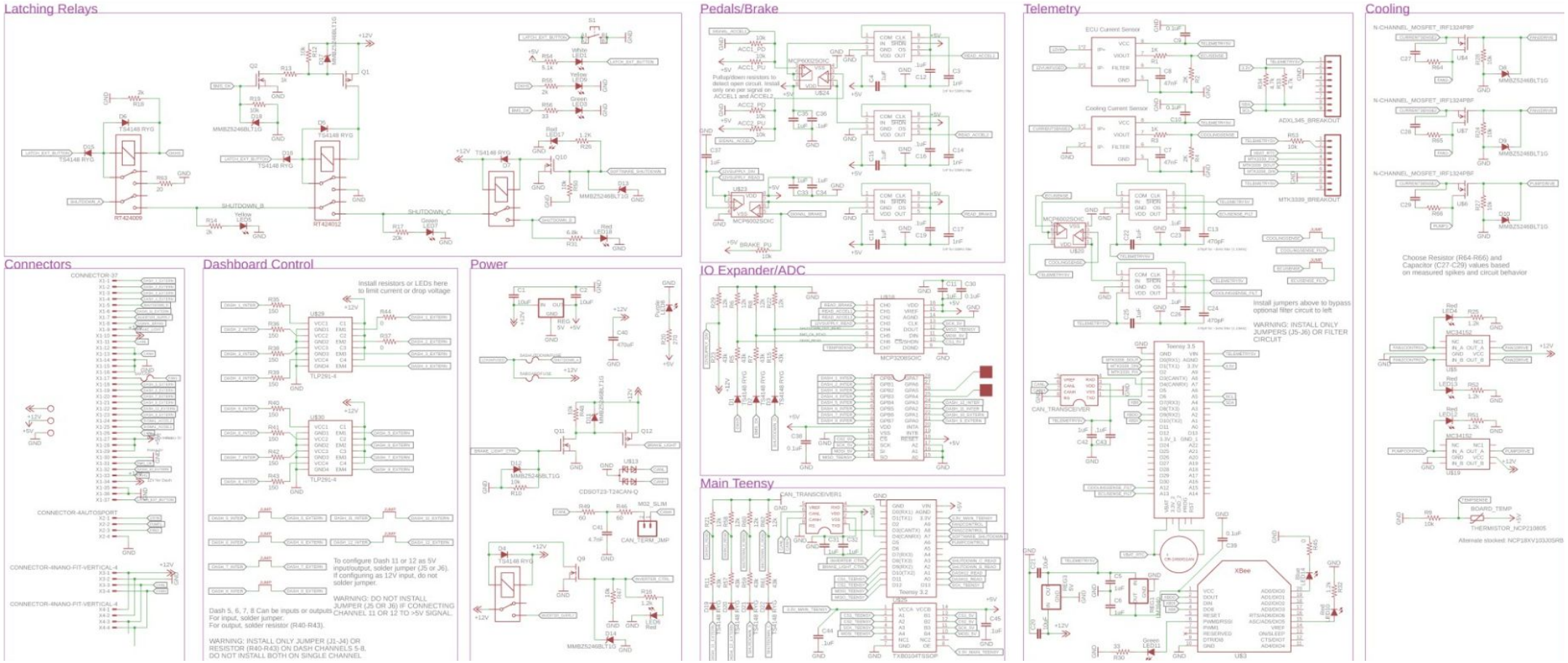
HyTech Racing Electrical Team

2019-2020

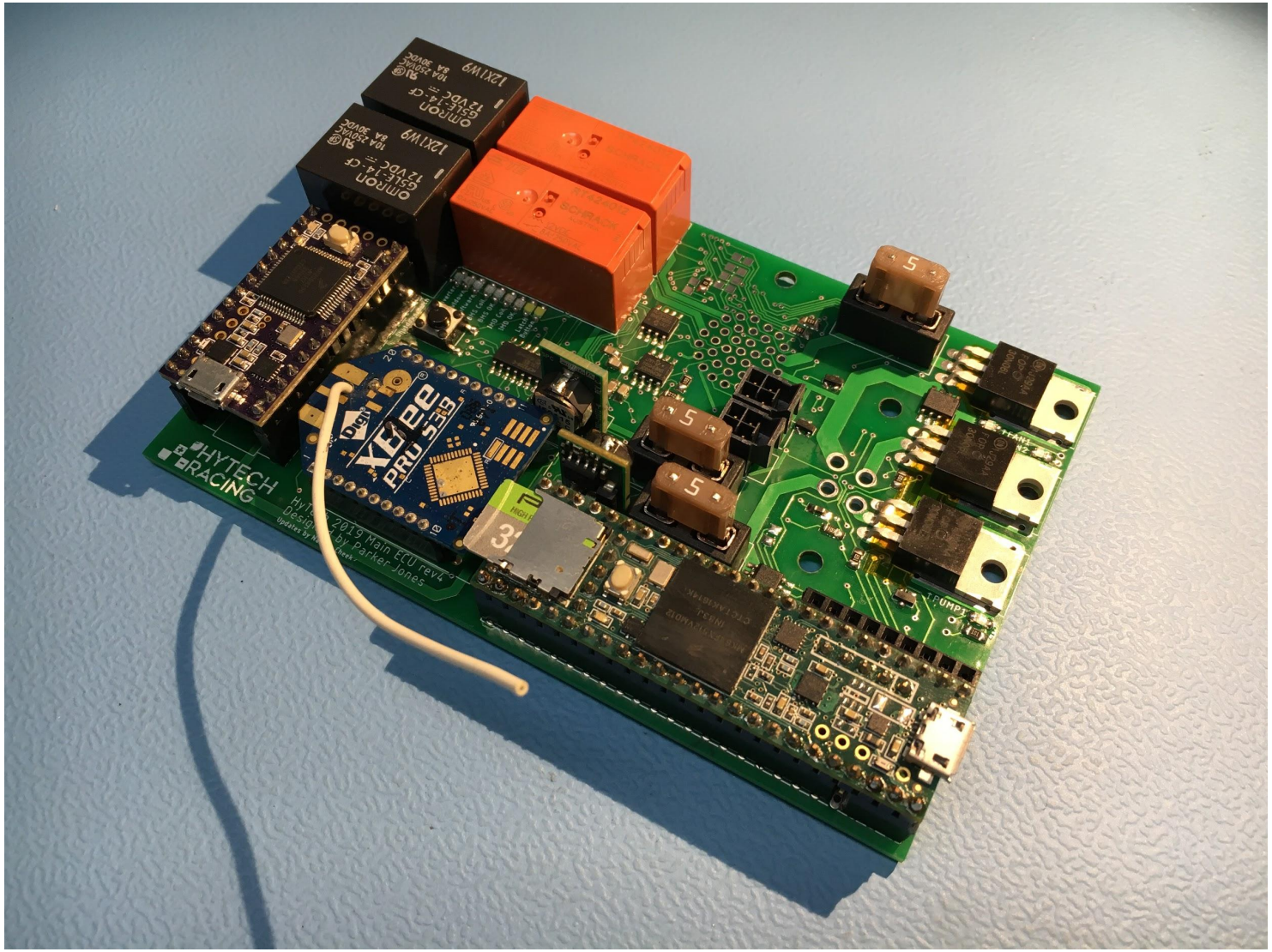
Low Voltage Controls

Dean Plaskon



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

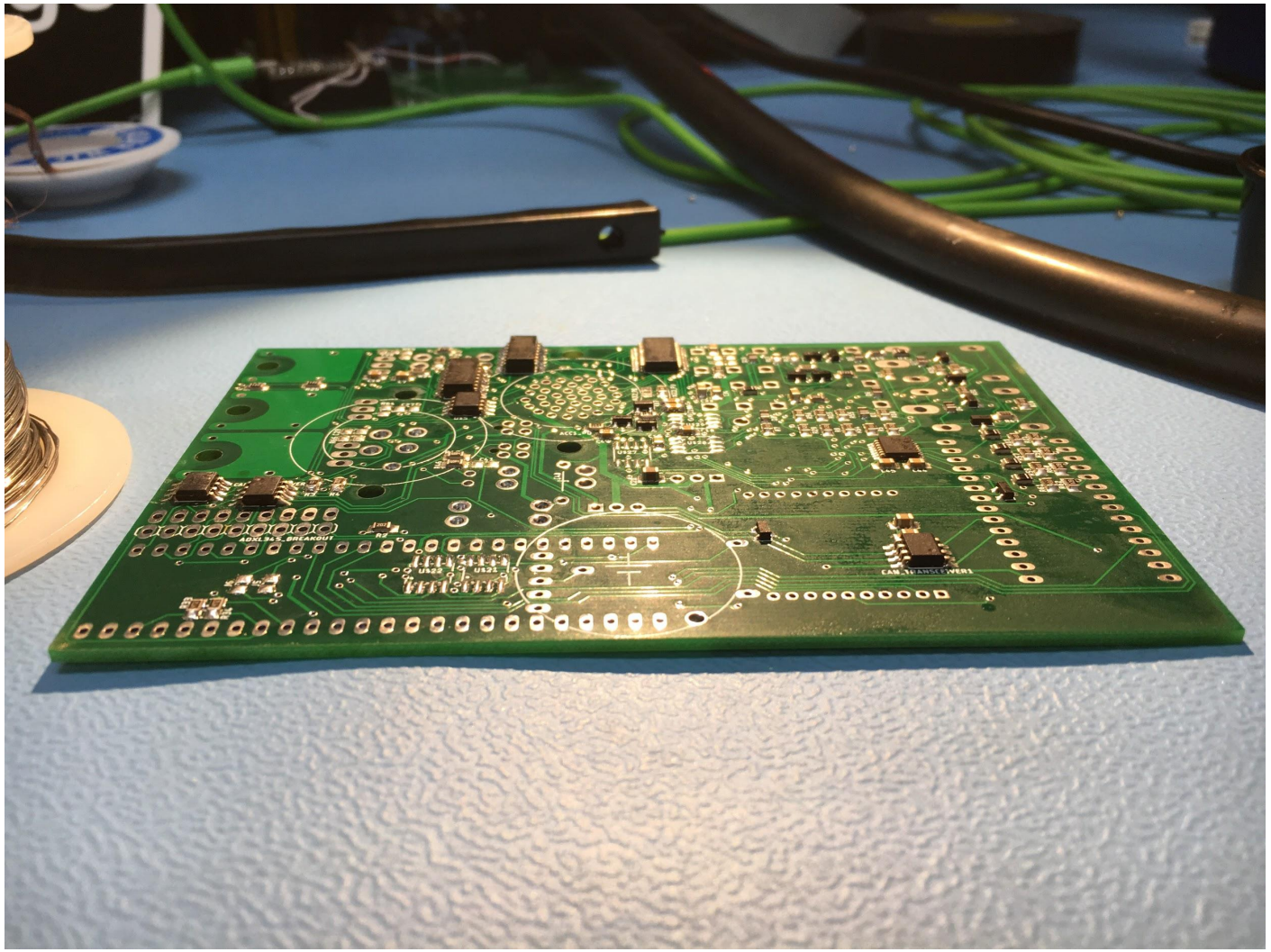


Wiring Harness

- 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

