First Prototype Testing Plan

RoboSaw

By

Team 35

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Required Materials:

Hardware:

- Metabo HPT 10-Inch Compound Miter Saw
- Torsion Spring
- RoboSaw Intake Mechanism
- RoboSaw Turn Table Mechanism
- RoboSaw Wood Stock Clamping Mechanism
- Nema 11 Dual Shaft Stepper Motor
- Nema 17 Dual Shaft Stepper Motor
- Raspberry Pi 4
- Adafruit ESP32 Feather - For motor testing only
- DRV8825 Stepper Motor Driver
- 24V 5A DC Power Supply
- 1000 CPR Optical Rotary Encoder

Software:

- Stepper motor control script
- User input form

Set up:

The RoboSaw setup has two parts, the hardware setup and the software setup. The hardware setup consists of placing the saw in an open area on the jobsite on top of a miter saw stand. The saw must then be loaded with the wood stock that needs to be cut. The RoboSaw will be tested with stock of 2X4,4X4, and 2X6 lengths. Once the saw is loaded and plugged in, the RoboSaw software can be set up. The cutlist for RoboSaw will be loaded onto the Raspberry Pi in a .csv file format. This contains all the

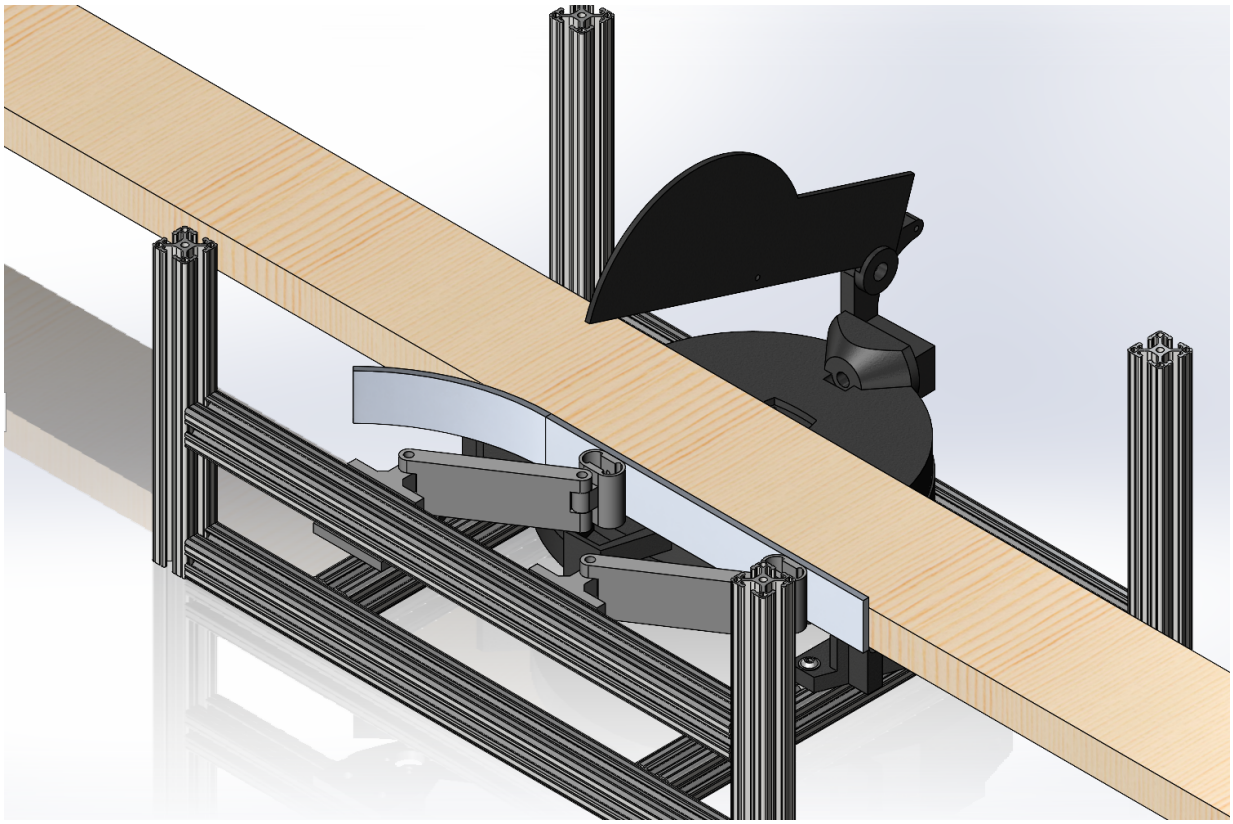
desired cuts at various lengths. Once the file is loaded, the user can initialize the start procedure and the RoboSaw will begin cutting. Once the cutting process has begun it will go to completion. Alternatively it can be forcibly stopped via an emergency stop (E-stop) command initiated by pressing the emergency stop button located on the RoboSaw frame.

Note that for testing, the Raspberry Pi is not controlling the stepper motors. This is being handled by a separate ESP32 for easier testing and prototyping on the hardware level.

Pre-Testing Setup Procedure:

Hardware:

1. Mount RoboSaw to miter saw stand.
2. Ensure there are no obstructions on the cutting platform and remove saw dust.
3. Load wood into intake.
4. Plug in and power on the RoboSaw.



A render of the miter saw wood stock clamping mechanism, consisting of a 4-bar linkage driven by a stepper motor.

Hardware - Motor Control (TESTING ONLY):

1. Connect ESP32 over serial to laptop
2. Send rotation angles to ESP32 over serial

Software:

1. User inputs the cuts to the input form.
2. Form generates .csv file and loads it to flash drive.
3. Python script optimizes the order of the cuts to minimize wasted wood.
    a. Aligns similar angles to use the same cut where possible.
    b. Fits multiple cuts onto one piece of stock where possible.
4. Load .csv file containing the cutlist onto Raspberry Pi.

Testing Procedure:

1. Load stock into robosaw intake.
2. Initialize the .csv file with cutting instructions.
3. Measure accuracy of cutting and feeding system
4. Verify rotation angle based on angles calculated from software
5. Place an object to act as an obstruction during the cutting process. This will test the raspberry Pi's ability to detect such an obstruction.
6. Perform an emergency stop with the endstop.

Measurable Criteria:

The following criteria determine a successful cutting operation:

1. The miter saw and all electronics should power on.
2. The Raspberry Pi should accept and process the cut list.
3. The intake mechanism should be able to feed the correct length of wood into the saw.

4. The clamping mechanism should hold the wood firmly in place and move out of the way of the saw blade during the simulated cut.
5. If a miter cut is required, the turn table mechanism should rotate the saw to the correct angle.
6. The Raspberry Pi camera should be able to detect an obstruction in the path of the saw.
7. If a line is drawn on the wood and no cutlist is supplied, the Raspberry Pi should identify the marked line of cut and the turn table mechanism should rotate the miter saw to the correct angle.