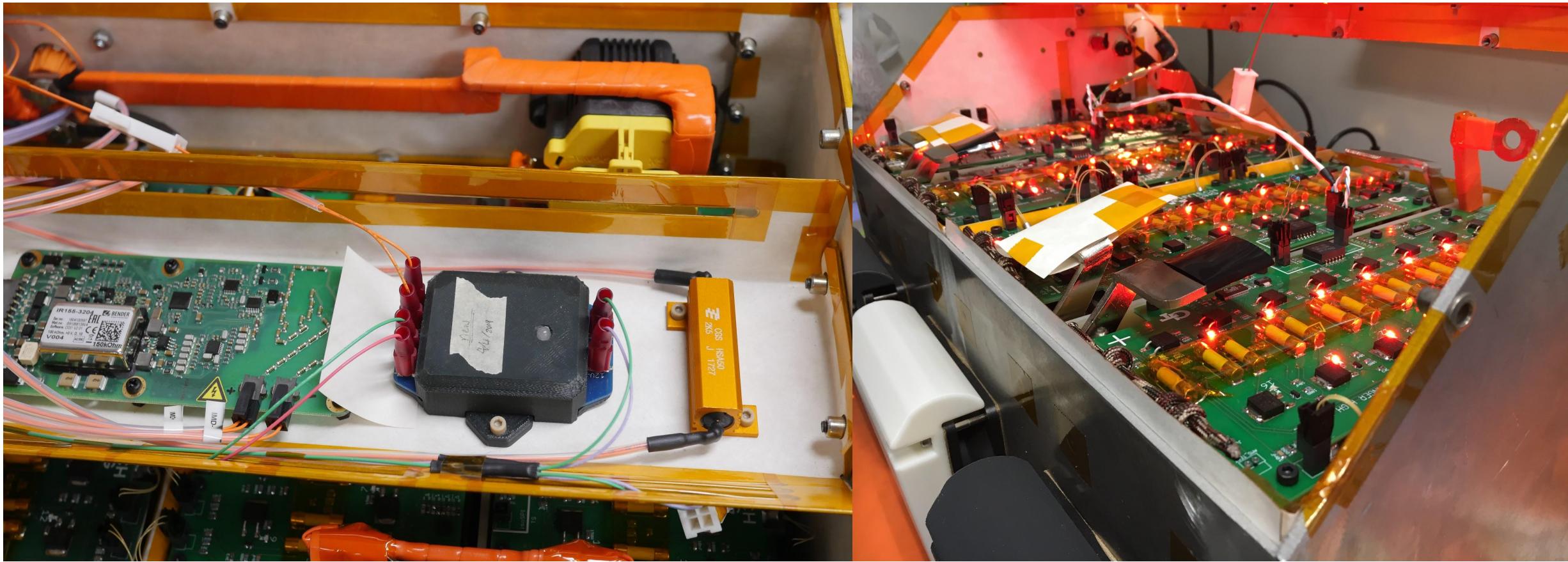


- Current Process:
 - Simultaneous 4 cell discharge
 - Water cooling for power resistors (constant resistance testing)
 - Data analysis in MATLAB
- Future Improvements:
 - Improve current discharge rig mechanical design
 - Implement constant load discharge testing
 - Design charge testing rig
- End goal:
 - Improve analysis techniques and documentation
 - Unified Hybrid Pulse Power Characterization (HPPC) test



