Critical Design Review

LFEV-Y6-2018

Agenda

PART I: System overview, and demonstration plan

1. Introduction
2. Subsystems
    a. Tractive System Voltage (TSV)
    b. Tractive System Interface (TSI)
    c. Vehicle Supervisory Control and Data Acquisition (VSCADA)
    d. Ground Low Voltage (GLV)
    e. Interconnect Cabling
    f. Dynameter
    g. Cooling System
3. Demonstration

LAFAYETTE MOTORSPORTS

PART II: Future plans, management, schedule, and budget

Introduction

Motivation:

- Get into the competition, Get into the competition, and Get into the competition!

Competition Details:

- April 30th - May 3rd @ New Hampshire Speedway

Two units, one team:

- Working in conjunction with Department of Mechanical Engineering

Introduction - subsystem's components

Tractive System Voltage (TSV)

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

Tractive System Interface

- Provide interface between motor controller and TSV
- Determine throttle plausibility and provide isolated signal to motor
- Read Insulation Monitor Device (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

Grounded Low Voltage

- Provide 24V DC to power all low voltage systems
- Control safety loop and COCKPit indication light

Introduction - subsystem's components

Vehicle Supervisory Control and Data Acquisition (VSCADA)

- Stores, Displays, and Reacts to CAN bus data.

Cooling System

- Provides cooling to the motor/motor controller and keeps it at safe temperatures

Interconnect Cabling

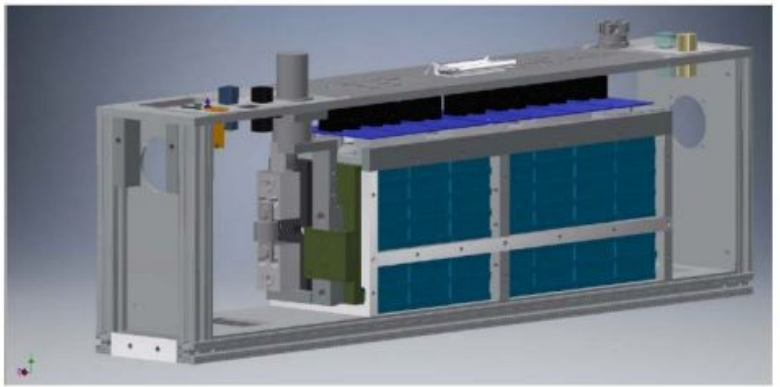
- Transfers power to each subsystem
- Connects subsystem to subsystem
- Labeling and color coding promotes organization
- Fits subsystem design physically within the car

Dynamometer

- Control the motor in the Dyno room
- Read CAN bus data from the subsystems and sensor data from the motor

Tractive System Voltage (TSV) - Previous Status

- PacMAN
  - Watchdog not working
  - Non functional Interface
  - Base for configurable parameters
- Accumulators
  - No CAN bus communication with VSCADA
  - One cell dying
  - Missing charging/LCO connections
  - Non compliant HV connectors
- AMS
  - Mix of working/non working AMS boards



Tractive System Voltage (TSV) - Current State

- PacMAN
  - Working watchdog (might be too sensitive)
  - Interface working correctly
  - 4 PacMAN boards installed in packs
  - Configurable parameters
- Accumulator
  - CAN communication of all 4 packs to VSCADA
- AMS
  - 28 functional AMS boards installed in segments
  - One board as a test board for rules committee
  - New boards ordered

Tractive System Interface (TSI) - Previous State

Hardware

- PCB
  - TSI circuit board had most functionality
  - No way to adjust throttle plausibility windows
  - DC/DC converter underpowered for TSAL
- Enclosure
  - Ribbon cables made interface with external connectors difficult
  - HV cables were not liquid tight

