Functionality:

The Motorvator's Low Voltage Power Supply is a compact and rechargeable, dual-output power supply that will assist the Aztec Electric Racing team by powering the vehicle's on-board, low-voltage electronics during competition. The internal battery management system protects the power supply against short circuits, overcharging and over-discharging, and damage from high temperatures. The microcontroller interfaces with the BMS integrated circuit through the I2C protocol and data bus to extract and process power supply data, namely voltage, current, and temperature. This data will be sent to the built-in display to indicate when the power supply must be charged and to allow the AER team to determine the current status of the device. As a backup storage, the microcontroller will also write this data to a log in the micro-SD card.

Inputs and Outputs

Inputs/Outputs – Describe the inputs and outputs of the system. Include protocols, voltage levels, impedances, and dynamic range. Refer to your sketch or process diagram. This is a descriptive section. Formal specifications must be included in the Specifications section.

The six 18650 lithium ion battery cells shown in the diagram of the device outputs 24V at a max of 10A and 12V at a max of 5A to the AER race car. They also supply 3.3V to power the ESP32 microcontroller through the ground and header pins as well as supplying power to the BMS IC through the wires outlined in the diagram. The BMS outputs digital data encompassing voltage and current levels as well as temperature to the data bus from which the microcontroller reads and processes from. The microcontroller then outputs this digital data to a micro SD breakout board using the serial peripheral interface (SPI) protocol. This micro-SD card stores power supply information that can be extracted and read through an external computer. The microcontroller is also responsible for outputting the digital data to the lcd screen for display. The AC-DC wall adapter provides direct current to the battery cells, allowing for easily rechargeable functionality from any standard 120V or 240V AC outlet.

- Voltage levels of BMS IC?
- Resistance or load numbers?

The SEA-310 Amplifier Test Fixture is a PCB that will assist an instructor leading a group of students building the SEA-310 Amplifier kit by efficiently testing the SEA-310 and localizing assembly problems. The SEA-310 Amplifier Test Fixture feeds audio signals into the SEA-310 and then analyzes the signals from the SEA-310 speaker output to determine if the SEA-310 is working properly. The user controls the Test Fixture and views results using the Arduino Serial Port Monitor. The SEA-310 Test Fixture analyzes the SEA-310 by measuring gain, frequency response, and distortion. The result of testing is a Pass/Fail indication on the computer screen and a test report.

Figure 1 shows the SEA-310 Amplifier Test Fixture. Power for the SEA-310 Amplifier Test Fixture and the SEA-310 is provided by the external 12V power supply connected to J1 and routed to the PCB to terminal block J8 which provides power to the SEA-310. The SEA-310 Amplifier Test Fixture connects to a computer via the Arduino's USB ("Programming") port thereby allowing the user to execute the test and view results with the Arduino Serial Port Monitor. The fixture has two analog outputs for testing the SEA-310. J5 connects the SEA-310 Amplifier Test Fixture to the Guitar input of the SEA-310 using a standard ¼" M-M guitar cable. J7 connects the SEA-310 Amplifier Test Fixture to the AUX input of the SEA-310 using a standard 3.5 mm to 3.5 mm audio cable. A third analog output, J6, "Monitor" optionally allows an operator to feed test signals into a second SEA-310 using a standard 3.5 mm to 3.5 mm audio cable. This is useful when the SEA-310 under test does not have its speaker connected. All outputs have a 510 Ω source resistance and can generate signals in the range of 0.5 mVrms to 250 mVrms. Terminal block J2 connects to two test leads with alligator clips on the ends. These clips are connected to the speaker terminals of the SEA-310. Alternatively, if the user wants to test the SEA-310 with a 4 Ω load, but not produce loud noises, the speaker can be disconnected, the alligator leads from J2 can be connected to the speaker leads, and SW1 is moved to the leftmost position thereby enabling the 4 Ω load on the SEA-310 Amplifier Test Fixture. LED D1 is turned on when the internal 4 Ω load is enabled. The input impedance of each leg of the SPKR input is 180 kΩ. The maximum input level for no ADC clipping is 9.0 Vrms.