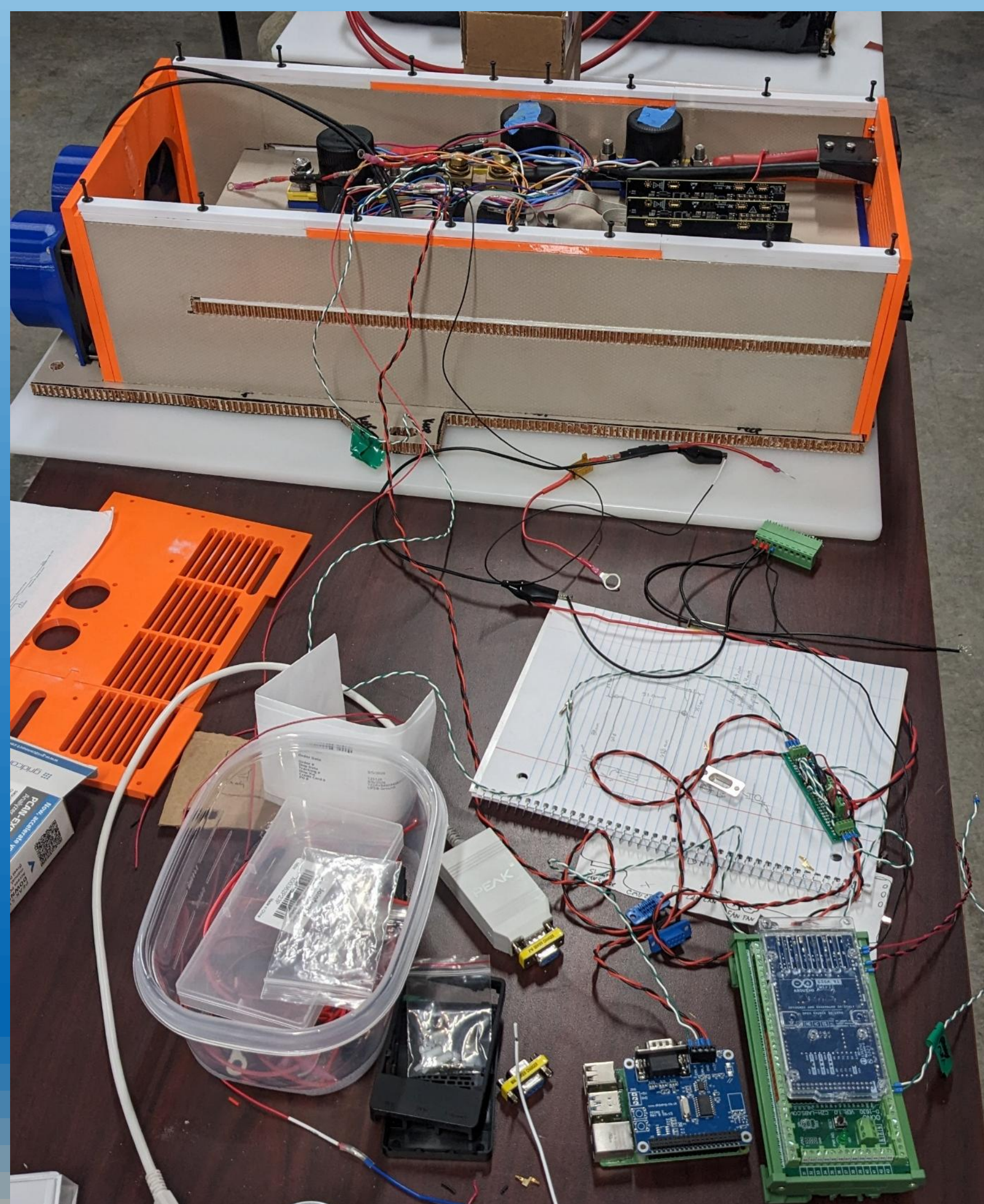


Executive Summary

Solar racing is an efficiency marathon. Car #33, Soltron, runs a 120V battery pack with a motor peaking at 5,000W. With systems like battery, solar array, and motor all operating simultaneously, unified real-time data is mission-critical. You cannot win a race if you do not know exactly how much energy you are burning or bringing in from the sun.