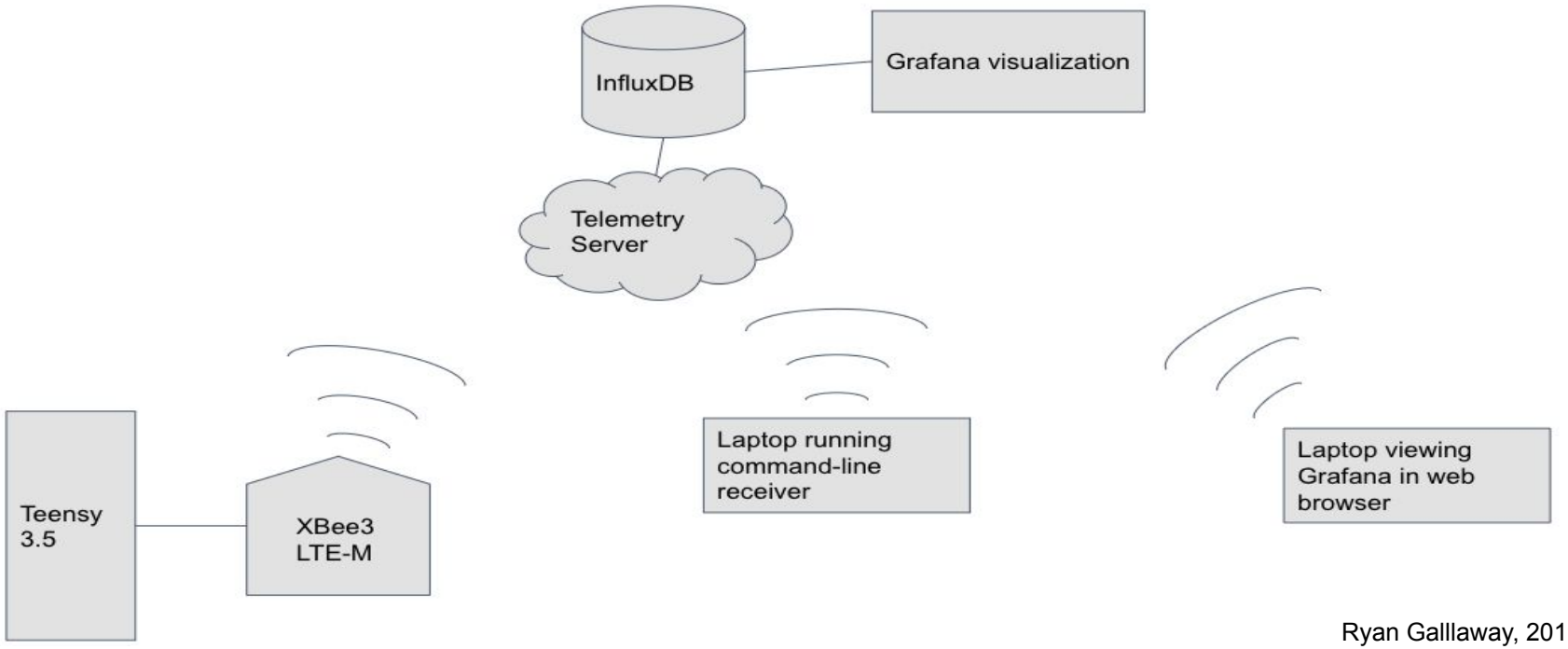
- Current Process:
  - Manual soldering using soldering iron and hot air station
  - SMD and through-hole components
- Future Projects:
  - Incorporate a reflow oven into the process
  - Use smaller SMD packages



Data Acquisition

