

# Test Plan

Full Range of motion on each finger - The device should be able to move in the full range of motion for each finger. Determine through flex sensor data in the amount of flexion (degrees).

## Scope:

- **System:** Robotic/assistive hand device equipped with flex sensors
- **Goal:** To determine if each finger achieves its full range of motion
- **Test Expectations (Hypothesis):** The device should enable each finger to achieve range of motion within 5% error of an average human's natural finger range.

## Administrative Details:

- **Date/Location of Testing:** ???
- **Client/Organization:** This class idk
- **Test Conductors:** Research Team under Prof. David Harrison

## Design of Experiment:

- **Type of test method:** Controlled experiment using flex sensors to track finger flexion
  - **Significance:** Ensures the device can replicate the expected movement range of human fingers.

## Testing Apparatus & Equipment:

- Glove with integrated flex sensors
- Voltage divider circuit with known resistor (? ohms)
- Arduino
- Computer for data logging and visualization

**Independent variable(s):** Actuation movement signal sent to device.

**Dependent variable(s):** Measured flexion angle (degrees) from flex sensors

Step 1:

Ability to download/save metrics - Data should be stored and sent remotely after each exercise is completed.

Step 1: Plug the device into a stable 120V AC power supply, preferably a wall outlet.

Step 2: Load the exercise onto the device and begin the workout. Preferably a short workout routine.

Step 3: Pair the device to a therapist's computer, allowing it to download and store the device's workout data.

Step 4: Start the workout and wait for it to finish.

Step 5: Observe the download of the device

Multiple exercises -

Accuracy of repetition counting - The device should be tested to report as many repetitions as are being performed. We need to know the degree of error of our data.

1. Turn the device on and begin basic squeeze exercises, where fingertips must touch, for 10 seconds.
2. While the device records repetitions, manually count how many repetitions occur until the time is over.
3. Compare the number of repetitions the device reports to the number of repetitions observed.

Individual controllability - Each finger should be able to operate independently of any other finger.

1. Turn the device on and verify each finger individually can be pulled in individually.

2. Verify each finger individually can be extended back out.

Resting-state - The device should return to a resting state after the completion of each exercise.

1. Turn the device on and begin an exercise.
2. After completion of the exercise, verify that the device has returned to its neutral resting state.

Ability to be turned on/off - The device should have the ability to be turned off separately then being unplugged.

Step 1: The device should not be connected to any person.

Step 2: The device should be plugged into an AC stable power supplying at least 120V. A common wall socket is preferred.

Step 3: Load any basic exercise and wait for a time longer than 10 seconds.

Step 4: Turn off the device by pressing the power button on the box connected to the wall. Make sure to press the power button before the exercise has finished.

Step 5: Observe and measure the time it takes for the device to stop movement.

Step 6: Repeat steps 3-5 multiple times with differing exercises.

Goal: The device should stop within 2 seconds of the power button being deactivated. Visually observe the device stop moving and pay attention to servo movement.

External Factors: Make sure the power connection is stable and not underload.

Weight - Determine the weight of the device that is worn on hand. Under two pounds.

The device that is worn on the hand and arm should weigh less than two pounds.

Step 1: Unplug the device from the power bank and computer.

Step 2: Place the device on the scale. The glove should be dry and empty. Strings should be attached from servos to fingers.

Goal: The device should weigh under 2 lbs or 1kg. Write down and log the data in the table below.

External Factors: The scale should be accurate enough to detect under five pounds and should be zeroed before use.

Ability to fit on common hand-