The battery monitoring system is designed to motor the voltages of the four batteries powering the robot and display them on an LCD in real time. The main system is incorporated into the power board; however, the LCD and a hall sensor are separate. The system uses two INA3221s to monitor the voltages of the batteries and the current from the motors. Each of the INA3221s can monitor up to three channels and detect load voltage, bus voltage, and current from each channel using small current sensing resistors. The INA3221s have several warning features such as power-valid, warning, and critical that are active based on the voltages measured. These features have not yet been coded or tested, but the wiring is there for future use. The system uses a teensy 3.2 to run the INA3221s, a standard 16x2 LCD, a shift register, and a hall sensor. The teensy was chosen due to its small size, low cost, and compatibility with Arduino software. To reduce the number of LCD pins required on the teensy from six to three, a 74HC595N shift register was added to the board. To conserve power, the backlight of the LCD can be switched on and off using a DRV5033 digital omnipolar hall switch which will be mounted near the outside of the hull. In summary, the INA3221s measure the voltage and current values which are collected by the teensy. This data can be used by the software team to determine exactly when voltage or current drops occur. The teensy also sends the voltage data to the LCD mounted next to the hull which displays the values when a magnet is present near the hall sensor.

The system is powered by 3.3V and 5V rails. The INA3221s require 2.7-5.5V to operate and are being powered by the 3.3V output of the teensy. The monitoring channels can operate between 0-26V on all channels regardless of the IC being powered, but the current cannot exceed 5mA on any input pins so 0.001Ω current sensing resistors were used. The hall sensor supports 2.5-38V and is also run off of 3.3V. The hall sensor uses an open drain output and can sink up to 30mA. The teensy is powered by 5V and has a 3.3V output. The 74HC595N is an 8bit serial-in parallel-out shift register the accepts 2-6V and is being powered by 5V. The LCD is a TC1602A-09T module with can use a 4 or 8 bit interface and accepts 0-7V, it is being used in 4-bit mode and is powered by 5V.