Trail Mix Dispenser

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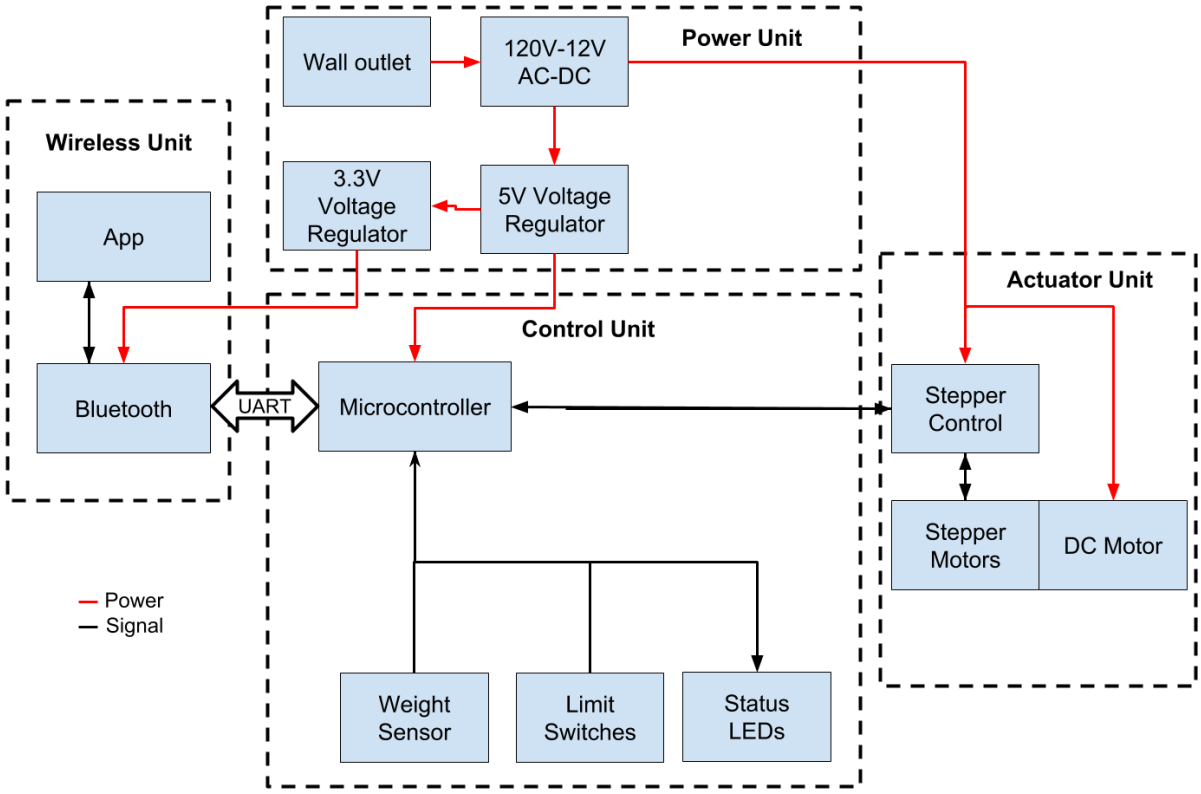

Figure 1. Block Diagram of the Trail Mix Dispenser.