Parker Jones and Shaan Dhawan

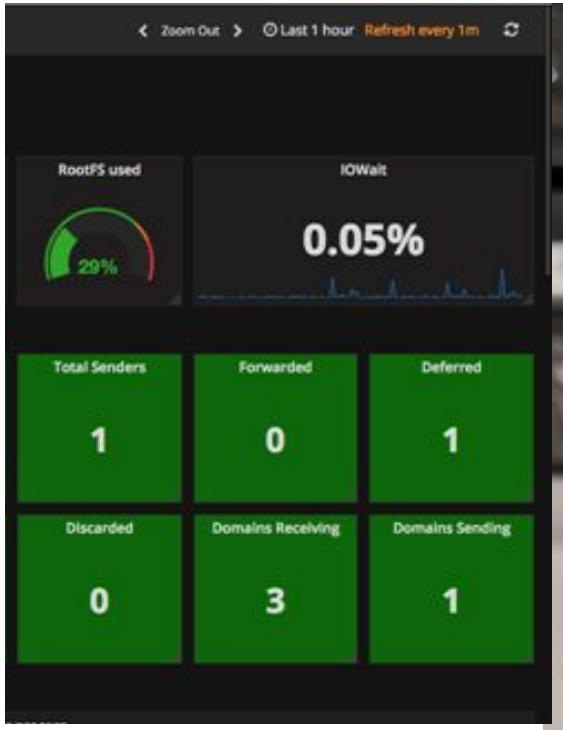
- Data Collection on the Car:
  - Sensors
  - SD card storage
  - CAN Bus logging
- Real Time data collection
  - LTE XBee
    - MicroPython
  - AWS server
    - Python
  - Database for storage
    - InfluxDB
  - Data Visualization
    - Grafana