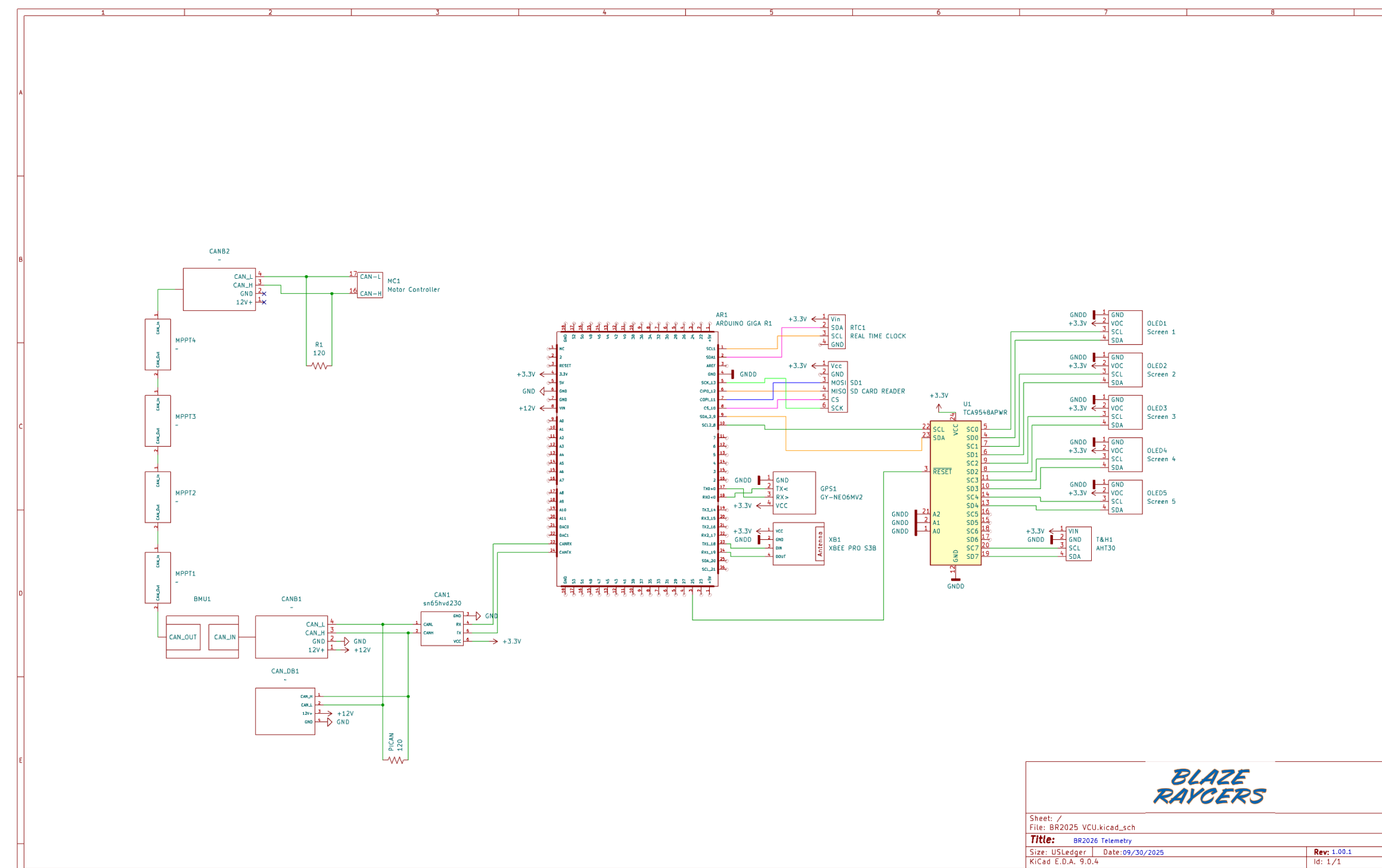
Background

- Solar racing demands precise, continuous awareness of battery state, solar power generation, and system health. Without a unified data layer, energy decisions rely on guesswork.
- Research of other competing teams identified reliability as the most common failure point. Simplicity and elimination of failure modes became the top design priority.
- No prior integrated T&DAQ solution existed for the team. This project fills that gap with a low-cost, Arduino platform that future seasons can build upon and learn from.