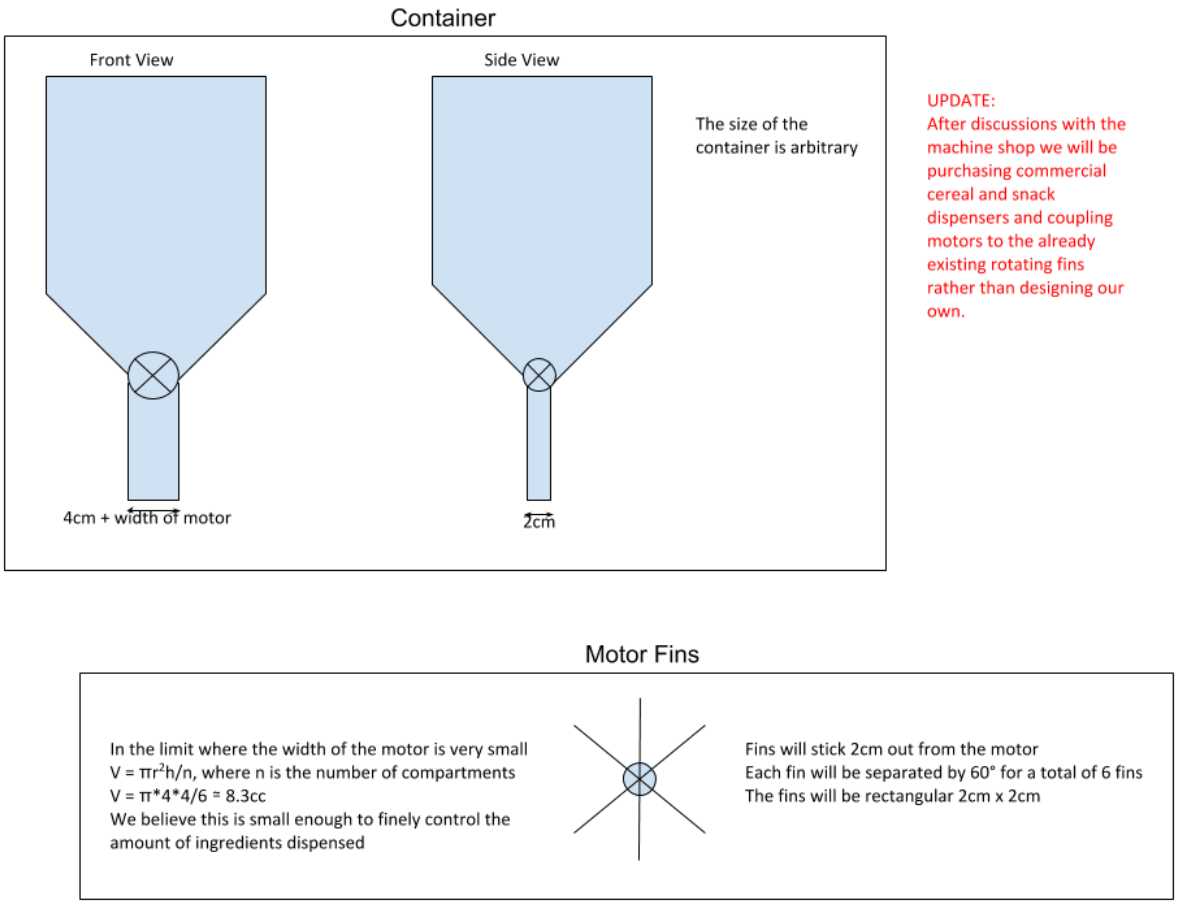

Figure 2. Physical diagram of the container modules.

