

E2.03 - Diamond Dogs



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Sponsors: Mr. Brown, Mr. Mark Welker

Project Overview

What Our Project is:

- Lower-cost shield for the NXP FRDM board family
- Designed for Microprocessors labs
- Intended to replace the RealDigital Blackboard
- Combines the main lab peripherals onto one board

Why It Matters:

- Blackboard includes more hardware than needed for the labs
- The design is more focused and easier for students to use
- Reinforces hands-on work with embedded interfaces
- Makes lab hardware easier to follow and troubleshoot

Design Requirements

- Support core Microprocessors lab activities
- Includes user I/O, display, sensing, motor control, and SPI logging
- Support removable microSD memory for lab exercises and data logging
- Stayed within the project cost target: \$70.00

Major Design Changes

- Switched from dedicated flash memory to removable microSD memory over SPI
- Confirmed temperature sensor and IMU over I3C
- Added mikroBUS headers
- Added eFuse protection on the 5V external power supply for motor

Meet the Team

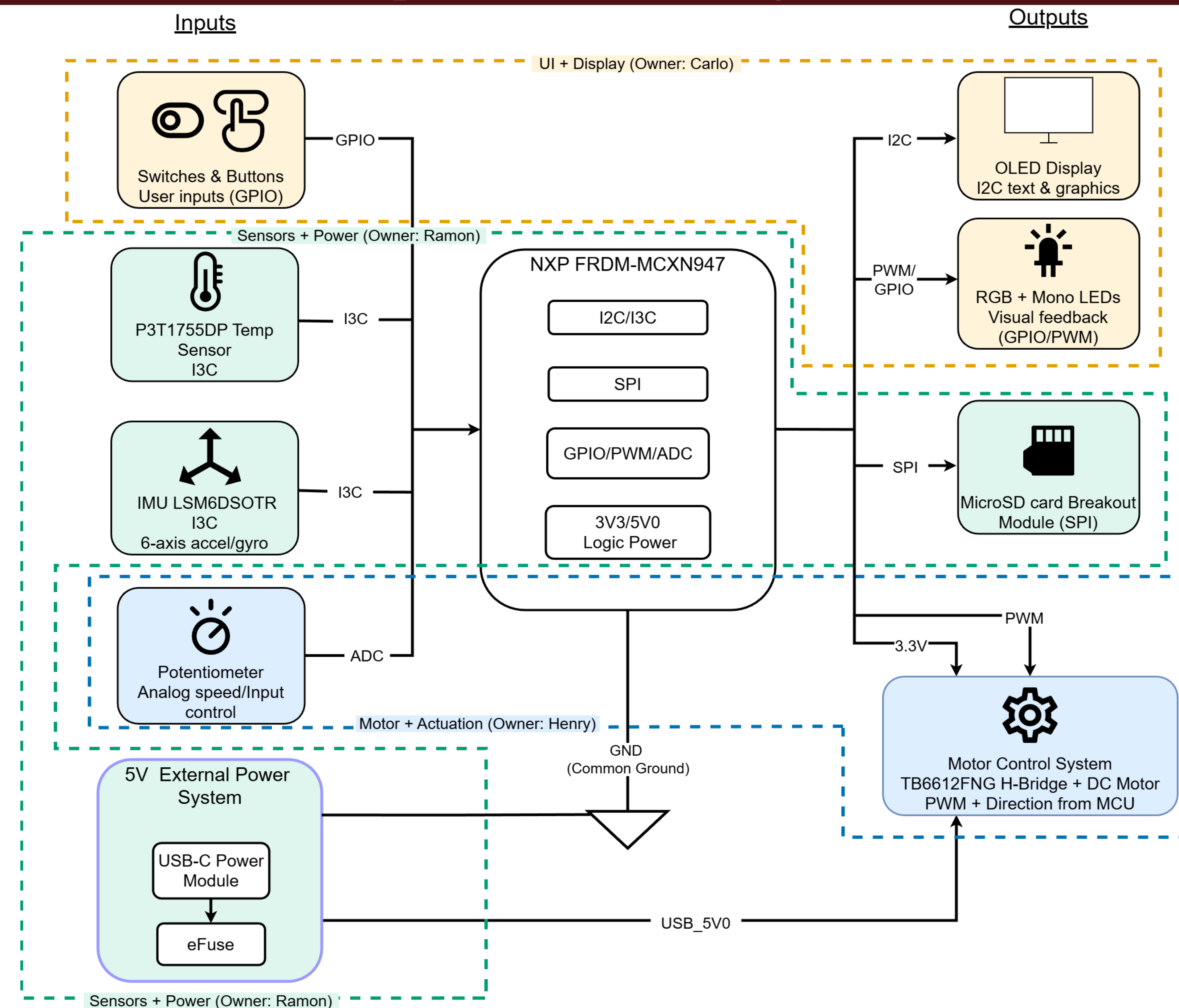


Ramon Elizondo **Carlo Marroquin** **Henry Celidon** **Ian Boyd**

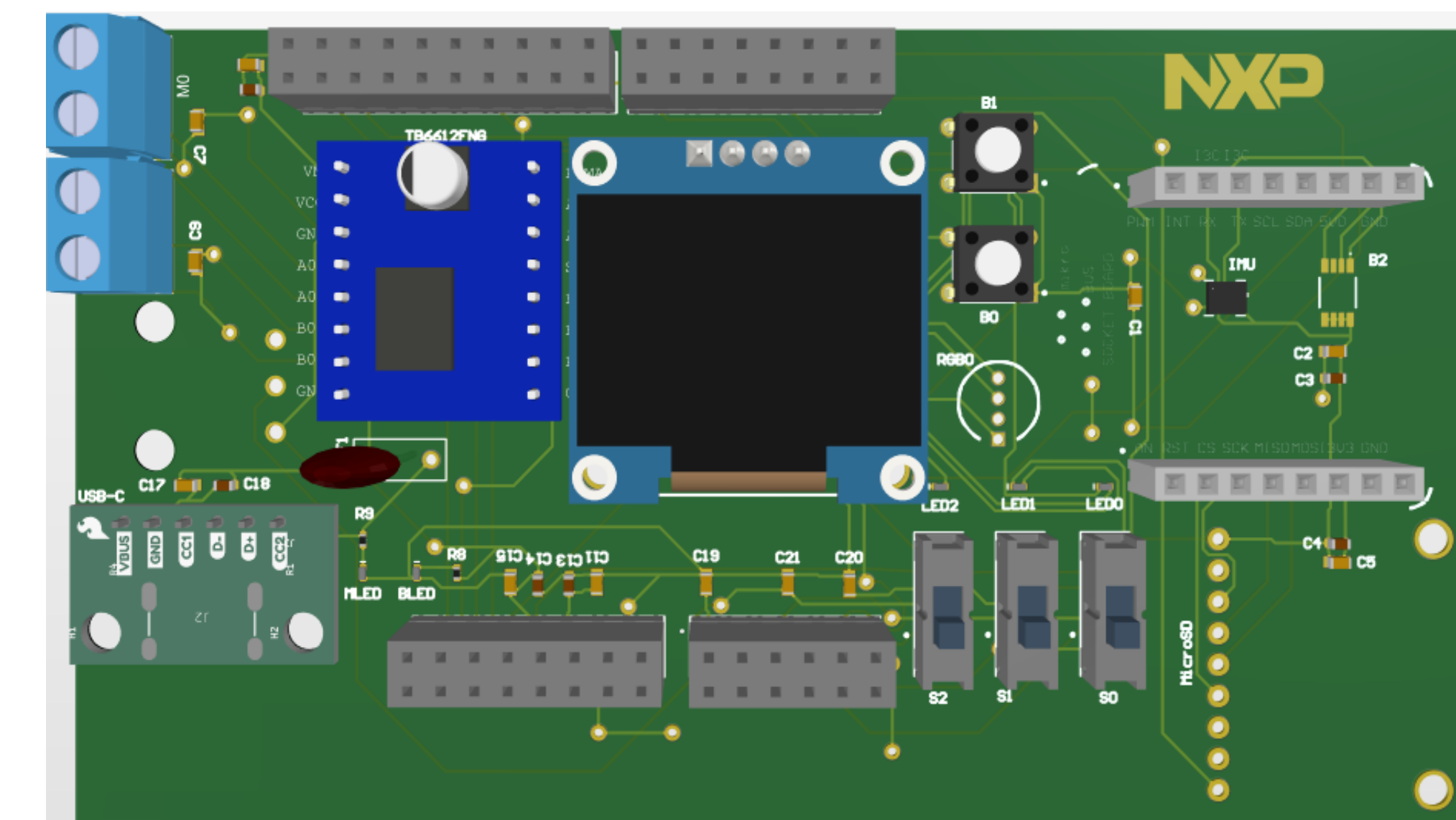
Acknowledgments

- Sponsor – Mr. Brown NXP
- Course Instructor - Mr. Mark Welker
- Faculty Advisor – Mr. Jeff Stevens

