

Custom 10 cells, high-power BMS hardware & firmware design

Context:

The EPFL Xplore Research Pole has the objective of building a legged robot. The robot is designed to autonomously navigate through challenging terrain using its on-board sensors. The Xplore Research Pole aims to develop custom state-of-the-art hardware with experienced students. Creating a custom BMS will be an interesting challenge, completing the already developed power distribution board, GEODE.

Project description:

The objective of this project is to design and integrate a custom BMS for the quadruped robot. It should accept up to 10-cells batteries (min 42V -> margin at 50V) and be able to deliver 100A continuous and 200A peak. It should provide secured battery operation, various protections, and communicate the BMS status over CAN-FD to the main computer. Hardware for EtherCAT protocol is expected, but no need to implement the firmware yet. Ideally a custom software or advanced visual indicators should be implemented to enable easy and quick BMS fault debugging and monitoring.

Furthermore, the student will be an integral part of the Xplore Legged Robot Team, actively participating in its weekly meetings and working sessions. This collaboration will facilitate close interaction with other team members, and the student is expected to share their findings and progress with the team regularly.

Tasks:

- **Literature Review and Familiarization** - conduct a literature review focused on existing power BMSs like the one currently used in the Xplore Rover (Tiny BMS), or the open source FoxBMS.
- **PCB Design** - Design the complete board in KiCAD or Altium
- **Coding** - Implementation of the main firmware structure.
- **Manufacturing** - Order, assembly and rigorous testing of the PCB.
- **Documentation** - Rigorous documentation is expected to facilitate transition with future members.

Requirements:

- Experience with PCB design (KiCAD, Altium) with 4+ layers.
- Experience with power routing and high voltage protections.
- Experience with design guidelines for EMC. Good grasp on grounding strategies.
- Experience with embedded systems development in C on STM32.
- Experience with CAN-FD protocol (configuration, setup on STM32, etc.) is a plus.

Contact:

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