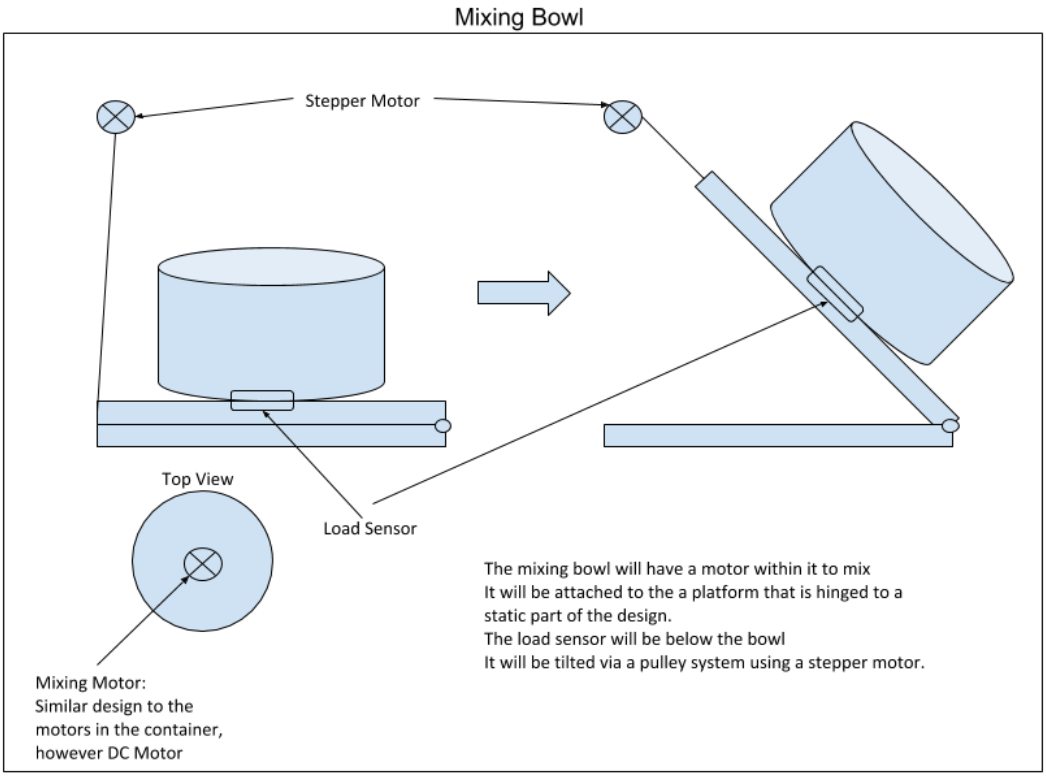

Figure 3. Physical diagram of the mixing bowl.