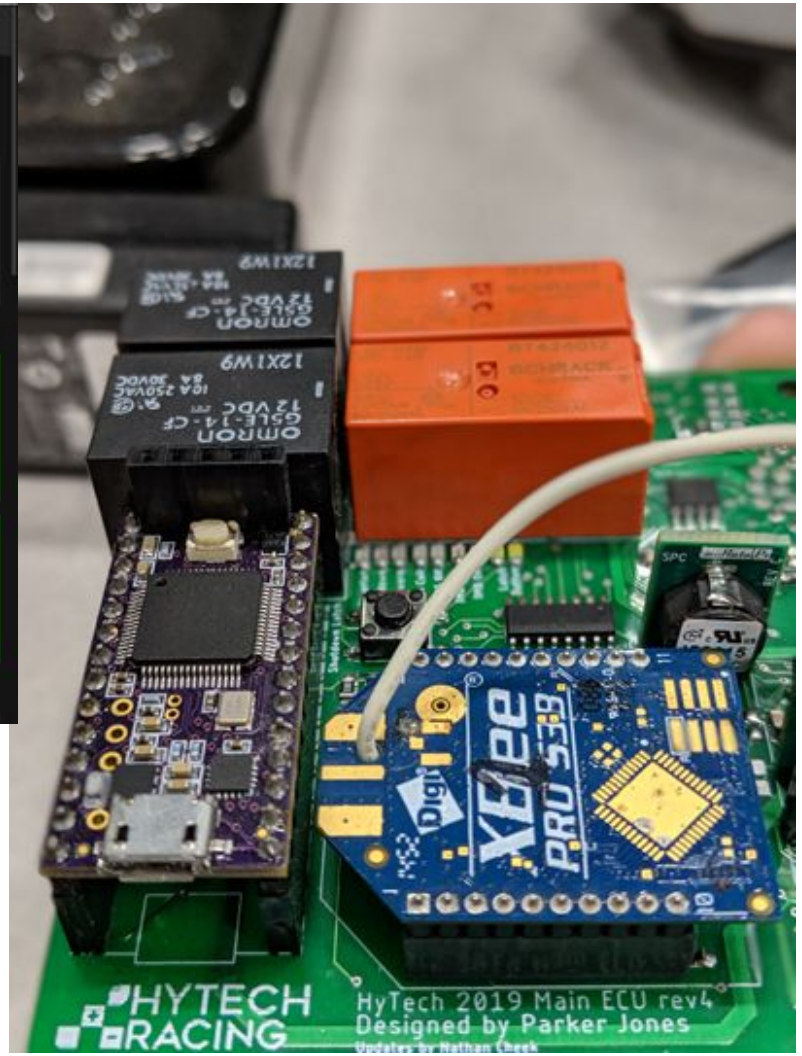


Ryan Galllaway, 2019

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



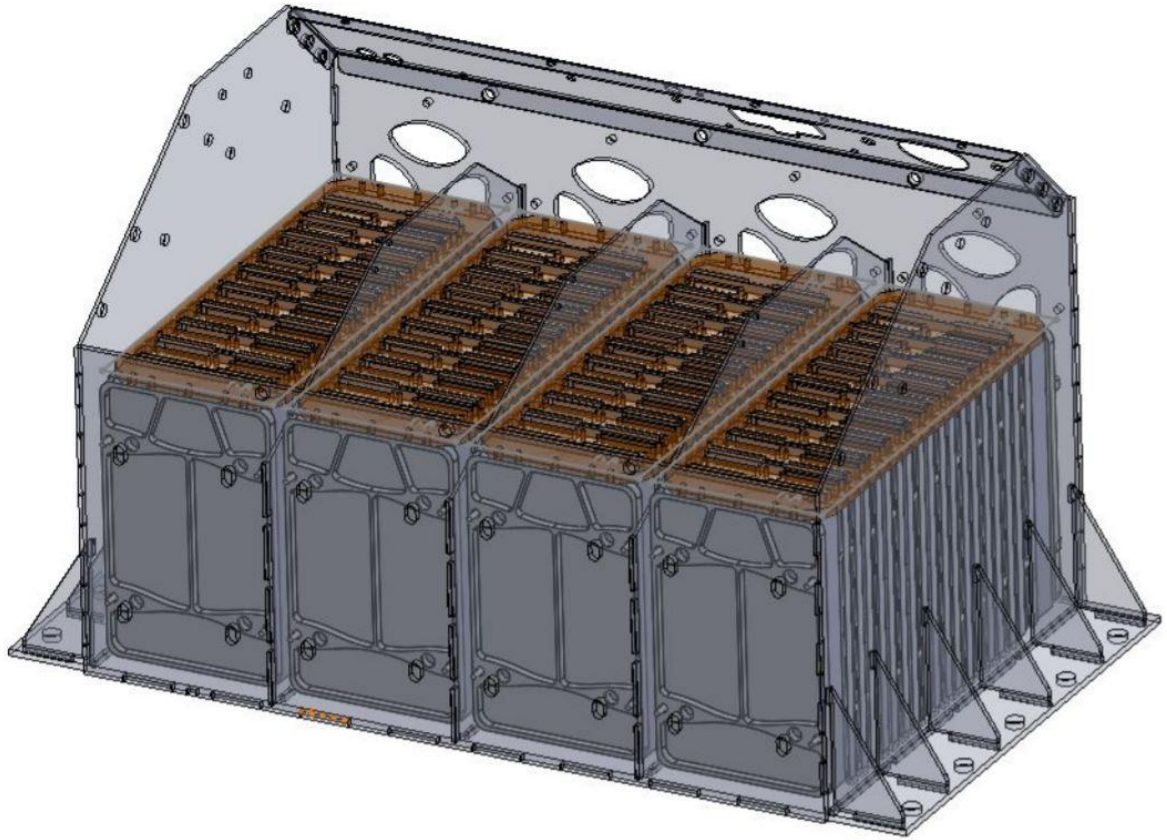


Electric Drives

Anson Tsang

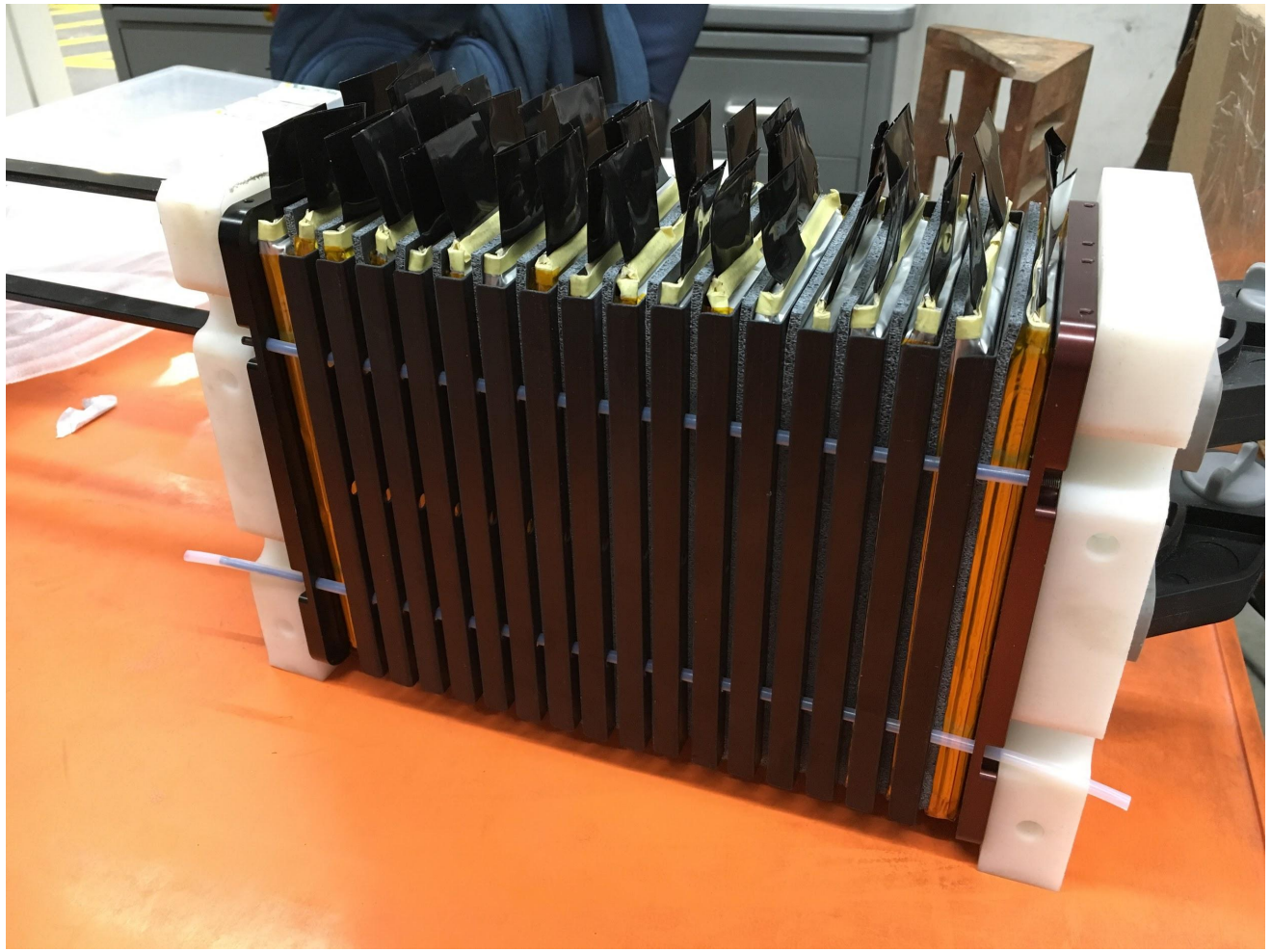
