EE/CprE 4910 – sdmay25-26
Week 5 Report
10/10/2024 - 10/17/2024

Cost-Effective and Easily Configurable High Voltage Motor Controllers for Automotive Use
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Summary

Software has been continuing to tinker with generated example code while developing the architecture of the main software project for the motor controllers. Hardware tests were conducted to determine that the motor controller development board is functional and to understand more on how it works at a hardware level. This research continues as we look to develop our own PCB with our own customizations.

Accomplishments

- Built a test rig for working out the operations of a motor HAL sensor
- Spare solar car motor assembled; 2/3 HAL sensors tested inoperable
- Fixed issues with previously generated ST-XCUBE-MCSDK projects – Gavin
- Implemented basic high-level design in software – Bryce
    - File system was designed with some function prototypes and configurations
    - In the next couple of weeks, more "blanks" will be filled in

Pending Issues

We allocated more time for getting project work done, but there was an unexpected increase in assignments/paperwork from this class, so we'll need to account for this again.
Multiple hall sensors on the motor we planned to use are inoperable so that needs to be debugged.
Gavin will be out of town, so we will be a man down for a few days. He's allegedly heading to North Carolina but could be stuck in Detroit for all we know.
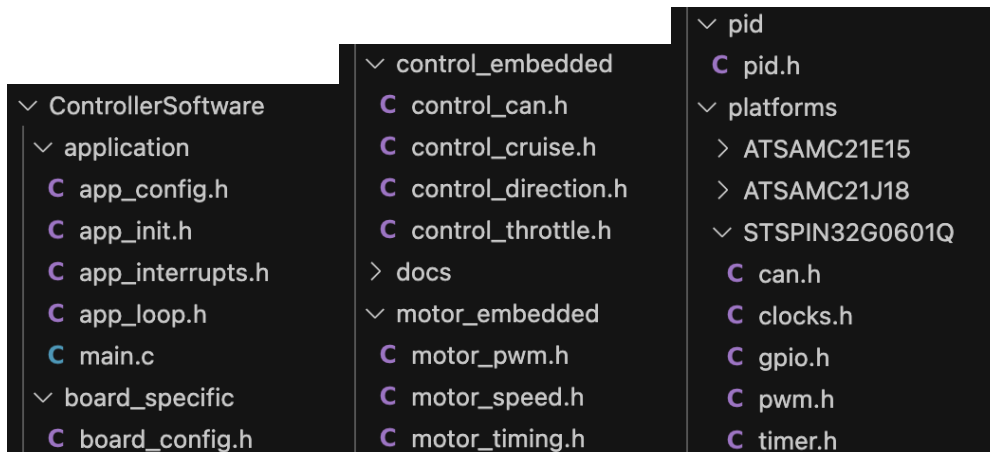
Individual Contributions

Member	Contributions	Week Hours	Cumulative Hours
Gavin Patel	Fixed ST generated C-projects	5	19
Bryce Rega	Started high-level software implementation	6	23
Marek Jablonski	Reassembled motor, diagnosed hall sensors	7	22
Jonah Frosch	Made a HAL sensor board interface	6	21.1
Long Yu	Tested the hall sensor of the motor	6	21

Upcoming Week

- Continue reverse engineering software examples.
    - This is a multi-week task and will be continuously done until minimum viable product (MVP) of software is ready
- Fill in the blanks for custom MVP implementation
    - Using clues from re-generated projects, fill in firmware mysteries as well as motor control mysteries
    - This will take a few weeks, but we can focus on just firmware or just motor control or just high-level application sections. What exactly gets done will be detailed in the next report.
- Run generated projects on the development board.
    - See some sign of life from the board
    - Should work now that the generated projects are fixed
- Configure the spare solar car motor.
- Design implementation of test setup schematic.
- Develop the first sections of the Design Document

High-Level Software Design Development

```
∨ ControllerSoftware
  ∨ application
    C app_config.h
    C app_init.h
    C app_interrupts.h
    C app_loop.h
    C main.c
  ∨ board_specific
    C board_config.h
  ∨ control_embedded
    C control_can.h
    C control_cruise.h
    C control_direction.h
    C control_throttle.h
    > docs
  ∨ motor_embedded
    C motor_pwm.h
    C motor_speed.h
    C motor_timing.h
  ∨ pid
    C pid.h
  ∨ platforms
    > ATSAMC21E15
    > ATSAMC21J18
    ∨ STSPIN32G0601Q
      C can.h
      C clocks.h
      C gpio.h
      C pwm.h
      C timer.h
```

Base motor testing setup diagram

Three phases and	Developm	HV Power

Motor used

Oscilloscope

Scope measuring

Calibrate hall sensors