PRELIMINARY DESIGN REVIEW (FALL 2017)

LAFAYETTE FORMULA ELECTRIC VEHICLE – YEAR 6

LAFAYETTE
MOTORSPORTS

Electric Vehicle Competition

MOTIVATION

Complex engineering design project to represent Lafayette College as a team

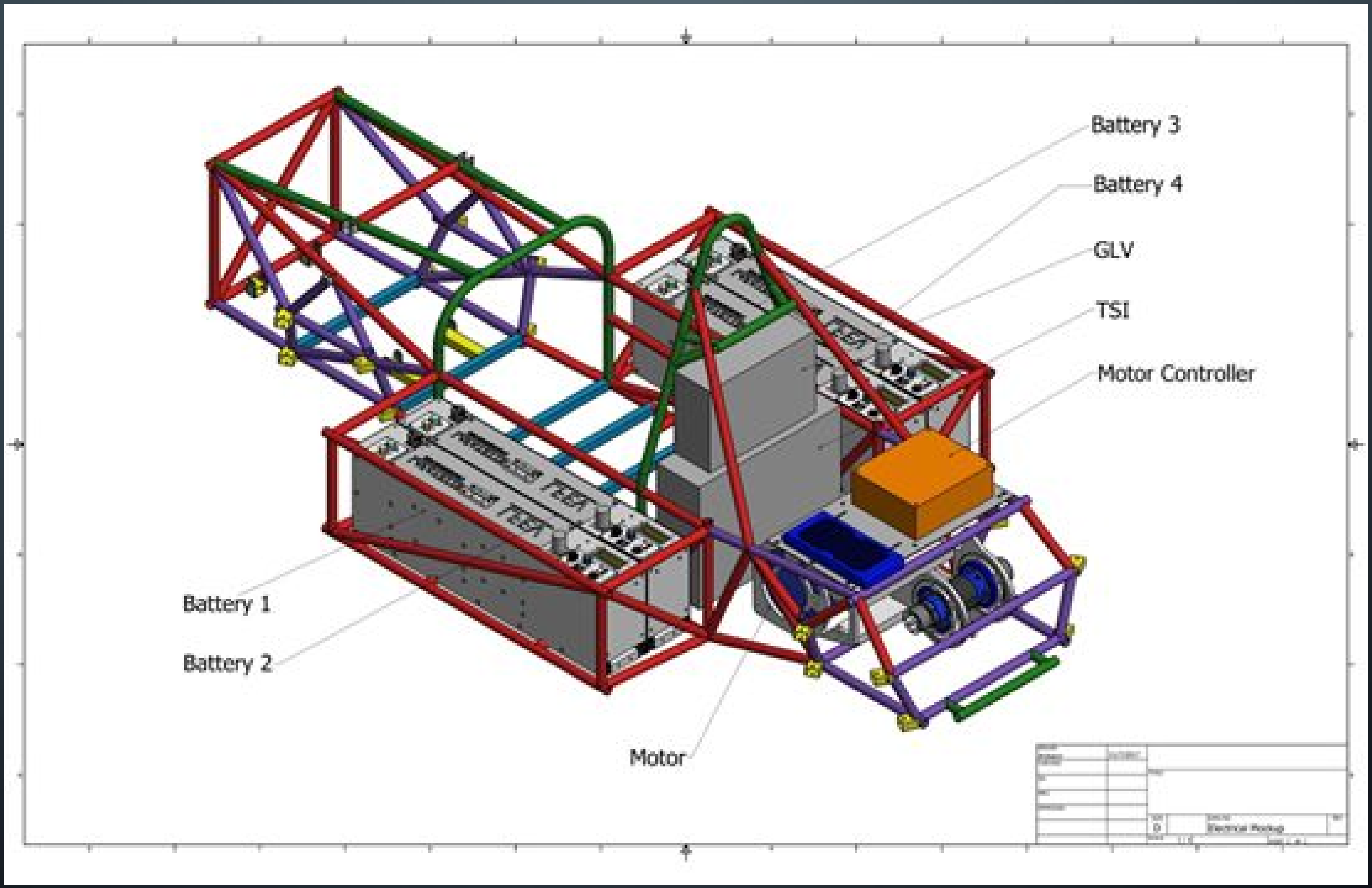
COMPETITION DETAILS

April 30 – May 3, 2018 | New Hampshire Motor Speedway

TWO UNITS, ONE TEAM

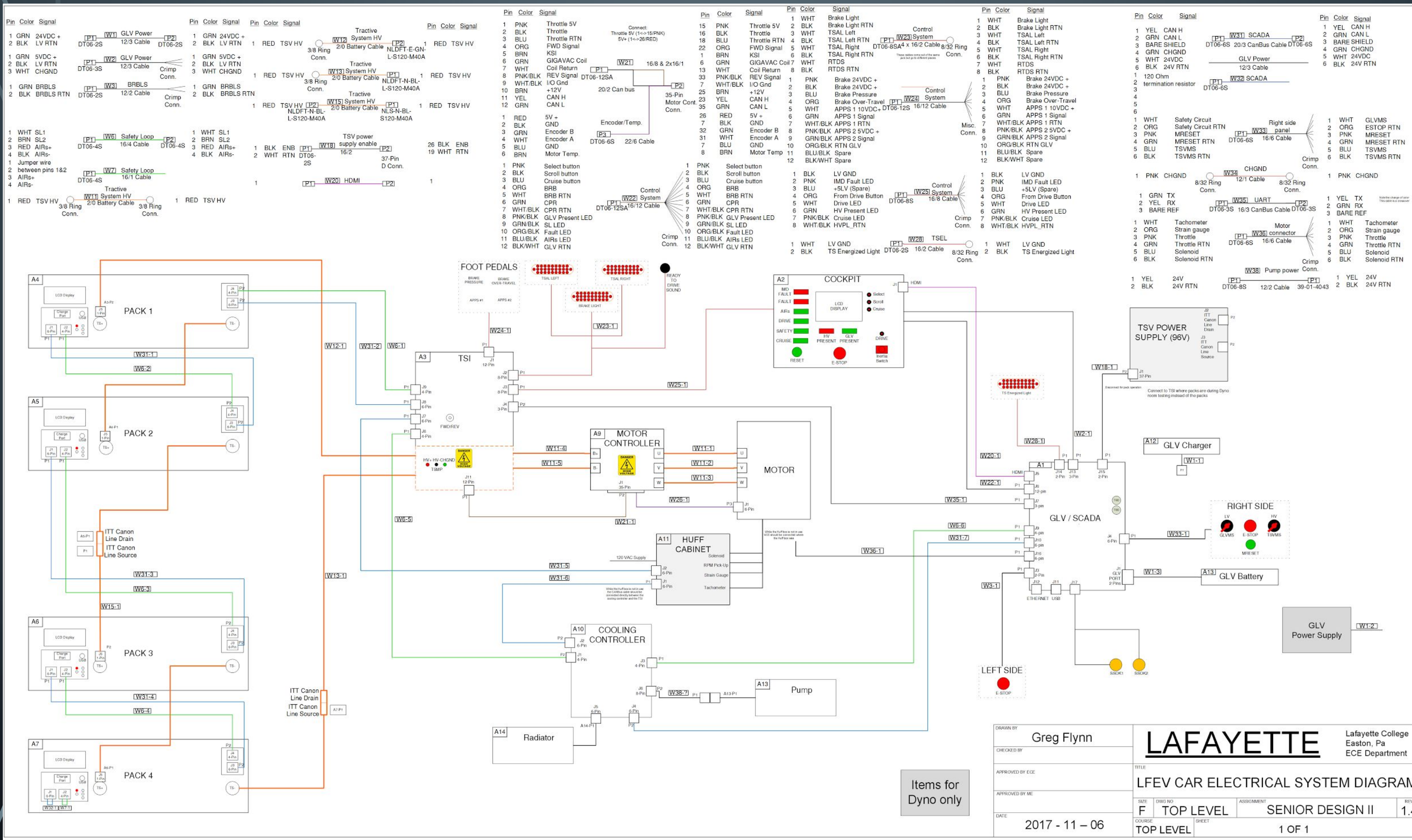
Working in conjunction with Department of Mechanical engineering