Accumulator Design and Analysis

- 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



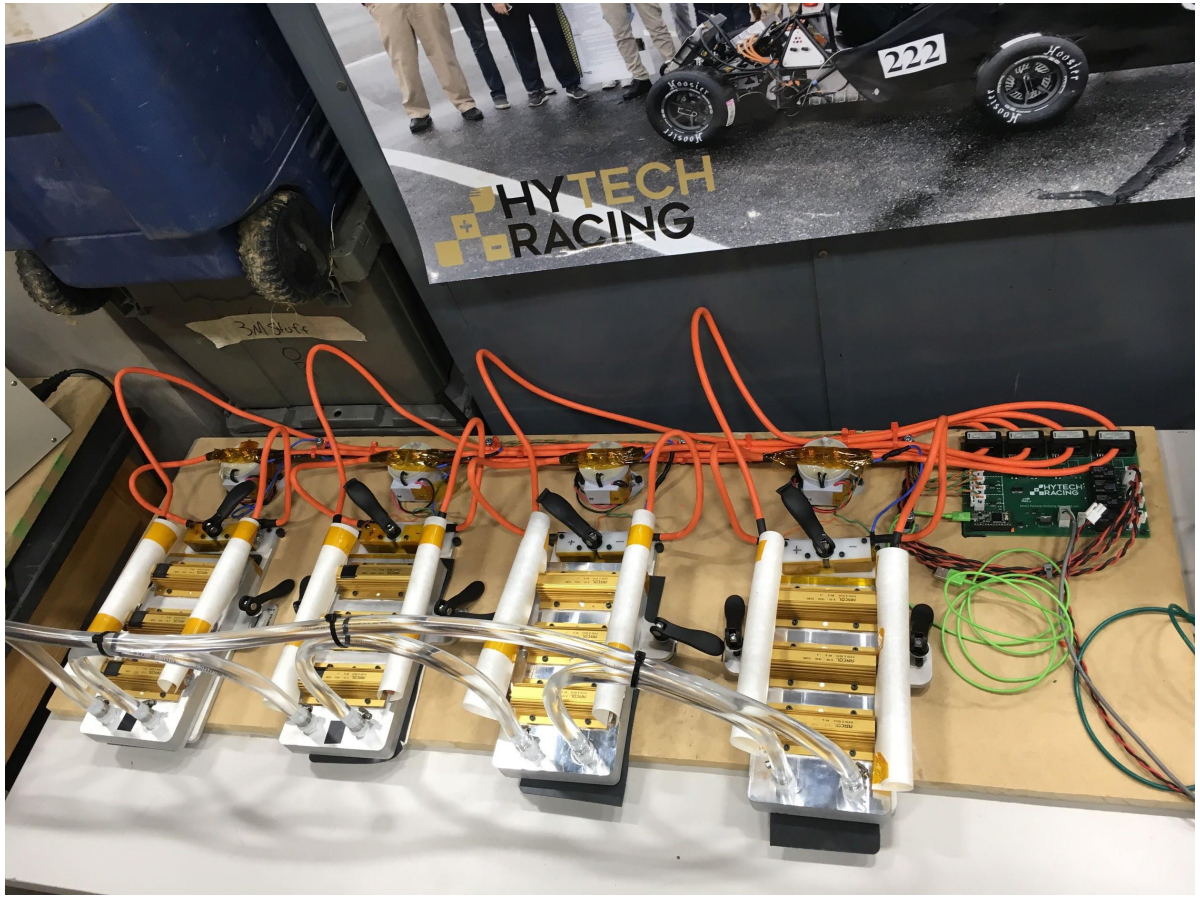
Accumulator Manufacturing

- 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