System Design & Integration

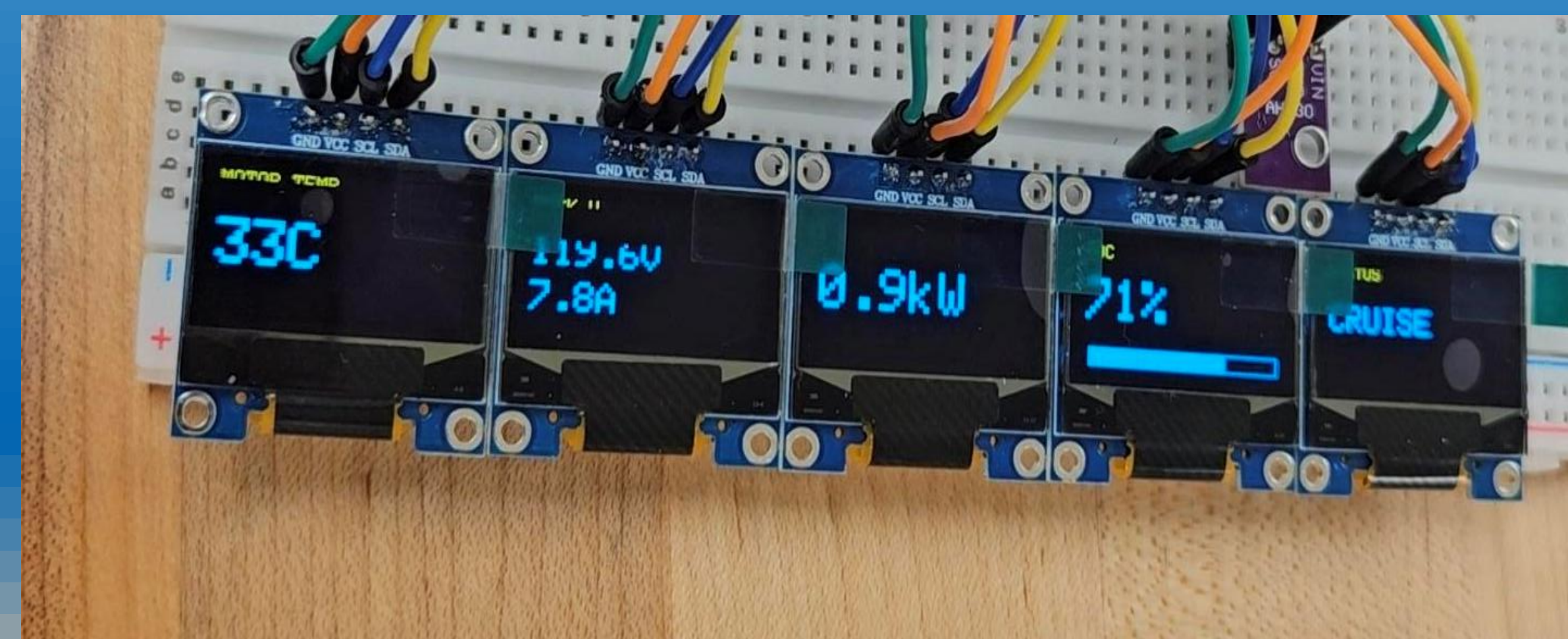
- CAN Bus:** Links BMS, MPPTs, and motor controller; reads and validates all frames against the Interface Control Document at ≥ 10 Hz.
- Driver Information System (DIS):** High-brightness display (>500 nit) — sunlight-readable. Shows only what the driver needs: SoC, motor power, speed, and fault indicators.
- Wireless Telemetry Link:** On-board radio transmitter streams live data to the pit dashboard so the team can forecast power budget and prevent energy shortfalls mid-stage.
- Redundancy:** Speed is one example of redundant design, being primarily calculated from motor controller RPM data, with a GPS module providing an independent cross-check for added certainty.