FORMULA HYBRID



Battery 3
Battery 4
GLV
TSI
Motor Controller
Battery 1
Battery 2
Motor

ELECTRICAL SYSTEMS

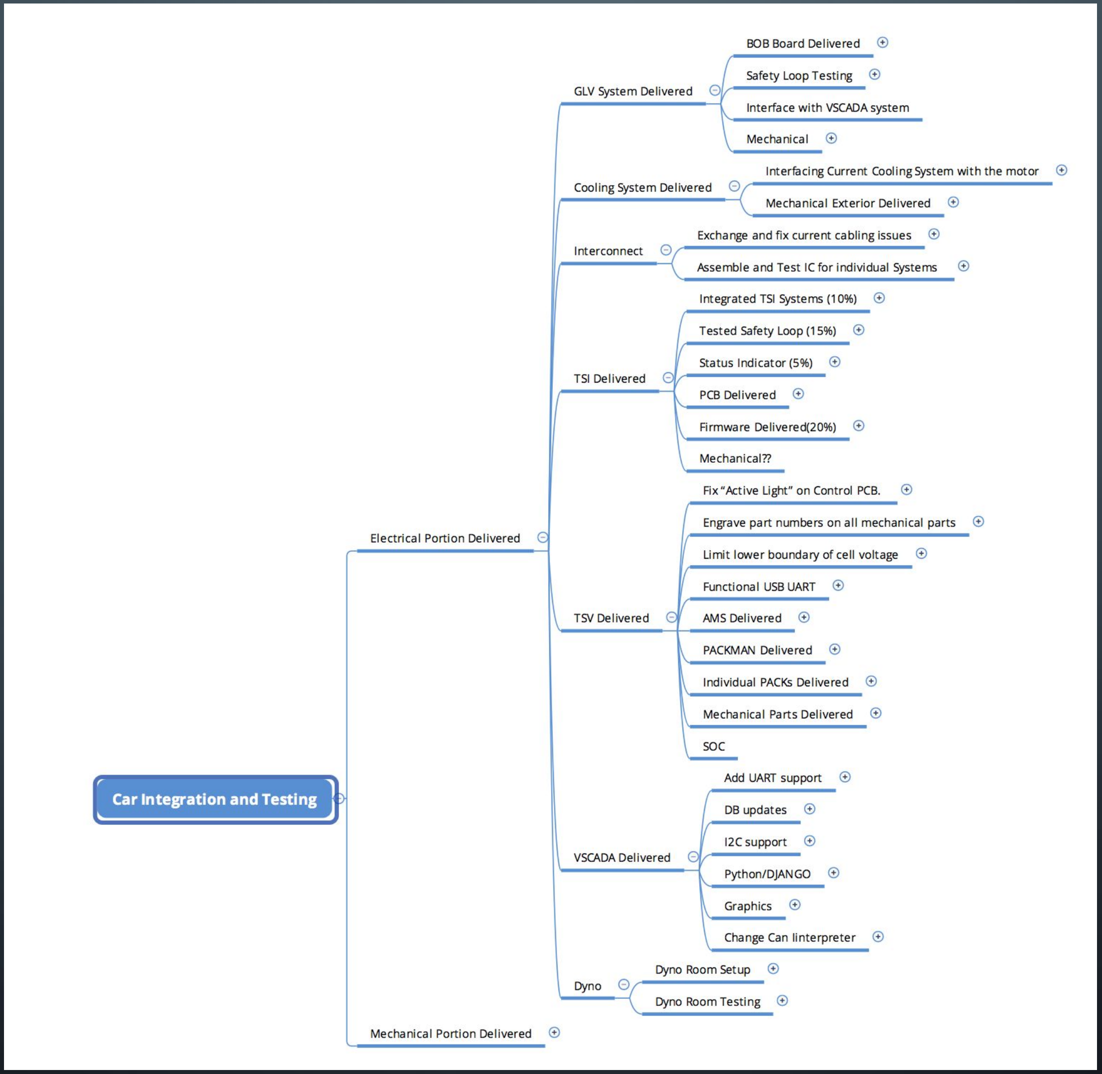


FUNCTIONALITY

Integration with mechanical design

Safety and Monitoring

WORK BREAKDOWN STRUCTURE



https://docs.google.com/spreadsheets/d/15JU6rdUReKeuP997CeSqEazxu3hTdUtKWZh_nVc_N80/edit#gid=1925126301

Schedule

	Week 1 (First Week)	1.22-1.28
	Week 2	1.29-2.4
	Week 3	2.5-2.11
	Week 4	2.12-2.18
CDR	Week 5	2.19-2.25
	Week 6	2.26-3.4
Dyno Testing, Hardware Purchasing Deadline	Week 7	3.5-3.11
	Week 8 (Spring break)	3.12-3.18
code freeze	Week 9	3.19-3.25
	Week 10	3.26-4.1
Car Integration and testing	Week 11	4.2-4.8
	Week 12	4.9-4.15
	Week 13	4.16-4.22
	Week 14	4.23-4.29
	Week 15 (Last Week)	4.30-5.6

~~Program Submission (2%)~~	~~12/08/2017~~
~~ESF-1 (10%)~~	~~11/10/2017~~