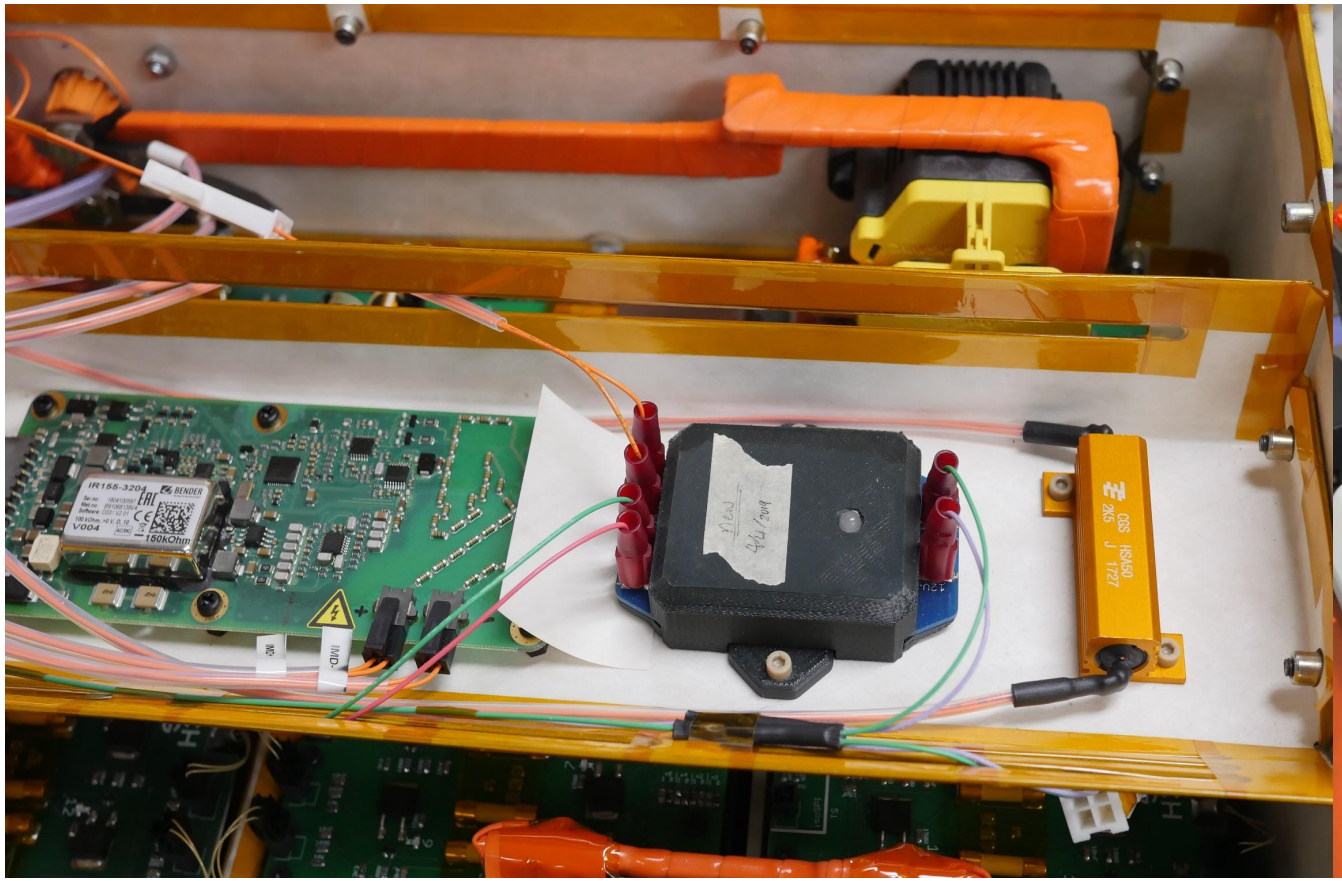
Cell Testing

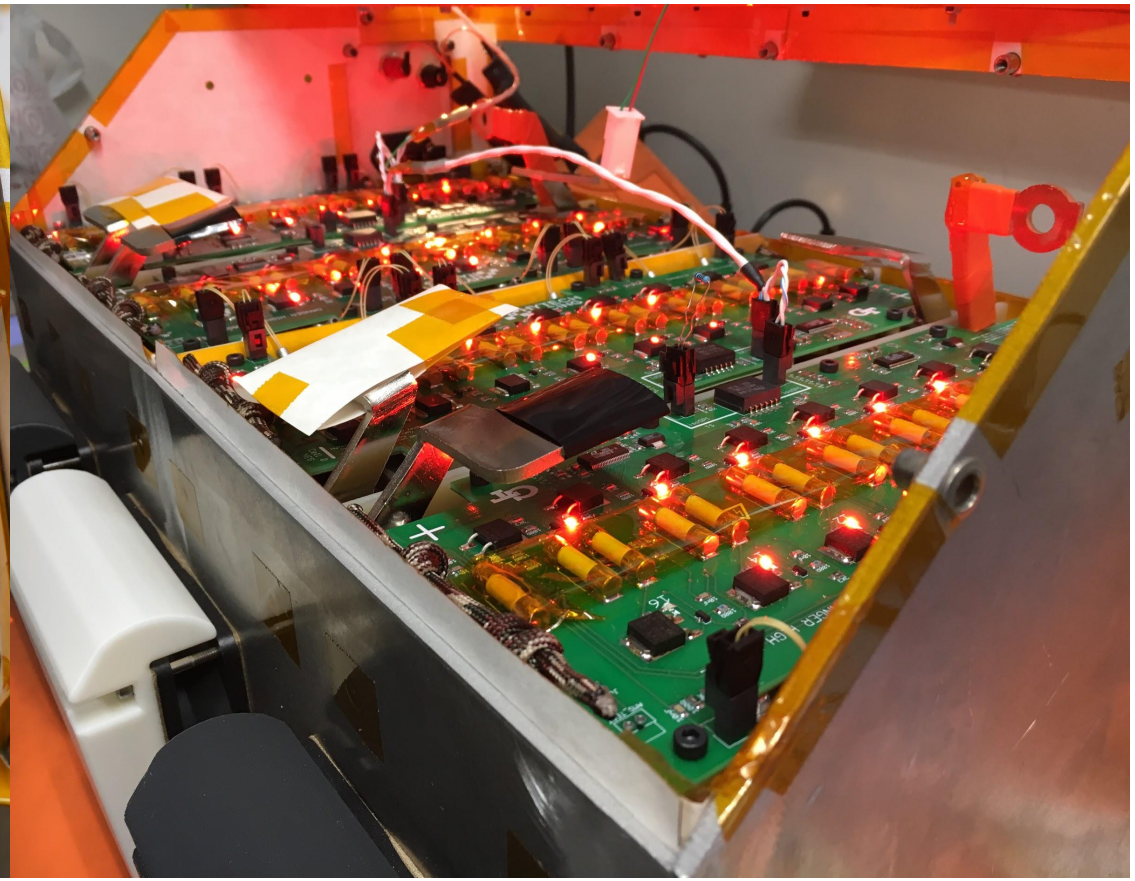
- Current Process:
  - Simultaneous 4 cell discharge
  - Water cooling for power resistors (constant resistance testing)
  - Data analysis in MATLAB
- Future Improvements:
  - Improve current discharge rig mechanical design
  - Implement constant load discharge testing
  - Design charge testing rig
-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