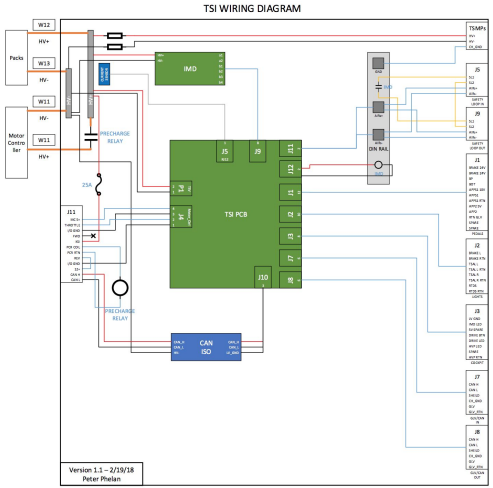
Software

- Drive States existed but not much other major functionality

Tractive System Interface (TSI) - Current State

Hardware

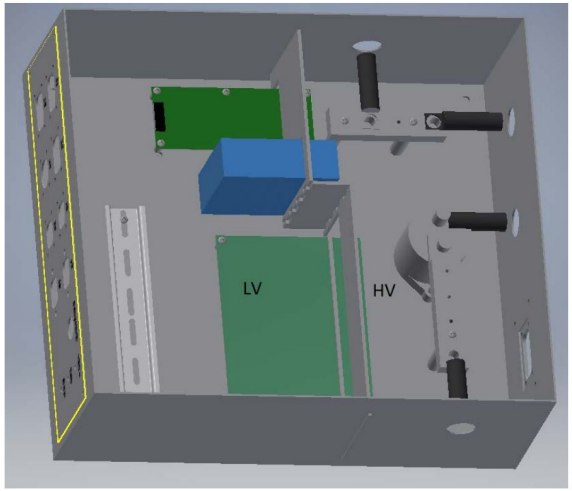
- PCB
  - Different DC/DC converter selected for powering new TSAL according to rules (EV9.1)
  - Replaced ribbon cable/DIN terminals with Molex connectors
  - Added trim pots for adjusting throttle plausibility window
  - LED added for showing throttle implausibility
- Enclosure
  - Removed brake over-travel (BOT) relay to comply with rules (T7.3.1)
  - Removed several DIN terminals
  - Created cables for HV interface between TSI and motor controller
  - HV liquid tight connectors added to connector plate



Tractive System Interface (TSI) - Current State

Software

- System Measurements
  - Voltage, Current, Temperature, IMD Status, Drive State
- CAN Communication
  - Sending various system measurements to VSCADA
  - Receiving a “throttle control” signal from VSCADA to drop out of drive mode
- Drive States
  - Currently building upon last year’s drive states



Vehicle Supervisory Control and Data Acquisition (VSCADA)

Previous State

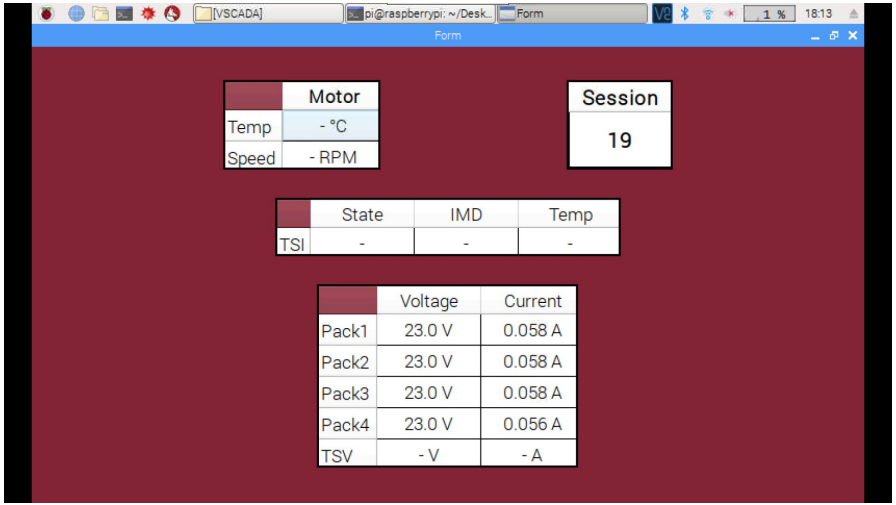
- Java program for storing and displaying data
- One display for cockpit
- Raspberry Pi
- USB to CAN converter (finicky)
- Some functionality but not in the car