~~Team Photo (1%)~~	~~12/08/2017~~
Interim Project Management Report (5%)	02/02/2018
Impact Attenuator Data (15%)	02/09/2018
Site Pre-Registration (1%)	02/16/2018
Failure Mode Effects Analysis (10%)	02/23/2018
ESF-2 (10%)	02/23/2018
Design Reports (15%)	03/23/2018
Sustainability Report (15%)	03/23/2018
Design Specification Sheet (15%)	03/23/2017
Mentor Request (1%)	

Division of Labor

VSCADA - Geoff, Connor

TSI - Tom, Peter, Austin

Interconnect - Matt

TSV - Waseh, Sarah

Cooling - Austin, Russell

GLV - Russell, Kevin

Dyno - Chen, Amrit

SOC - Shu

MGMT - Nakul, Kevin

Purchasing/Inventory MGMT - Amrit

*Only initial proposal, might change in the future

Ground Low Voltage (GLV)

Provide 24V DC to power all low voltage systems

Control safety loop and COCKPit indication light

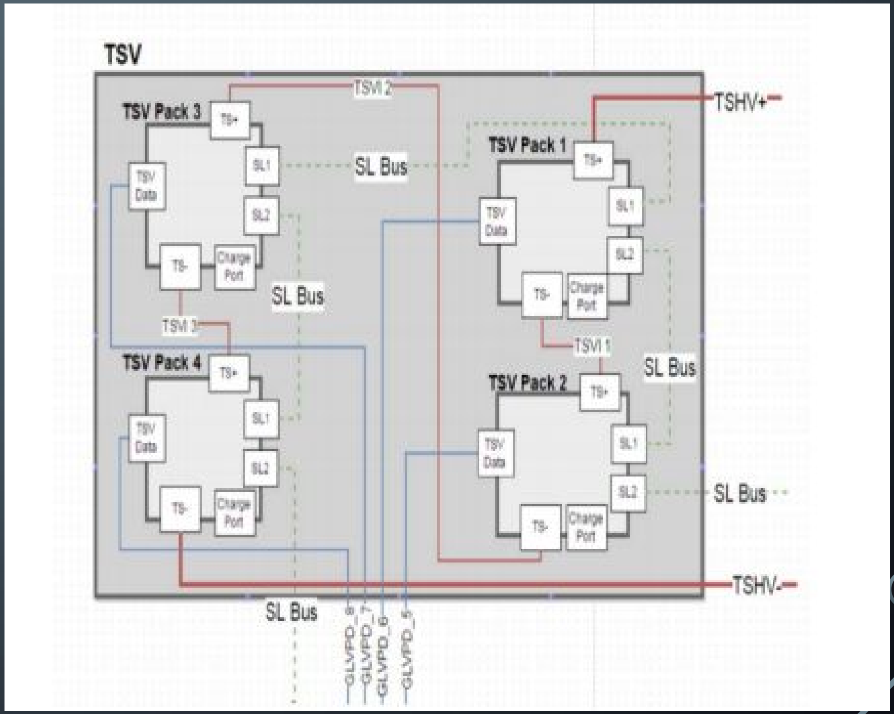
GLV box:

- Safety Loop, GLV PCB, and VSCADA system
- Connect to GLV charger and battery when operating

Tractive Systems Voltage (TSV)

Battery based power system responsible for providing adequate and accurate current supply to the vehicle.

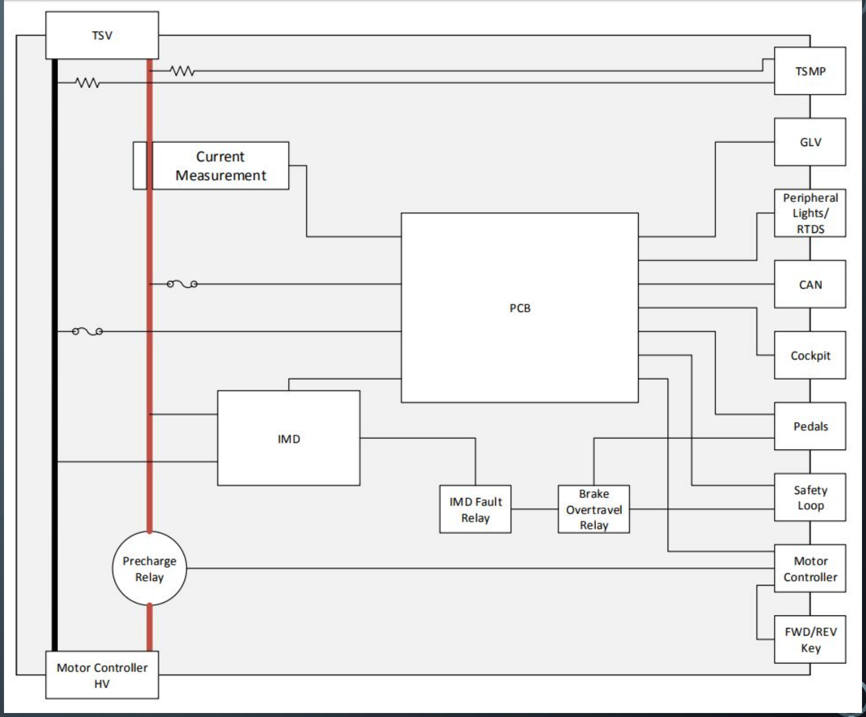
- Charging and discharging
- Temperature and voltage monitoring
- Safety



Tractive System Interface (TSI)

