Abhay Anand

Abhay Anand | abhayanand2k4@gmail.com | +91 72009 43982

Embedded Systems — Battery Management Systems — EV Powertrain Engineering

Education

2023 – 2027 Bachelor of Technology in Electronics and Communication Engineering, **VIT Vellore**

Work Experience

xEV Intern – UD Trucks May 2026 – July 2026

- Developed a **semi-empirical, physics-informed degradation model** for **LFP cells**, integrating duty-cycle effects to predict capacity fade and internal resistance growth over battery life.
- Built and parameterized a **2RC Equivalent Circuit Model (ECM)** coupled with degradation dynamics, enabling BMS-oriented **State of Charge (SoC)** and **State of Health (SoH)** estimation under real-world operating conditions.

Team Captain & Powertrain Engineer – Team Ojas Racing May 2024 – Nov 2026

- Developed a custom **STM32H7-based bare-metal/RTOS Battery Management System** for a **3p140s 600V Formula Student EV Battery Pack**.
- Designed and validated multiple **high-voltage safety and monitoring PCBs** by interpreting component datasheets, verifying timing diagrams, and debugging hardware with oscilloscopes.
- Implemented deterministic firmware routines for **real-time CAN telemetry**, cell-balancing control loops, and fault detection algorithms.
- Led a cross-functional team of 30+ engineers in the design and manufacturing of an electric Formula Student race car.

Research Intern – SMART Lab, IIT Madras May 2025 – Jan 2026

- Developed an Extended Kalman Filter (EKF) in MATLAB achieving less than **2% SoC estimation error** on laboratory charge-discharge datasets for Li-ion cells.
- Supported Battery Management System development by integrating and validating estimation algorithms against laboratory charging and discharging cycles.

Projects

600V Battery Management System **STM32H7, Altium, KiCad**

Engineered a custom **600V Battery Management System** using **STM32H7** MCUs and **LTC6804** battery monitoring ICs over **ISO SPI**. Developed communication firmware using **DMA**, implemented cell balancing logic and real-time **SoC estimation** for a 3P140S system.

Real-Time CAN Bus Intrusion Detection System **Embedded C, Python, FreeRTOS**

Developed a lightweight intrusion detection framework for automotive **CAN networks** using a custom **GRU-based** model. Implemented the underlying **CAN communication stack**, achieving less than **3% false positive rate** against spoofing, fuzzing, and DoS attacks, outperforming CNN and MLP baselines. Accepted at the **iSENSE Conference, IIIT Kottayam**.

I-Align: Post-Retinal Surgery Monitoring Device **ESP32, MPU6050, EEPROM**

Designed a wearable monitoring device for post-retinal surgery patients. Implemented **Kalman-filter-based sensor fusion** for MPU6050 orientation tracking, **EEPROM-based data storage**, and low-power operation using **deep sleep modes** on ESP32. Accepted for panel discussion at the **VRSI National Conference**.

Skills

Software	Embedded C/C++, Bare-metal, FreeRTOS, Linux, STM32, ARM Cortex-M, Interrupts, DMA, CAN Bus, ISO SPI, SPI/I2C/UART, MATLAB Coder, Python
Hardware & Lab	Altium Designer, KiCad, Schematic Design & Datasheet Interpretation, Multi-layer PCB Layout, PCB Bring-up, Oscilloscopes, Logic Analyzers, Debugging, DFM
Battery & Control	BMS Architecture, High-Voltage Systems, SoC/SoH Estimation (EKF, ECM), Control Loops, Telemetry, Cell Characterisation, LFP Degradation Modelling, MATLAB/Simulink