So, we started from scratch using Python and a new CAN interpreter

Vehicle Supervisory Control and Data Acquisition (VSCADA)

Current State:

- Successful collection of CAN data
- Touch screen mounted on GLV to monitor real-time data
- Successful monitoring of CAN data
  - Drop out of drive mode
- Successful logging of CAN data



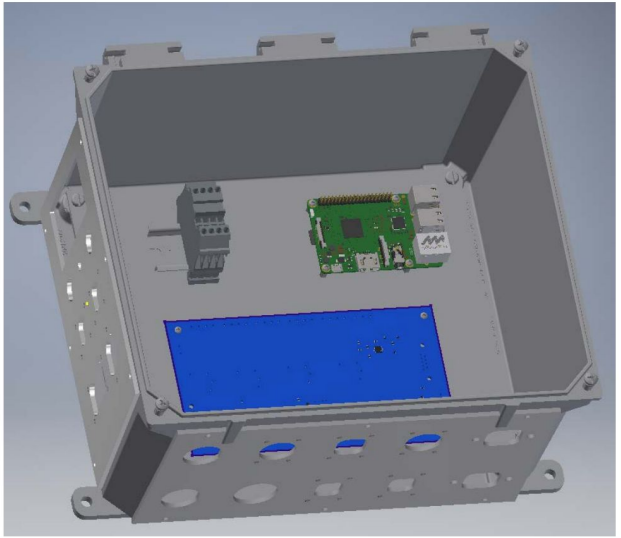
Grounded Low Voltage (GLV)

Previous State:

- Already fully functional

Current State:

- New case has been re-designed by ME team.
  - Re-wired and tested the GLV in the new enclosure
- SSOK lamps added to comply with rule EV 9.3
- VSCADA monitor added on the side of the GLV



Interconnect Cabling

Previous state:

- Cables scattered throughout 400 and 401, many out of date.
- All cables had some sort of label or indication

Current state:

- All interconnect cables organized in 400
- New orange shielded battery cable ordered and Amphenol Powerlok connectors ready for installation on TSV battery packs
- Fixed low quality cables that would not have passed tech inspection (exposed wiring, etc.)

Dynamometer

Previous state:

- CAN bus and Huff box data did not display correctly
- Software CPU usage was too high

Current state:

- Software on Windows side collects CAN data from motor controller
- Software on Linux side communicates with Huff Box

Future Plan

- Move the software on Linux to Windows to improve performance

Cooling System

Previous State:

- Used an Arduino as the controller
- Was part of the safety loop
- Exported CAN data to VSCADA
- Not functional

Current State:

- No Arduino
  - Using controller from DYNO
- Added 24v to 12v DC converter
- Functional!

Demonstration Plan

What you should see in the actual integration:

- TSV: Connection of CAN Bus - Show status on each pack display
- TSI: TSI Box integrated with the dyno and functional
- GLV: Safety loops operation, VSCADA integrated in the Case
- Cooling: Functional when GLV is turned on

What you should see on the GLV screen:

- Display real time data from packs and motor on GLV display
- Data will be stored in database
- Dashboard display will show placeholder data

Time to Demo!

Welcome Back!

Part II: Future plans for subsystems, schedule, and budget

Schedule

CDR and Demonstration	Week 6	02/26 - 03/04
Work	Week 7	03/05 - 03/11
Spring break	Week 8	03/12 - 03/18
Reach 100% of each subsystems, Dyno integration and testing	Week 9	03/19 - 03/25
March 29. Drop dead date. Car Integration	Week 10	03/26 - 04/01
Peer Evaluation: April 6,7,8	Week 11	04/02 - 04/08
Car Integration and testing	Week 12	04/09 - 04/15
Car Integration and testing	Week 13	04/16 - 04/22
Car Integration and testing	Week 14	04/23 - 04/29
Go to Competition!	Week 15	04/30 - 05/06