Experimental Test Plan

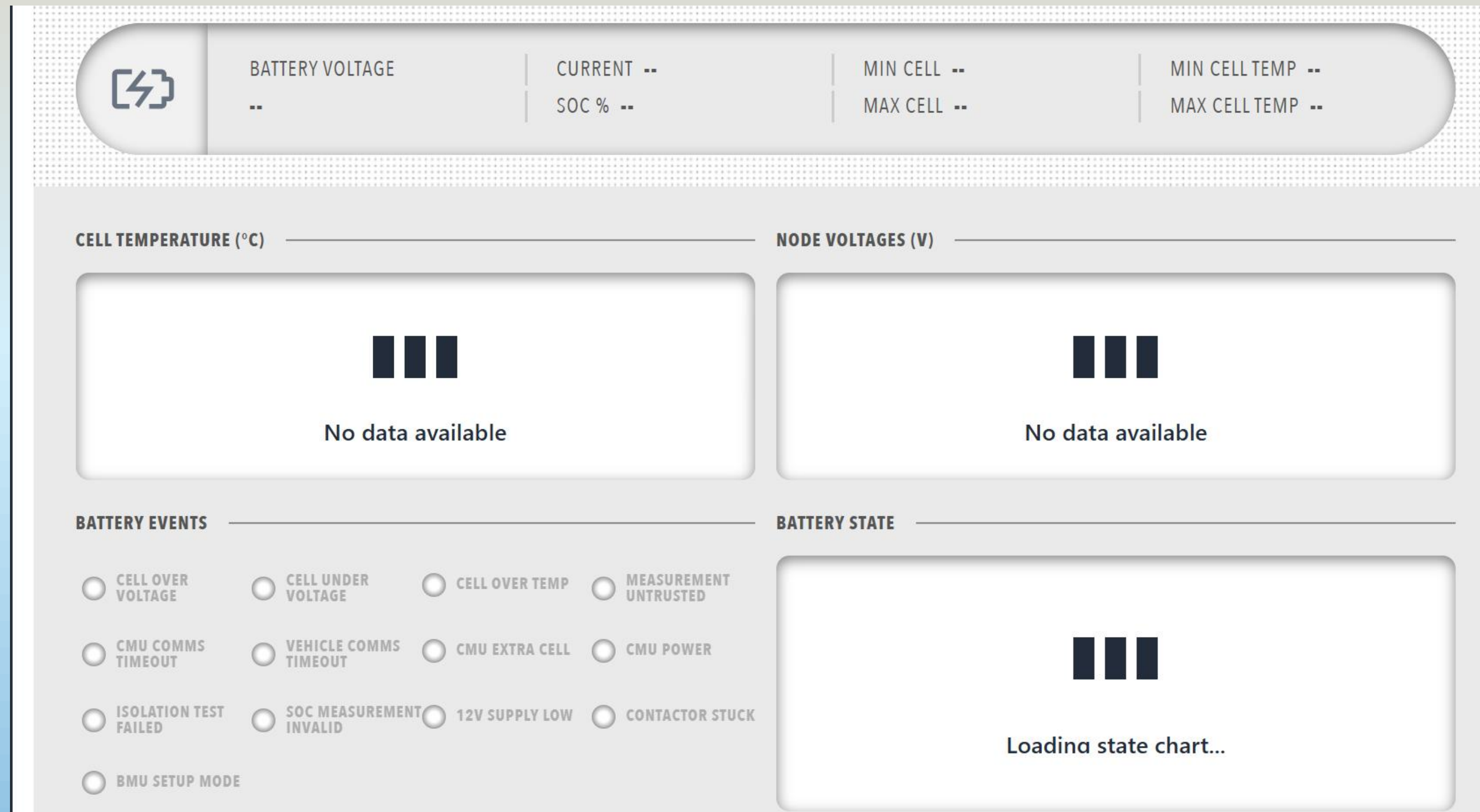
Tests are defined and staged; execution is pending full-system hardware availability ahead of FSGP 2026.

- Latency:** Inject CAN event; timestamp at BMS source and display update. Target: <200 ms.
- Power draw:** Bench power meter during full operation. Target: <3 W total.
- Data fidelity:** 1-hour continuous log; compare frame count at ≥ 10 Hz. Zero dropped frames required.



Experimental Results

- BMU CAN Integration — Confirmed:** Successfully established live CAN communication with the Proheliion D1000 Gen1 BMU. All 13 message IDs (0x600–0x6FD) validated against the DBC and decoded in Profinity. Pack voltage, SoC, cell min/max, and fault flags confirmed readable in real time.
- Key Challenge — BMU Wakeup Sequence:** The BMU requires continuous 0x505 EV Driver Controls packets at >5 Hz before it will transmit. This was identified and resolved in firmware; the Arduino now sends the wakeup sequence on boot, enabling bench testing without a live battery pack.
- Pit Dashboard — Confirmed:** Profinity dashboard successfully configured for the Proheliion BMU subsystem. Battery events, SoC trend, and cell voltage displays are configured



- CAN bus integration with the BMU is fully operational. Solving the BMU wakeup sequence was a critical technical milestone of the project for critical safety systems ensuring proper battery operation and energization..
- Performance targets <200 ms latency, <3 W draw, ≥ 10 Hz frame rate are grounded in the modular design and will be validated against the full pack ahead of FSGP 2026.
- The team delivered more than hardware/firmware, pit dashboard, ICDs, Race Operations Playbook, and a full technical document suite establish the foundation for all future Blaze Raycers seasons.
- Acknowledgements: Dr. Chris Boyer, UTA College of Engineering, and all Blaze Raycers team members and ASC/FSGP sponsors.

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