Autonomous Motorized Mount for PATHS sensor
Mock Design Review

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Block Diagram

Circuit Schematics

Power Supply Schematic
Motor Control Schematic

Microcontroller Schematic
Overall Circuit

Requirements and Verification

| Requirement | Verification |
### Power System

1. **AC/DC Power supply must output 12V ±0.1V DC with maximum current of 6A.**

2. **5V DC regulator must supply a voltage of 5V±0.1V with maximum current of 500mA.**

3. **12V DC regulators must supply voltages of 12V±0.1V with maximum current of 2A respectively.**

4. **The Autonomous Motorized Mount system shall be able to have power at all times for continuous operation.**

### Stepper Motor Control

1. **Drivers must be able to control the direction of the motors.**

2. **Steppers must be able to supply**

### Verification Process

**Power System**

1. **Verification Process for Item 1:**
   - (a) Attach 2Ω resistor as load.
   - (b) Attach oscilloscope across load.
   - (c) Measure voltage and verify that output is steady between 12.1-11.9V.

2. **Verification Process for Item 2:**
   - (a) Attach 10Ω resistor as load.
   - (b) Attach oscilloscope across load.
   - (c) Measure voltage and verify that output is steady between 4.9-5.1V.

3. **Verification Process for Item 3:**
   - (a) Attach 6Ω resistor as load.
   - (b) Attach oscilloscope across load.
   - (c) Measure voltage and verify that output is steady between 12.1-11.9V.

4. **Verification Process for Item 4:**
   - (a) Set the power supply with regulators as in verification process 1, 2, and 3, operational mode.
   - (b) Let it run for at least 12 hrs.
   - (c) Verify the power supply is still operating properly and there are not damaged parts.
   - (d) Repeat (a)-(c) 2 more times.

**Stepper Motor Control**

1. **Verification Process for Item 1:**
   - (a) Microcontroller will output a LOW (0V) to the DIR pin and a HIGH (1V) to the NXT pin on both drivers.
   - (b) Verify that both motors are moving in the clockwise direction.
   - (c) Microcontroller will output a HIGH (1V) to the DIR pin and a HIGH (1V) to the NXT pin on both drivers.
   - (d) Verify that both motors are moving in the counterclockwise direction.
enough torque to hold and move the load smoothly.

3. Drivers must be able to supply at least 12V±1V at 1.7A with a maximum current of 3A.

Verification Process for Item 3:
(a) Attach a 10kΩ resistor as a load.
(b) Hook up an oscilloscope across the resistor.
(c) Verify that the output for this load has a voltage of at least 11-13V.

Encoder Requirements
1. The encoder must be able to detect the smallest resolution step, 0.134 degrees, on the stepper motor.

Verification Process for Item 1:
(a) Output a HIGH (1V) to the NXT pin for only one pulse
(b) Read the inputs A+ and B+ from the encoder.
(c) Verify that there is exactly one change (rising or falling edge) from either A or B.

Temperature Sensor
1. Sensor must be able to read within ~1 degree C of accuracy

Verification Process for Item 1:
(a) Place a digital temperature sensor alongside the thermo-resistor.
(b) Attach a multimeter across the thermistor.
(c) Read the resistance value and check temperature at the resistance against the datasheet.
(d) Verify that the temperature is within 1 degrees of the digital temperature sensor.

Firmware Requirements
1. Firmware must correctly initialize and control the drivers.
2. Firmware must be able to correctly
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<tr>
<td>detect a step of the encoder.</td>
<td>(b) Power system and verify movement.</td>
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<td>3. Firmware must correctly move motors to a location specified via USB.</td>
<td>Verification Process for item 2:</td>
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<td>4. Firmware must report position and temperature via USB.</td>
<td>(a) Program microcontroller to move motors 10° along each axis when powered up.</td>
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<td>(b) Power up system and measure angle moved.</td>
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<td>Verification Process for item 3:</td>
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<td>(a) Issue a goto command via usb.</td>
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<td>(b) Verify correct angles moved.</td>
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<td>Verification Process for item 4:</td>
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<td>(a) Read serial data from microcontroller via usb.</td>
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<td>(b) Verify correct position reported.</td>
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<td>(c) Verify correct temperature reported.</td>
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### Safety

Users should constantly watch the Autonomous Motorized Mount when it is in operation and quit the operation if mounts are stalling. Stalling the stepper motors drains excess power exceeding the power supply limits potentially damaging the power supply. Also, it can cause the stepper motors as well as the controller integrated circuits to heat up to dangerous temperatures that can damage the mount. It will be up to the user to supervise the mount during use.

Therefore, the power supply will have a fuse included from the power supply output to the input of the regulators. This will provide protection against excessive power consumption and protect the power supply circuit. Each driver driving the stepper motors posses an overcurrent protection that switches off the functionality of the stepper motor protecting the life of these.

In addition, since the mount will be operating outdoors, sometimes working at high temperatures, a heat dissipator will be included for the power supply to handle high temperatures.

### Citations
References