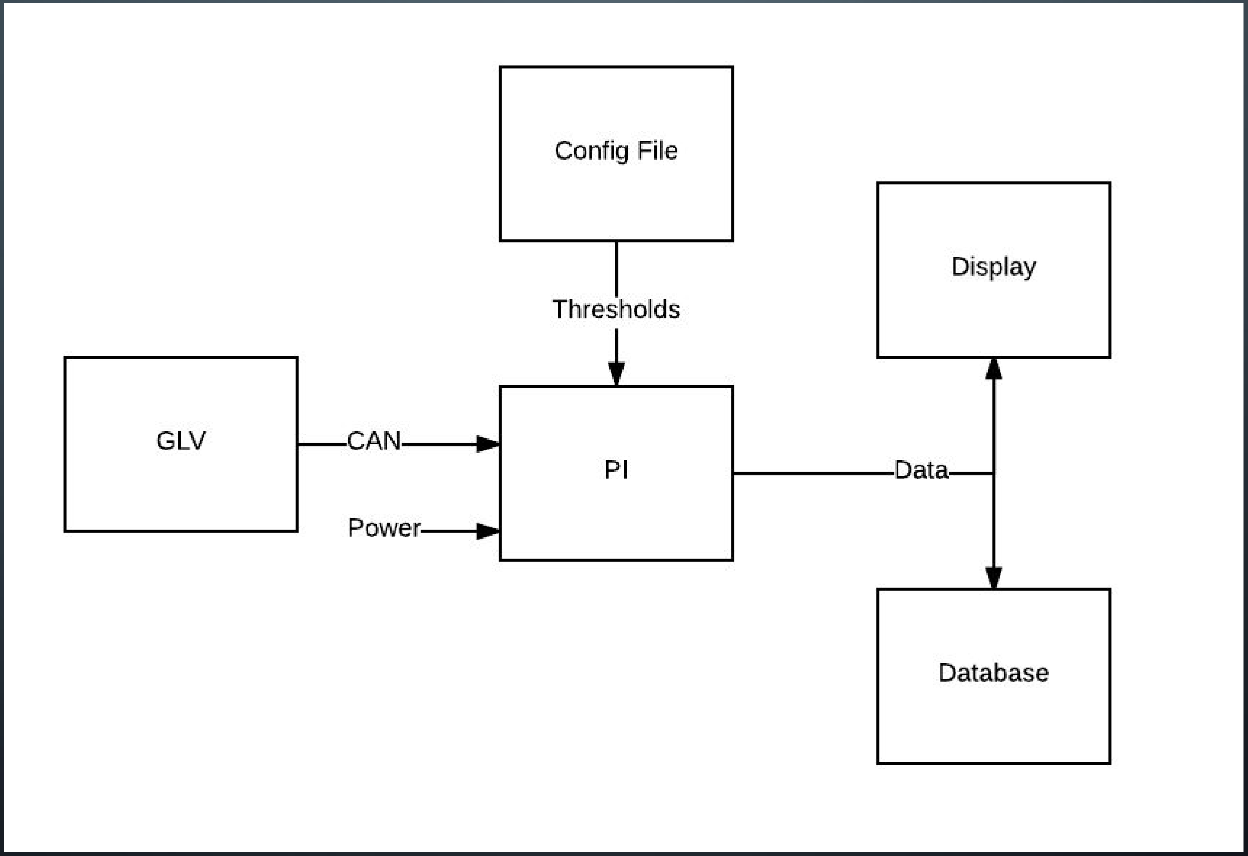
Subsystem description-

- Provide interface between motor controller and TSV
- Determine throttle plausibility and provide isolated signal to motor
- Read IMD status for tripping safety loop
- Measure motor voltage and current inputs and sent to VSCADA
- Manage drive state and respond to startup/shutdown conditions
- Display system status lights



VSCADA

Stores, Displays, and Reacts to CAN bus data.



INTERCONNECT CABLING

- Transfers power to each subsystem
- Connects subsystem to subsystem
- Labeling and color coding promotes organization
- Fits subsystem design physically within the car

COOLING

- Provides cooling to the motor/motor controller and keeps it at safe temperatures
- Going to use the Koolance controller along with fans and pumps currently in the dyno room

DYNO

- Device for measuring force torque, rotational speed, and power of a motor.
- Provides simulated road loading of the motor
- Used to test the interaction of electrical systems before actual integration in the car
- Controlled by software which also records dyno data, which will be investigated for further modification of certain components on the car.