Tractive System Voltage (TSV) - Future Plans

- TSV 2.6 & TSV 3.1 - Replace Fuses to comply with rules (3/9)
- TSV 3.3.4 - Install amphenol connectors and replace busbars (3/23)
- TSV 3.5 - Make and install LCO/Charging cable (3/9)
- Rule compliance
  - Pictures of boards
  - Final Configuration Parameters set
- TSV 2.5 - Delay Switch Off of Safety Loop (3/9)

Tractive System Interface (TSI) - Future Plans

- Hardware
  - TSI 1.4 - Build New Board/Populate new PCB (3/9)
  - 1TSI 3. - Wiring board into new enclosure (3/23)
  - TSI 3.3 - Calibrate voltage and current sensors and throttle plausibility pots (3/23)
  - TSI 3.5 - TSAL/RTDS Mounted and Wired (3/23)
- Software
  - TSI 2.5 - Drive States Delivered (3/9)
  - TSI 2.1 - Current Measuring Delivered (3/9)
- Integrated Subsystem
  - TSI 4.1 - Create and execute acceptance test plan (3/26)
  - TSI 3.6 - Grounding and sealing of TS cables (3/23)
  - Integrate into rest of car and test with other systems (3/30)

Ground Low Voltage (GLV) - Future plans

Enclosure:

- Wire organization (Done by 3/6)

Integration with the car.

Vehicle Supervisory Control and Data Acquisition (VSCADA)

Future Plans:

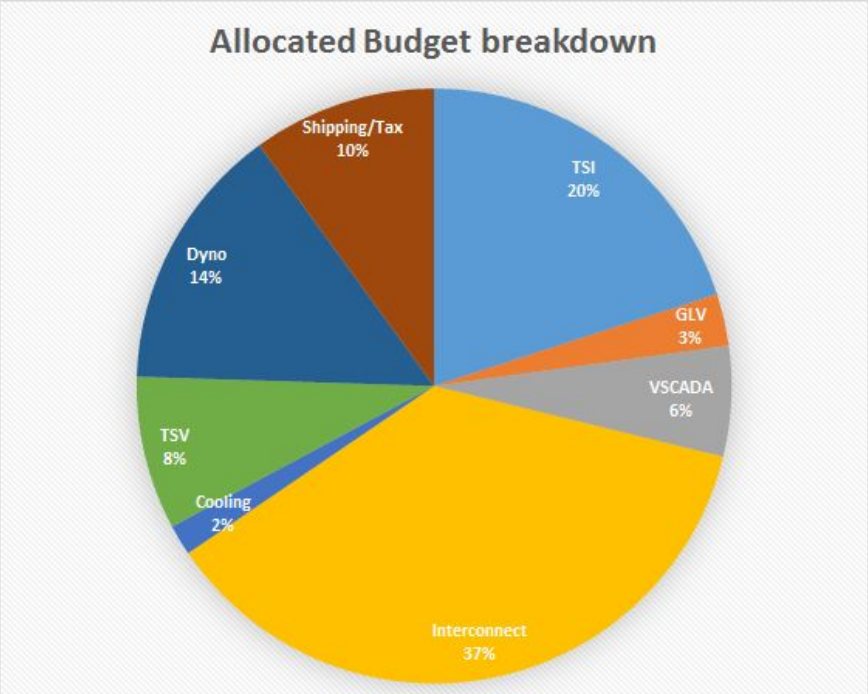
- SCADA 3.4 - Dashboard display
  - Write to screen
- SCADA 1.8 - Export CSV (more reliably)
  - Mount USB to Pi
- SCADA 4.5 - Mount Pi in the GLV
- SCADA 2.6 - Ignore spikes in CAN data that could drop out of drive mode
- SCADA 3.8 - Indicate when data is not being received from a sensor