High Voltage Controls

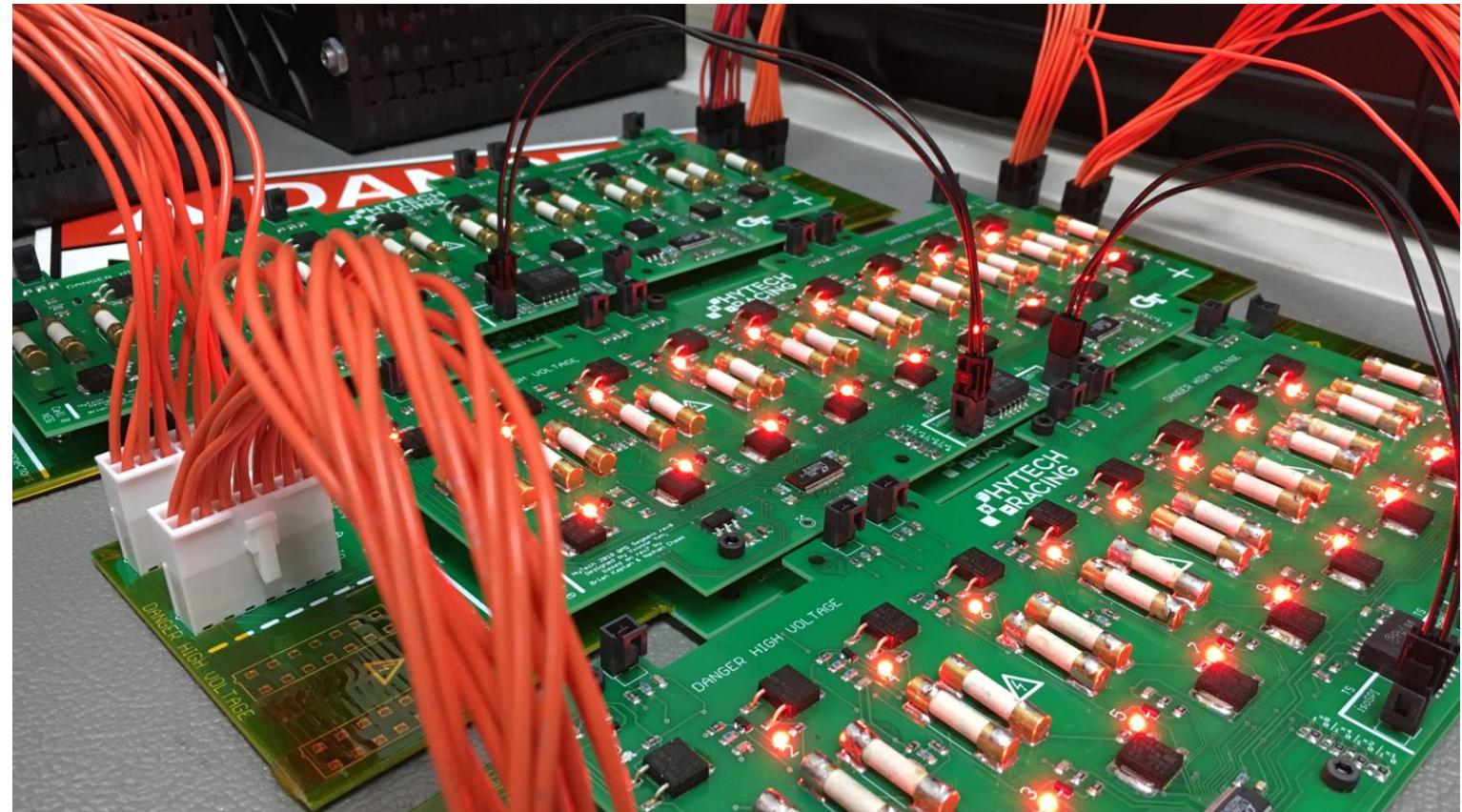
Arvind Srinivasan



Battery Management System Segments

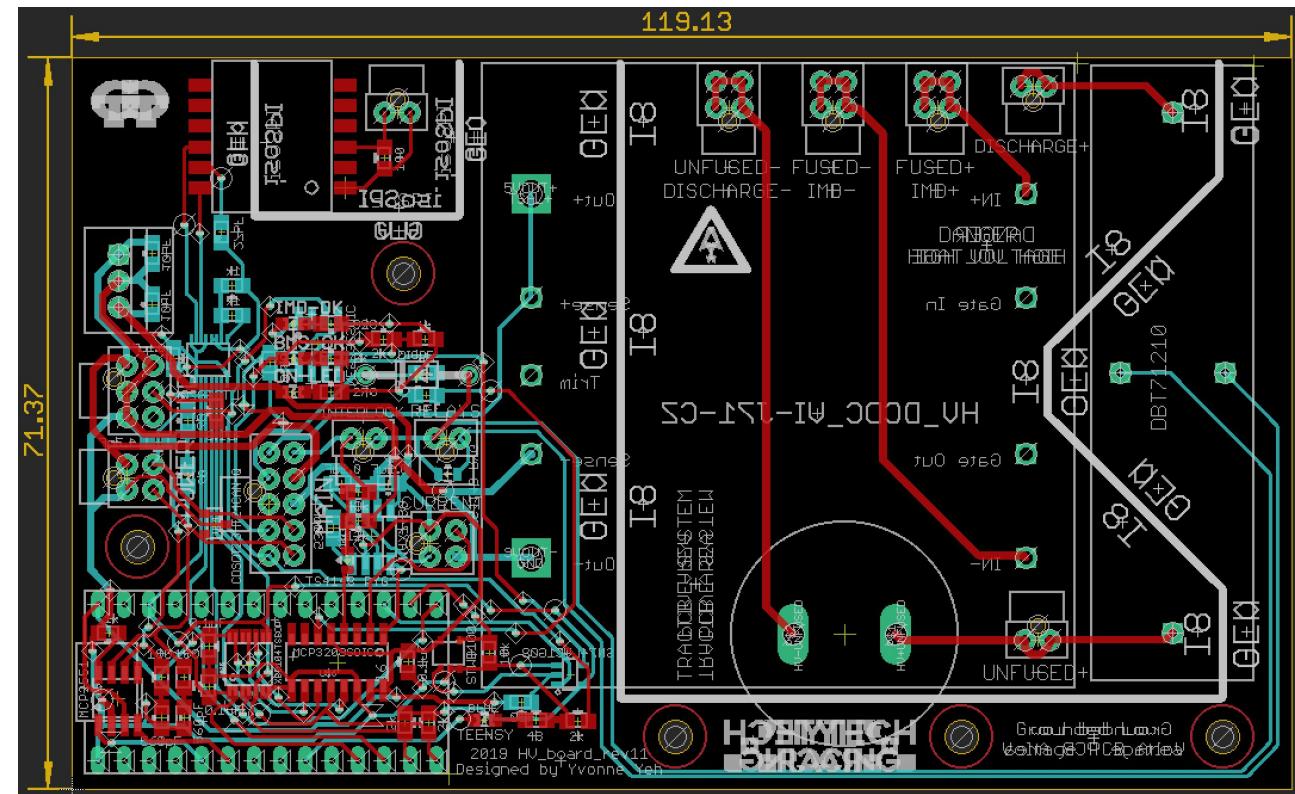


- Current Features:
 - Monitoring cell temperatures
 - Monitoring cell voltages
 - Balancing cells
- Future Projects:
 - New board revision
 - Improving IC soldering yield
 - Upgrading battery monitor ICs
 - Speed up production
 - Improve reflow oven process
 - Optimizing IsoSPI communication



High Voltage Board

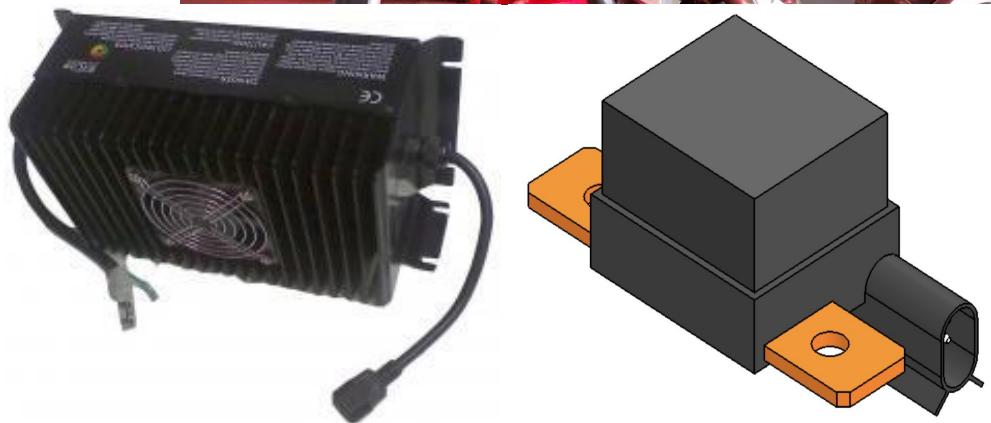
- Current Features:
 - Controls TSAL
 - Connects to BMS segments
 - Part of shutdown circuit
- Future Projects:
 - New board revision
 - Current monitoring system
 - Output voltage monitoring (60V Threshold)
 - Support Voltage Indicator and TSAL
 - Powering GLV system with DC-DC converter
 - Speed up software loop



Other Components



- New TSAL:
 - Needs to run on GLV
 - Must switch light modes
- Energy Meter:
 - Required per competition rules
 - Tracks vehicle performance
- Charger Control Board:
 - Ensures safety during charging
 - Independent of the car
- Power Switching Device:
 - Switch between battery and DC-DC converter
 - Smooth transition between power sources



Training Schedule

Date	Time	Location	Theme
Thursday 9/5	6:30pm - 8:15pm	Skiles 202	Circuits
Sunday 9/8	4:00pm - 6:00pm	SCC (Shop) AP Classroom	EAGLE
Tuesday 9/10	6:30pm-8:15pm	SCC (Shop) AP Classroom	Arduino
Thursday 9/12	6:30pm-8:15pm	Invention Studio	Soldering and Car Circuitry/EAGLE
Sunday 9/15	4:00pm - 6:00pm	SCC (Shop) AP Classroom	Safety