Progress Report - Week 8 | Mar. 1 - Mar. 8, 2025

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Progress Discussion:

- Issues with actuating N-Channel Mosfet using Microcontroller's GPIO Pins still persist for Cell Balancer.
- Transfer Switch in development; switching parameters are semi-operational. Currently on the 4th iteration of Transfer Switch.
- STM32 Peripheral mode prototyping successfully implemented
- STM32 reading from Qty. (1) INA260 and receiving messages over UART both on a timer interrupt basis.

Discussion Notes:

- New transfer switch design proposed by advisor, addition of nmos with the ideal diode will ensure switching using GPIO
- Don't use linear supply
- start sending data back to the master system
- Investigations needed for battery chip to replace one of two load switches
- Found new battery chip: https://www.ti.com/product/BQ25713

Tasks at hand:

- integrate all 4 INAs
- Work on 4th iteration of advisor proposed load switch design
- Debug issues with GPIO controlled NMOS for battery balancer
- use a power supply and resistors to simulate charging
- generate a cell balancing algorithm
- Test charging behaviors of the 18650 Sodium cells
- Investigate BQ25713 for use in wall-end load switch

General Notes From Meeting:

Load Switch Operation

- M3 and M4 are load switches in a high-side configuration.
- To power the load, both transistors must be on.
- If only M4 is on, current still flows to the load through the body diode of M3, causing a 0.7V drop.
- The body diode is an intrinsic part of the MOSFET, like D1 and D2 in the circuit.

Battery Charging and Voltage Regulation

Connecting a 20V charger to a 12V battery:

- Current flows from the charger to the battery.
- The amount of current depends on how the charger regulates its voltage.

Understanding Current Flow:

- If the external power supply is 12V and the battery is 12V, little to no current flows.
- Increasing the charger voltage slightly (e.g., 12.1V) causes some current to flow, depending on internal resistances (battery, wiring, etc.).
- To control current, the charger uses a constant current supply, which regulates voltage to maintain a set charging current (e.g., 1A, 5A, 10A).

Charging Phases:

1. Constant Current Mode:
    - The charger increases voltage until the target charging current is reached (e.g., 5A).
    - The battery voltage gradually rises as it charges.
2. Constant Voltage Mode:
    - Once the battery reaches its float voltage (e.g., 12.5V), the charger stops increasing voltage.
    - Current gradually decreases as the battery approaches full charge.
    - At full charge, current stabilizes at a low float value.

Charge Graph Behavior:

- Current rises sharply in constant current mode.
- As voltage reaches float level, current tapers off.
- The battery remains in a float state, maintaining its charge.