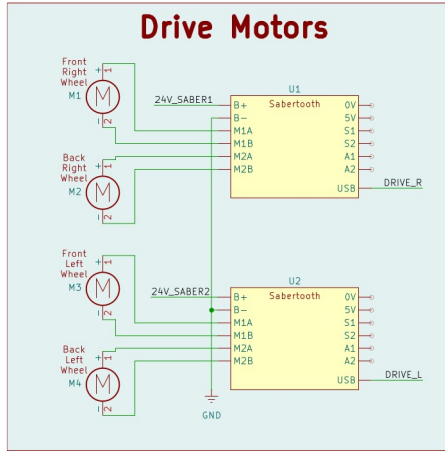


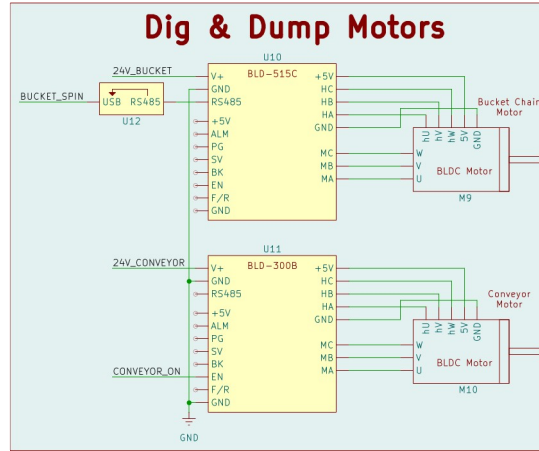
The robot is powered by two 24V (nominal) batteries in parallel which provide 12Ah (6Ah per battery). The batteries are wired directly into the source side of a Watt meter which records the power usage of the robot. The load side of the meter feeds through the E-Stop and circuit breaker, and into the power distribution board. The distribution board splits the main 24V into fused connections that power different sub-circuits.

There are two 24V  $\rightarrow$  5V converters. The 5V\_1 supply is used for sensors and servos. The 5V\_2 supply is only used for the externally powered USB splitter (This way the cameras have steady & adequate power).

There is one 24V  $\rightarrow$  12V converter which powers all of the linear servos as well as the Jetson.



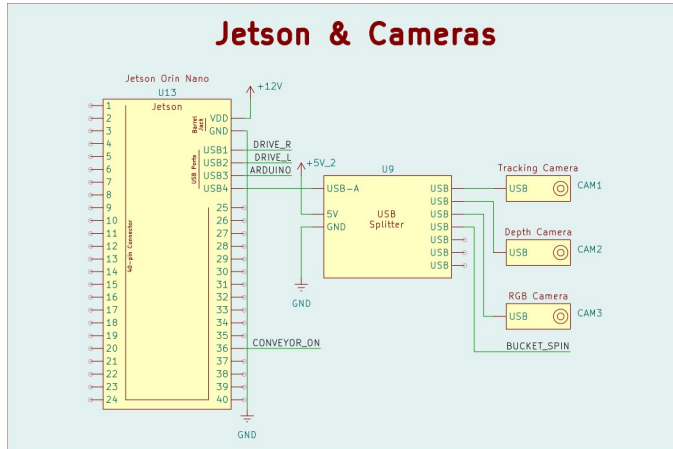
There are four DC motors used for driving (one on each wheel). Two dual-channel Sabertooth motor controllers are used to control the driving. They are connected to the Jetson's USB ports and communicate over serial. Serial commands are used for start/stop, speed, and direction, and can also provide current draw data.



The conveyor and bucket chain are both powered by brushless DC motors (BLDCs) and controlled by BLD motor controllers.

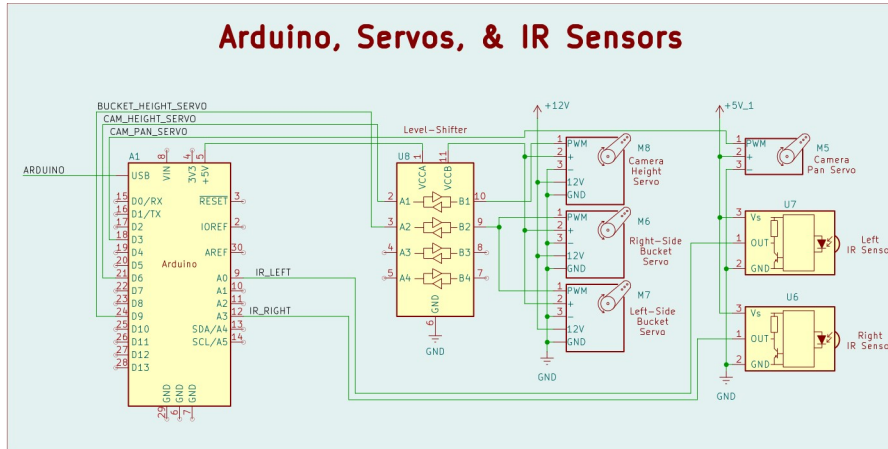
The conveyor is turned on/off using the CONVEYOR\_ON signal from the Jetson which enables/disables the motor controller. The speed is manually tuned using the embedded potentiometer in the motor controller.

The bucket chain is controlled through an RS-485 bus using the MODBUS protocol (this is converted to a USB compatible signal that can be interfaced through the Jetson). The serial connection is used for setting the speed, direction, starting torque, etc.



The Jetson Orin Nano runs the ROS2 codebase. It is powered by 12V (can be up to 19V). It connects to all of the peripherals over USB connections (aside from the conveyor controller which only requires a single GPIO). The externally powered USB splitter provides enough ports for all of the peripherals.

The tracking camera is mounted on the front of the robot and provides odometry data. The depth camera is also on the front of the robot and it provides point cloud data. The RGB camera is mounted on a linear actuator and is used for RC navigation and fiducial tracking.



The Arduino communicates with the Jetson over a serial connection. It is used for the servos and IR sensors.

The IR sensors are powered by 5V and provide analog distance feedback to the Arduino pins A0 & A3.

The camera pan servo is powered by 5V and controlled by a PWM signal from pin D3 on the Arduino.

The linear servos (camera height & bucket height) are powered by 12V. These servos provide their own 5V reference voltage so the PWM control signals are passed through a level-shifter in order to scale the Arduino 5V to the servo 5V (the servos usually output closer to 6V). The right and left side bucket height servos are connected to the same PWM control signal since they should always be evenly extended.