Interconnect Cabling - Future Plans

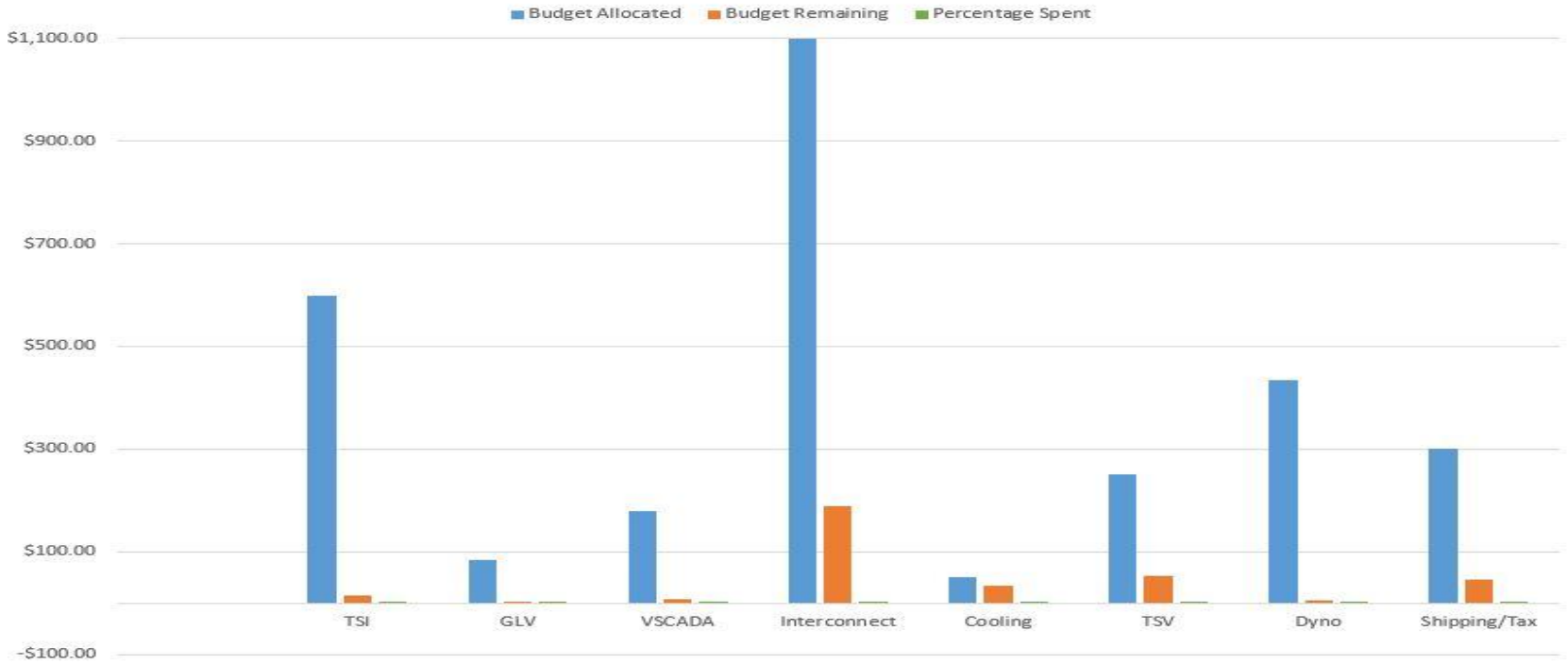
- IC 1.3.3- Install Amphenol Connectors on TSV battery packs(03/21)
- IC 1.2.6 - Replace black cable with orange shielded battery cable (03/23)
- IC 1.4.1- Give proper strain relief for necessary cables (03/21)

Budget

Subsystem	Spent to date	Budget Allocated	Budget Remaining	Percentage Spent
TSI	$586.04	$600.00	$13.96	97.67%
GLV	$82.22	$85.00	$2.78	96.73%
VSCADA	$172.59	$180.00	$7.41	95.88%
Interconnect	$910.02	$1,100.00	$189.98	82.73%
Cooling	$15.99	$50.00	$34.01	31.98%
TSV	$198.09	$250.00	$51.91	79.24%
Dyno	$430.57	$435.00	$4.43	98.98%
Shipping/Tax	$253.83	$300.00	$46.17	84.61%
Total	$2,649.35	$3,000.00	$350.65	88.31%



Budget Spending Per Subsystem



Q & A