High Voltage Controls

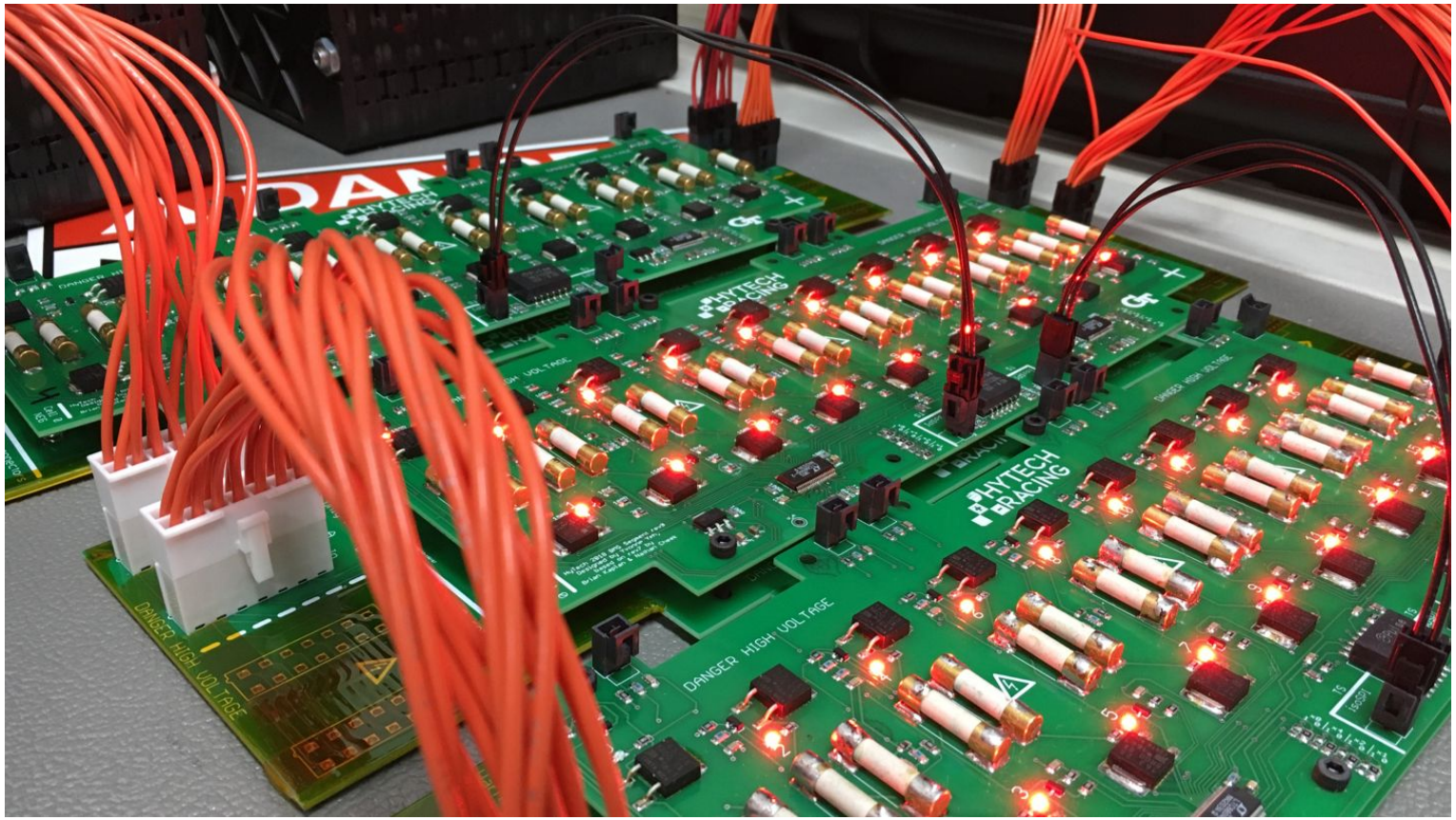
Arvind Srinivasan





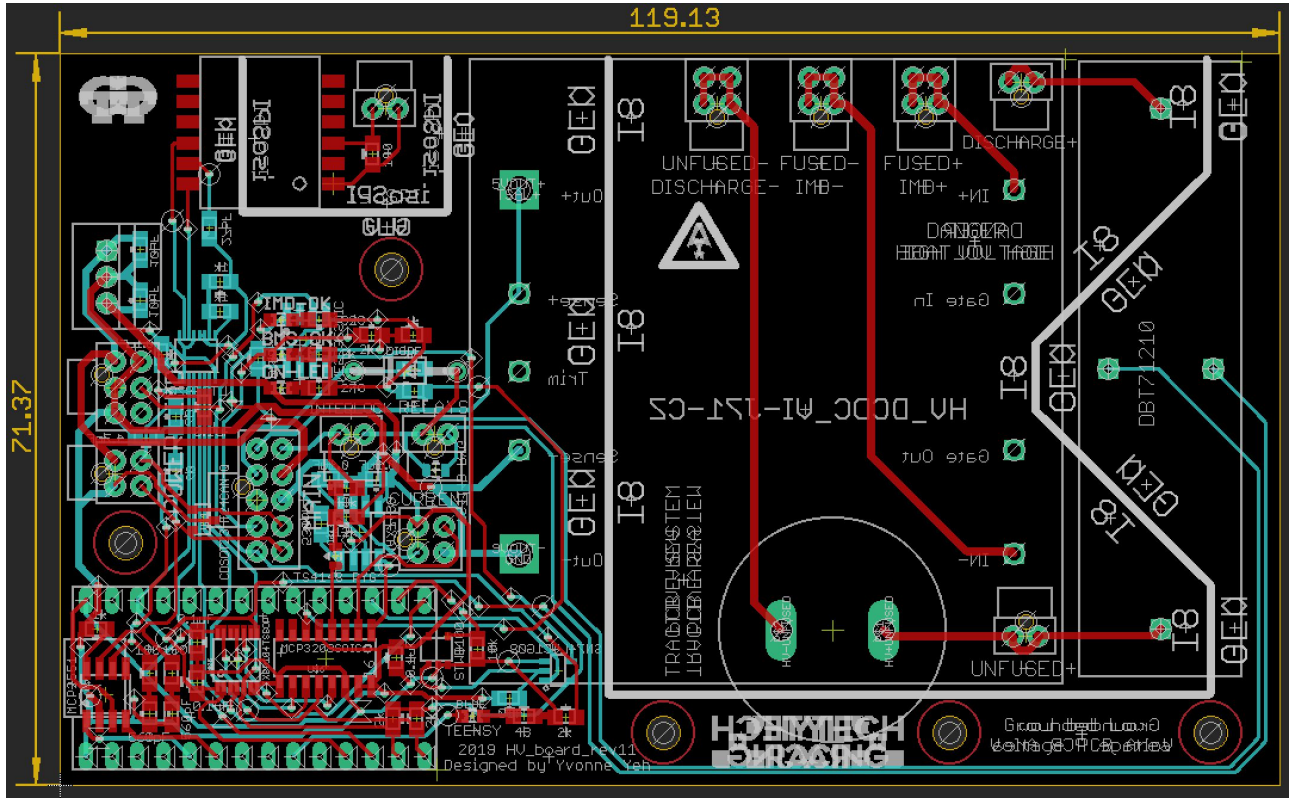
Battery Management System Segments

- 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



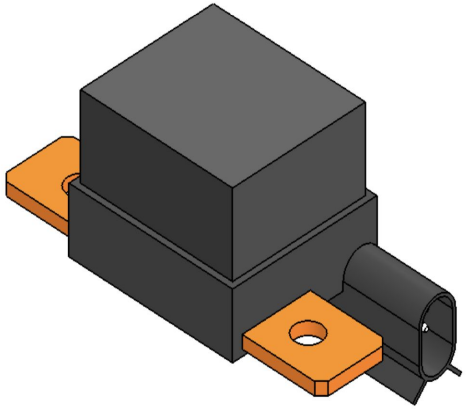
High Voltage Board

- 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	Arduino & EAGLE
Tuesday 9/10	6:30pm-8:15pm	SCC (Shop) AP Classroom	Car-related circuitry & EAGLE
Thursday 9/12	6:30pm-8:15pm	Invention Studio	Soldering