Methodology

My focus was on motor control and how to increase the reliability of the rovers. I chose to design an all-in-one printed circuit board to control the motors and watch battery health. I created my designs in Kicad and fabricated the boards with the help of JLCPCB out of China. My goals were to design an easy to program motor controller with enhanced battery monitoring to alert the users of failing or degrading batteries.

Data

This design is centered around the STM32F4 MCU. This is a very capable chip with variations found in high power speed controllers for electric bikes. A buck regulator circuit powers the MCU while it sends and receives data on an I2C network for reading the cell voltages of the battery and displays it to an LCD along with interfacing with the MOSFET driver ICs. Another buck regulator circuit supplies power to an external Raspberry Pi and Arduino for autonomous capabilities.

Results

Delays have been faced in the development of this board. From finding out of stock chips to simple spelling errors for part numbers while trying to send the fabrication and assembly order. The MOSFET driver ICs and the 5V buck regulator IC are among these chip shortages from the fabricator. This has resulted in looking toward other part marketplaces for the necessary components.

Conclusions

Designing a PCB is a valuable skill for electrical and computer engineers not typically taught in the classroom. YouTube videos, application notes, and datasheets were combed through for the best ways to layout a particular circuit or ensure steady DC for the MCU. Looking at components on quality speed controllers helped narrow down the search immensely. Improvements for the next versions include a better design cycle, higher current capabilities for both the MOSFET drivers and the 5V output.

Abstract

ET NavSwarm is an interdisciplinary group with the end goal of sending a swarm of small autonomous rovers to another planet to prospect for materials. My focus was on motor control and how to increase the reliability of the rovers. I chose to design an all-in-one printed circuit board to control the motors and watch battery health.