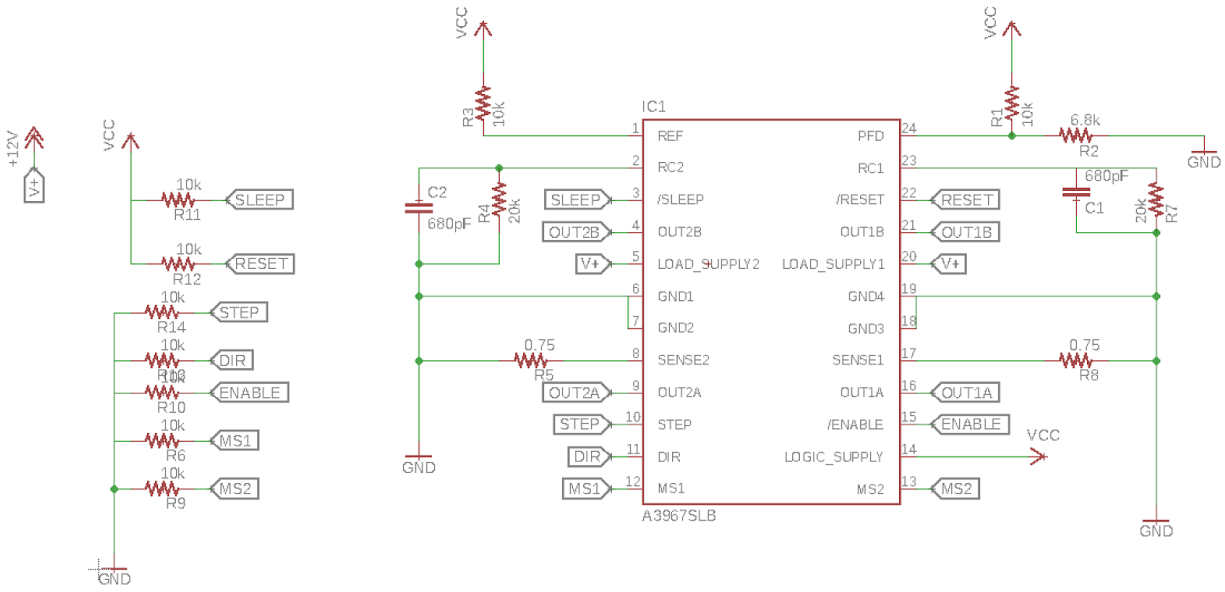

Figure 4. Sparkfun EasyDriver based stepper controller

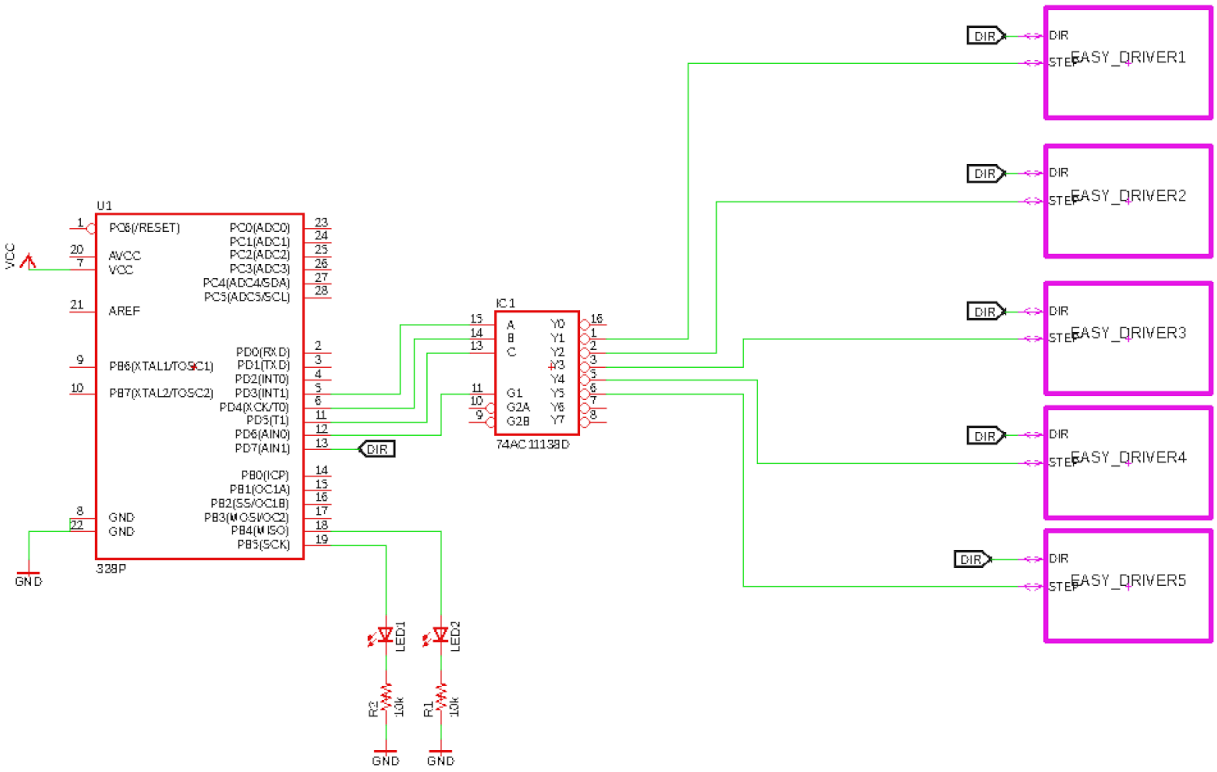

Figure 5. Stepper controller with individual control over 5 steppers

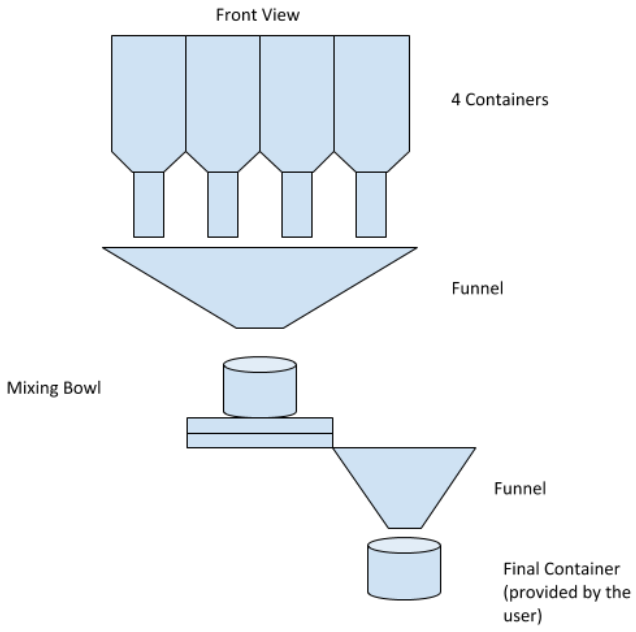

Figure 6. Physical diagram of the overall Trail Mix Dispenser

Requirements	Verification
120V-12V AC/DC Converter 1. V_{out} = 12V±0.2V at 3.33A	**Item 1** 1. Power converter with 120VAC from wall outlet. 2. Place 3.6Ω load between V_{out} and GND pins of the converter. 3. Ensure the voltage between V_{out} and GND is within 11.8V and 12.2V using multimeter.
5VDC Voltage Regulator 1. V_{out} = 5V±0.2V at 0.7A	**Item 1** 1. Power regulator with 12VDC. 2. Place 7Ω load between V_{out} and GND pins of the regulator. 3. Ensure the voltage between V_{out} and GND is within 4.8V and 5.2V using multimeter.

3.3VDC Voltage Regulator 1. V_{out} = 3.3V±0.2V at 0.22A	**Item 1** 1. Power regulator with 5VDC. 2. Place 15Ω load between V_{out} and GND pins of the regulator. 3. Ensure the voltage between V_{out} and GND is within 3.1V and 3.5V using multimeter.
5V to 3.3V Level Shifter 1. Shifts digital 1/0 reference voltage from 5V±0.2V to 3.3V±0.2V 2. Shifts digital 1/0 reference voltage from 3.3V±0.2V to 5V±0.2V	**Item 1** 1. Supply 5V to VCC(A) 2. Supply 3.3V to VCC(B) 3. Set DIR = 5V 4. Set A = 0 5. Verify that B = 0 6. Set A = 1 (5V ± 0.2V) 7. Verify that B = 1 (3.3V ± 0.2V) using a multimeter **Item 2** 1. Supply 5V to VCC(A) 2. Supply 3.3V to VCC(B) 3. Set DIR = 0V 4. Set B = 0 5. Verify that A = 0 6. Set B = 1 (3.3V ± 0.2V) 7. Verify that A = 1 (5V ± 0.2V) using a multimeter