Top Level Block Diagram



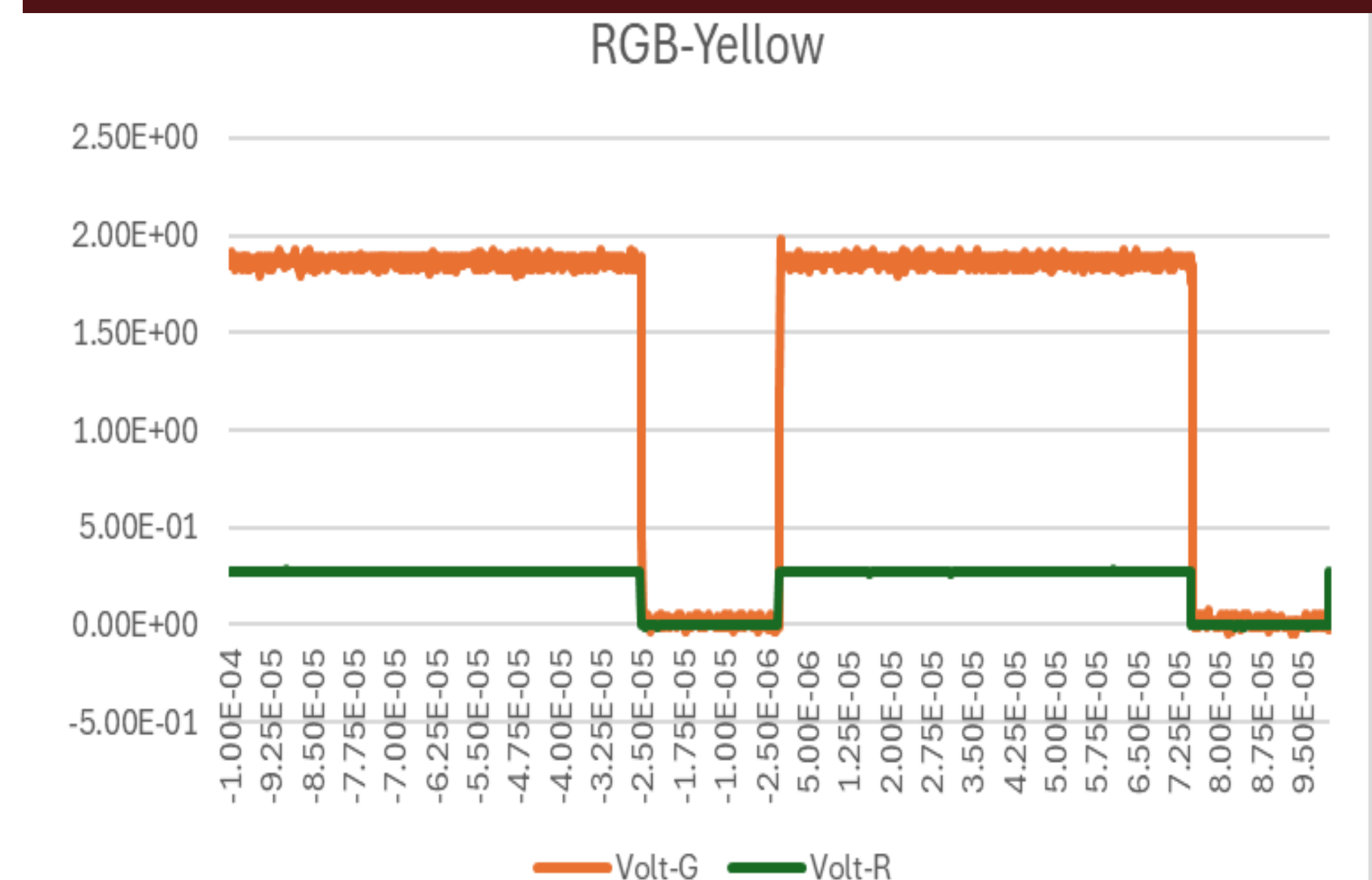
PCB SMD/SMT 3-D Layout



Validated Subsystems

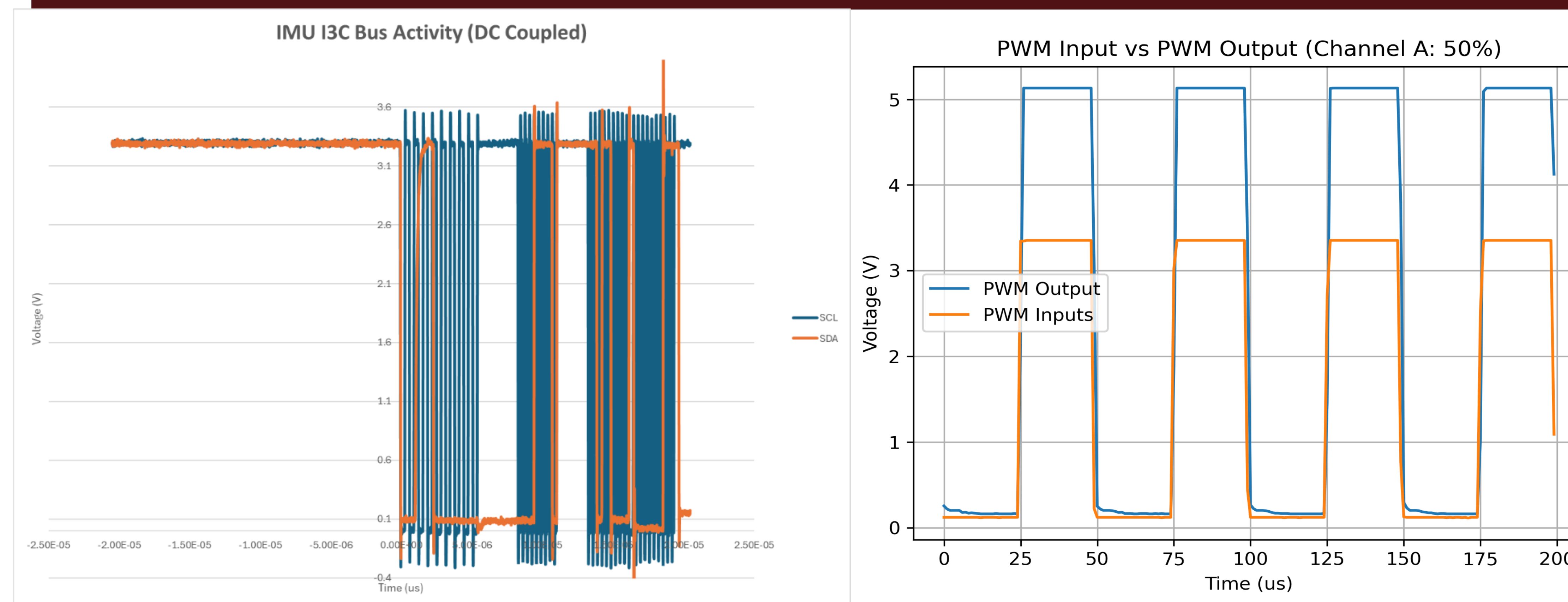
- IMU over I3C: successful enumeration and correct device response
- Temperature sensor over I3C: stable ambient readings and expected hot/cold response
- Motor PWM path: expected waveform behavior confirmed during duty cycle testing
- Project cost: met target at \$63.94

RGB PWM Validation



- RGB PWM waveform showing red and green channels overlapping to produce yellow at 75% duty cycle and 9 kHz.

Measured Test Data



- IMU I3C communication captured during testing, confirming successful enumeration and correct device response

- PWM input and output signals were confirmed across 25%, 75%, and 100% duty-cycle testing

Board Features

- Temperature Sensor (I3C)
- SPI microSD Memory
- IMU (I3C)
- OLED Display
- Switches & Buttons (GPIO)
- RGB+Mono LEDs
- Potentiometer (ADC)
- Motor Driver (H-Bridge)