Proposed Budget

Team	Allocated Budget	Total Spent	Budget Remaining	Percentage Spent
TSI	$500	$0.00	$500.00	0.00%
GLV	$150	$0.00	$150.00	0.00%
VSCADA	$100	$0.00	$100.00	0.00%
Controller Cooling	$150	$0.00	$150.00	0.00%
Interconnect	$1,150	$0.00	$1,150.00	0.00%
TSV	$500	$0.00	$500.00	0.00%
Shipping / Tax / Misc	$450	$0.00	$450.00	0.00%
TOTAL	$3,000	$0.00	$3,000.00	0.00%

- Each group gave a rough estimate of their expected costs
- Past 2 years spent ~%15 of budget on shipping/tax
- Remainder of budget was allocated to interconnect


ACOPIAN ENGINEERING CENTER

APPENDIX

GLV

Tasks accomplished-

- Designed Safety Loop with SSOK Lamps
- Determined change needed for existed design

Plans for next semester-

- Break Out Board (BOB) change
- Mechanical Change
- Safety Loop Testing
- Interface with VSCADA system

TSV

Tasks accomplished-

- Cells assembled
- Internal cabling
- Most AMS and PACMan functionality

Plans for next semester-

- PACMan full functionality
- 28 working AMS boards
- Firewall integration
- SOC improvement

Materials-

- New Connectors (Packs and PACMan)
- New Light

VSCADA

Tasks accomplished-

- Developed new database schema for sensor data
- Analyzed low power mode issue faced last year
- Setup Raspberry Pi

Plans for next semester-

- Integrate with all relevant subsystems
- Write Python program to store sensor data in db
- Interpret data to trip safety loop and display useful metrics (i.e. speed, battery level, etc.)
- Configuration File to set thresholds

Parts:

- PICAN2 -CAN interface for raspberry PI
- 1 male & 1 female DB9 Connector

INTERCONNECT CABLING

Tasks accomplished-

- Completed labeling on all cables on System Diagram
- Compiled order information for new grounded connectors for battery packs (Amphenol Powerlok)

Plans for next semester-

- Confirm Powerlok receptacle can fit without intrusions with computer model, remodel under small panel on the packs if necessary
- Update outdated connectors and cables
- Replace and relabel cables and connectors on the system diagram as new parts are ordered

TSI

Tasks accomplished-

- Determined state of current system
- Connected current board to test panel for validation

Plans for next semester-

- Test/validate current board
- Update and rebuild board
- Work with MechE team to finalize enclosure
- Install in car

COOLING

Tasks accomplished-

- Decided to use current 12V Koolance cooling controller with fans and pumps

Plans for next semester-

- Integrate cooling system with the motors and electrical system
- Work with mechanical engineers to get a casing/box fabricated for the cooling

Materials-

- 24V to 12V DC/DC converter
- Opticool-A-Fluid
- Additional tubing for pumps

DYNO

Tasks accomplished-

Cockpit Panel: all the panels with control buttons and indicator lights were taken off from the car and mounted in the dyno room for dyno testing.

TSI: TSI box was removed from the car and was reconfigured into a simpler version in the dyno room for testing

GLV: GLV box and all the cables were taken off the car. The GLV was reconnected with panels and TSI with the cables in the dyno room. It is powered by 24V power supplied in the dyno room. The GLV has passed the running test. As it was launched by ignition keys and each button on it was pressed in sequence, all the correct indicator lights turned on and functioned properly.

Cooling system for the dyno test was rebuilt and installed above the dyno.

Dyno software: The software was built by students from previous years and had multiple versions. The most stable modified version of them was selected for dyno test. It can be controlled remotely. The software currently is able to recode data collected by the dyno.

Plans for next semester-

Integrate the current dyno setup with other parts of the car including TSV and VSCADA.

MANAGEMENT

Tasks accomplished-

- Completed and submitted an Electrical Subsystems Form (ESF-1) for the Formula Hybrid Competition.
- Completed a preliminary work breakdown structure (WBS).
- Completed a preliminary budget plan.
- Setup website for 2018 project.

Plans for next semester-

- Complete and submit all required forms for the Formula Hybrid Competition (listed in WBS).
- Meet informally on a weekly basis to compile materials for weekly status meetings.
- Attend and record weekly project status meetings.
- Maintain a dynamic WBS with weekly changes based on project status letters.
- Maintain a dynamic project website with regular updates.
- Maintain a budget with cost analysis and purchasing reports.
- Complete and present a critical design review.