



Formula 1 Hybrid Car

Senior Design 2020-2021

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Introduction

Our team will be working with the Notre Dame Formula Hybrid team to continue development of the electrical system and powertrain in their hybrid vehicle. We will improve upon work done by previous senior design teams.

Problem Descriptions

- System Status Interface
- CAN Drive System
- Engine Feedback Loop

Problem/Solution: System Status Interface

Problem

- LCD display is difficult to read
- No data logging for RF Transmitter
- Does not update in real time
- Unknown baud rate

Solution

- Find baud rate of UART or use other protocol
- Improve Matlab GUI
- Add data log feature
- Fix LCD brightness and color contrast

Problem/Solution: CAN Drive

Problem

- Current system is not able to distinguish the difference between the left and right hub controller messages.

Solutions

- Implement two separate CAN busses, one for each side. The current PIC32MX795, and the motherboard are capable of doing this.
- Use the “Preferred CAN address”. Using this method we would set the identifying bits which using the Saleae Logic Analyzer we would identify the addresses.

Problem/Solution: Engine Feedback Loop

Problem

- Too much noise on signals
- System gets errors when motors are on
- Current algorithm only accounts for set RPM

Solution

- Add noise resistant cables between servo and motherboard
- Add separate pcb for RPM sensor circuit
- Implement new software that would account for variable RPM

Demonstrated Features

We plan to demonstrate real time vehicle information, including both hub motors individually to the driver, and to the off-track team through the RF Transmitter. Second, we will demonstrate a data log for the car sent through the RF Transmitter. Third, we plan to demonstrate a stable engine feedback loop which maintains stable RPMs using reference to the high voltage capacitors to prevent stalling.

Technologies

- Quad/Dual Supercapacitor Auto Balancing (SAB) MOSFET Array
 - <http://www.aldinc.com/pdf/ALD810025.pdf>
- Fuses
 - https://www.mouser.com/datasheet/2/240/Lit_telfuse_Smart_Glow_MINI_Blade_datasheet-1291256.pdf

Engineering Content

Classes: RF, Embedded Systems, Control Systems, Electric Vehicles

- We need to be able to do real time transmission and reception of data which will require concepts from RF
- Taking aspects from control systems and signal analysis will be essential for the ICE and motor control system
- We will be using a PIC microcontroller and writing C code, skills learned in Embedded Systems

Conclusion

- Opportunity to work in a multi-disciplinary team on a legacy project
- “Customer Experience” with specific design requirements/requests
- Complete ESF documentation needed for Formula Hybrid competition approval
- Receive and respond to feedback from an outside team
- Ultimate goal is to build a functional Formula Hybrid vehicle by the end of the year