This document contains some suggestions for what we think could be done to improve the robot’s performance.

Actuator Upgrade:

The current actuator design suffers from belt slip, requires expensive custom machined encoders and gears, and doesn’t have nearly enough torque to support the extra weight added by the batteries. Our first step to help the robot walk would be to redesign the actuator internals to reduce belt slip–whether by a thicker belt or new system entirely–and possibly raise the gear ratio. If the robot were to be rebuilt completely, we would recommend using off the shelf encoders (ODrive offers some good packages) to make it easier and cheaper to get backups.

12 Degree of Freedom Upgrade:

This would require a significant rebuild of the robot, and add significant complexity to both the kinematics and control systems, but it would vastly improve the robot’s capabilities. Among other things, adding an extra degree of freedom to each leg would allow for controlling stiffness along the plane and make turning a much simpler problem.

Battery Upgrade:

Swapping the batteries for the base cells instead of the Milwaukees with their heavy cases could save a great deal of weight.

XBox Controller System:

Rebuilding the commander node to accept XBox controller inputs (there are lots of libraries out there to reference) to control going forward, turning, standing once the rest of the system is in place would be very cool to show off.

Settings Calibration using ODrive ROS2 Libraries:

Theoretically, the gains, calibration, and zero position can be set by the ROS2 package given by ODrive. We recommend that future teams take a look at this for more convenient, in-depth control.