EE/CprE 4910 – sdmay25-26
Week 4 Report
10/3/2024 - 10/10/2024

Cost-Effective and Easily Configurable High Voltage Motor Controllers for Automotive Use
PRISUM Solar Car Club, Jonah Frosch
Nathan Neihart, Cheng Huang

Summary

With shipping issues resolved, we have all of the tools we need to get started. Software tests are ready to be run, hardware is ensuring that board is useable, and planning is continuing. Other research is also being conducted between the hardware and software focused members as we look to develop our own PCB with our own customizations.

Accomplishments

- Hardware inspected and test setup designed for initial software tests and motor calibration – Marek, Jonah, Long
- Generated multiple C-projects with ST-XCUBE-MCSDK – Gavin
    - Used to generate motor controller examples to reverse engineer
- Completed initial high-level design of software – Bryce

Pending Issues

Not much. The development board issues have been resolved and it has arrived from Detroit. We were a bit slowed down from some of the classwork, but we're making progress in accounting for that when we are allocating time for senior design.
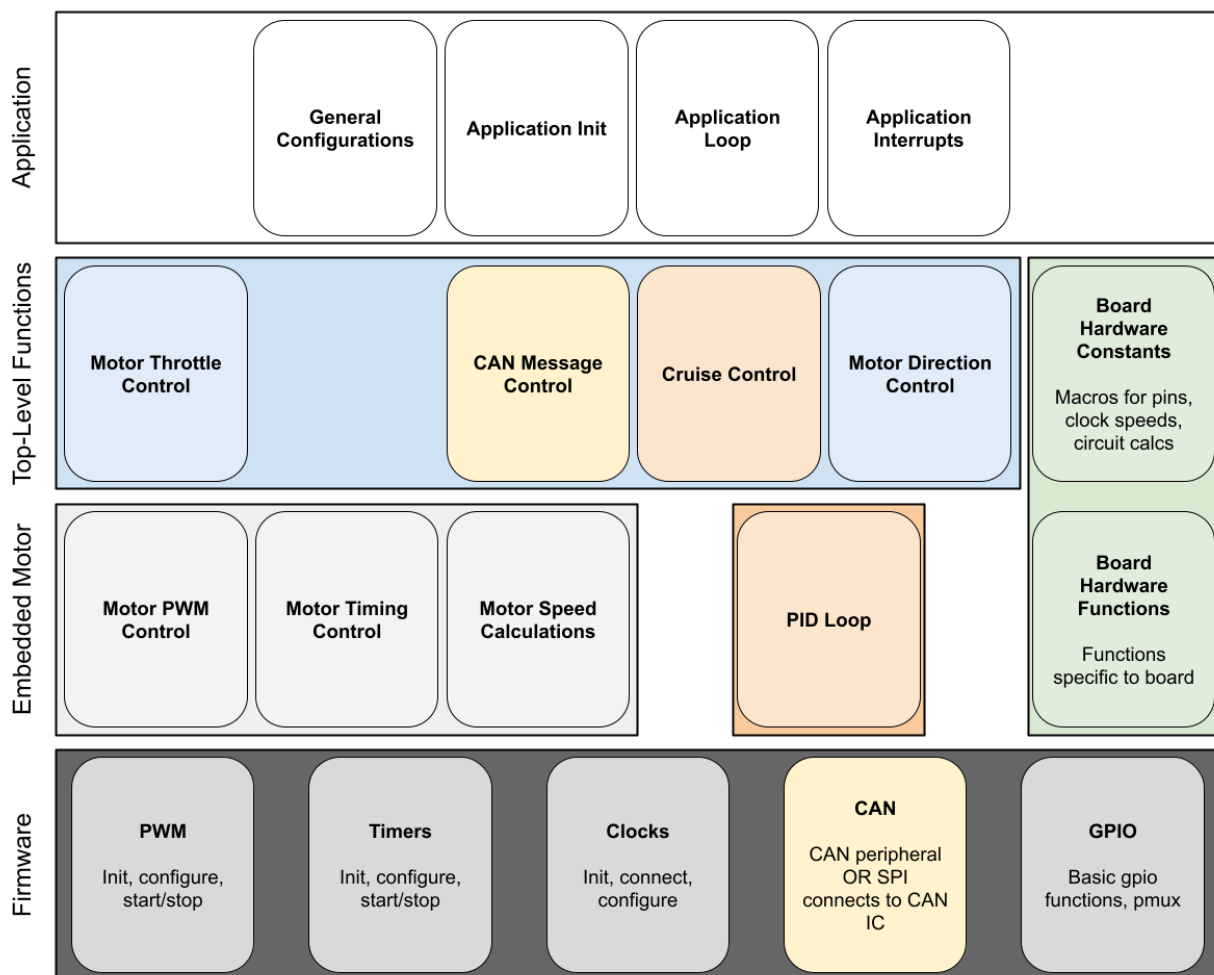
Individual Contributions

Member	Contributions	Week Hours	Cumulative Hours
Gavin Patel	Generated ST C-projects to reverse engineer	6	14
Bryce Rega	High-level software design	6	17
Marek Jablonski	Motor Calibration Setup Design	6	15
Jonah Frosch	Lighting Talk integration and IGBT driver options	6	15.1
Long Yu	Documentation, IGBT options	6	15

Upcoming Week

- Continue reverse engineering software examples.
  - Based on generating more projects with different configurations.
- Refine high-level software design based on the generated example projects.
  - What were we missing in our initial draft? What can we specify further?
- Run software tests on the development board.
  - Make an LED blink? Send power to correct locations?
- Obtain and configure the spare solar car motor.
- Design implementation of test setup schematic.

High-Level Software Design Draft

Application

- General Configurations
- Application Init
- Application Loop
- Application Interrupts

Top-Level Functions

- Motor Throttle Control
- CAN Message Control
- Cruise Control
- Motor Direction Control
- Board Hardware Constants — Macros for pins, clock speeds, circuit calcs

Embedded Motor

- Motor PWM Control
- Motor Timing Control
- Motor Speed Calculations
- PID Loop
- Board Hardware Functions — Functions specific to board

Firmware

- PWM — Init, configure, start/stop
- Timers — Init, configure, start/stop
- Clocks — Init, connect, configure
- CAN — CAN peripheral OR SPI connects to CAN IC
- GPIO — Basic gpio functions, pmux

Base motor testing setup diagram

Three phases and three hall sensor connections

Development board

HV Power Supply

Motor used for testing

Oscilloscope

Scope measuring two phases and two hall sensors

Calibrate hall sensors to electrical phases by spinning motor by hand