Load Cell 1. Must have ±5g combined error 2. Must be able to support a maximum load of 1kg	**Item 1** 1. Power load bar with 10V 2. Attach measurement leads to oscilloscope 3. Mount load bar so that weights can be placed on the non-mounting end 4. Place 0.25kg weight on load bar 5. Measure and record the voltage 6. Place 0.50kg weight on load bar 7. Measure and record the voltage 8. Place 0.75kg weight on load bar 9. Ensure that voltage is (0.25kg voltage + 0.5kg voltage)±1% **Item 2** 1.
Stepper Motors 1. Must draw less than 1A current draw when motor is static	**Item 1** 1. Power the stepper motor control with 12VDC and 5VDC and connect the

2. Must have a torque greater than 16oz-in at an angular speed of 10rpm	output leads to the motors. 2. Ensure the current drawn to power the stepper motors falls below 1A using a multimeter 3. Repeat for remaining motors **Item 2** 1. Calculate the number of pulses per second required to achieve 10rpm 2. Compare with the provided torque vs pps chart on the datasheet and confirm that the torque is greater than 16oz-in.
Stepper Motor Control 1. Must be able to separately control 5 stepper motors 2. Must be able to step motors at a rate equivalent to ≥10rpm for 60 seconds	**Item 1** 1. Power the stepper motor control with 12VDC and 5VDC and connect the output leads to the motors. 2. Provide the select bits for one of the motors with VCC and GND. 3. Give the equivalent of a single rotation in the form of a 5V square wave with a frequency of 100Hz 4. Ensure the motor completed a single rotation 5. Repeat steps 2-5 for the remaining motors **Item 2** 1. Power the stepper motor control with 12VDC and 5VDC and connect the output leads to the motors. 2. Mark a point on each of the motor shafts. 3. Record the motors. 4. Provide the select bits for one of the motors with VCC and GND 5. Give the control a 5V square wave with a frequency equivalent to 10rpm for 60 seconds. 6. Repeat steps 4-5 for all the remaining motors. 7. Watch the camera footage and ensure that each motor completed 10 rotations.

Table 1. Requirements and Verification for the Trail Mix Dispenser