The robot uses a Tamiya 70097 Twin Motor Gearbox, which uses to Mabuch Motor FA-130RA-18100 Motors (Pololu Corporation, n.d.).

These motors are powered between 1.5 and 3 volts, and at peak efficiency, they consume 0.56A at 9710 RPM. At stall, they consume 2.1A (Mabuchi Motor, n.d).

A 1A constant current draw will be assumed per motor.

A 10 minute total required run time will be assumed, to allow for testing and a five minute measured run.

The Arduino Uno will use around 50mA (<http://www.gadgetmakersblog.com/arduino-power-consumption/>).

Each ultrasonic sensor uses 15mA while working (<https://randomnerdtutorials.com/complete-guide-for-ultrasonic-sensor-hc-sr04/>), so a 30mA current draw for ultrasonic sensors is assumed. The Melexis MLX90393 Magnetometer uses a nominal current of 100 microamps (Melexis, 2020).

The marking system servo uses 100mA while moving with no load, which is similar to the desired use, where the servo motor moves only a paint brush. (<https://www.addicore.com/FS90-Mini-Servo-p/ad113.htm>)

The total current:

, , and

The constant current draw is:

10 minute drive time is hours

The battery must supply at least 0.365335 amp-hours. The Arduino input voltage is from 7 to 12 volts and the motorshield input voltage is from 5 to 12 volts. A voltage input between this range must be supplied.

A 2 cell lithium polymer battery will be used. These have a voltage range from 8.4 to 6 volts, with a nominal voltage of 7.4. The required capacity is 364mAh. An 800mAh battery will be used, to allow extra headroom for variation from calculations, and since its weight is still low (59g).

Available at:

<https://hobbyking.com/en_us/turnigy-800mah-2s-40c-lipo-pack.html?queryID=f7f63513e44df263f1d8c70f999a3935&objectID=18661&indexName=hbk_live_magento_en_us_products_hbk_price_stock_6_group_0_asc>

It is important to note that the supplied motors and motor controller are not explicitly compatible, since the motors work at a lower voltage range than the motorshield. Where the input voltage is 8.4V:

Where an input PWM duty cycle 36% or over is input, the motor voltage range is exceeded, so this must be the maximum PWM input in software. The PWM voltage spikes should not pose any issue for motor longevity as the inductive quality of motor windings will smooth these out.