

# Advanced Griphook Technology

"A simple, innovative, grip-assisting technology designed to aid individuals with mild to severely limited hand mobility & grip strength"



TANKSolutions: Anna Black, Tyler Ester, Narci Huang, Kristen Johnson, Scott Smyth | Professor Nauman | Purdue University Senior Design Project

## The Need

Many people worldwide have ailments of the hand which make independent living a challenge. These individuals need a device to help them regain their independence by grasping and holding objects for them.

## Statistics

- Dupuytren's Contracture: Affects 25% of over-fifty population; overgrowth of tendons on palm cause fingers to fold into palm.<sup>[1]</sup>
- Carpal Tunnel: Affects 3% of women and 2% of men; condition results in numbness, reduced grip strength, and pain during movement.<sup>[2]</sup>
- Arthritis: Affects over 50 million adults; results in joint stiffness, pain, and limited dexterity of fingers<sup>[3]</sup>
- Stroke: leading cause of long term disability; can result in "diminished ability to manipulate objects with hand" and "inefficient grip force scaling"<sup>[4]</sup>



Dupuytren's Contracture



Carpal Tunnel



Arthritis

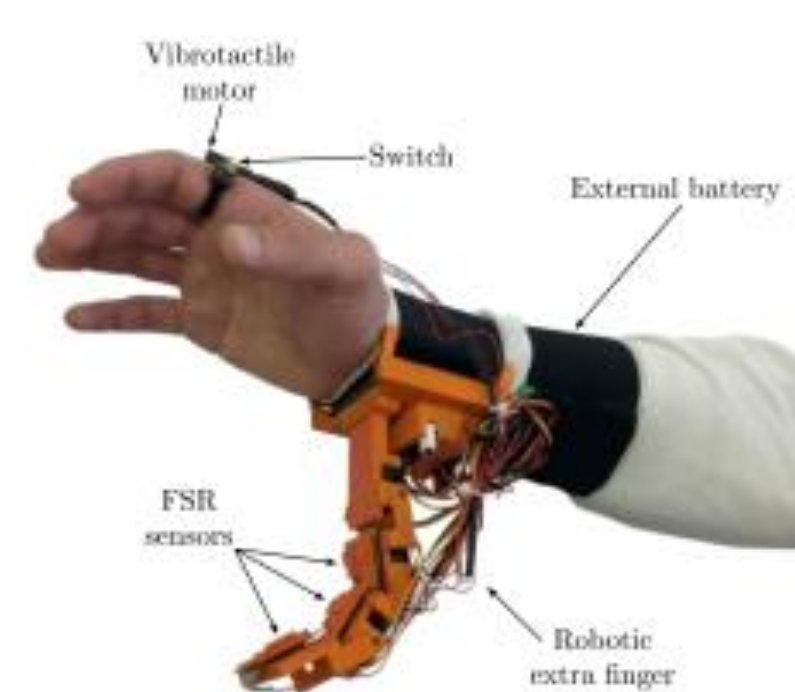
## Benchmarks



Deka Arm

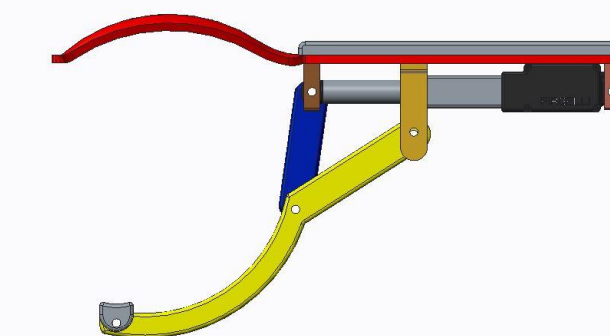
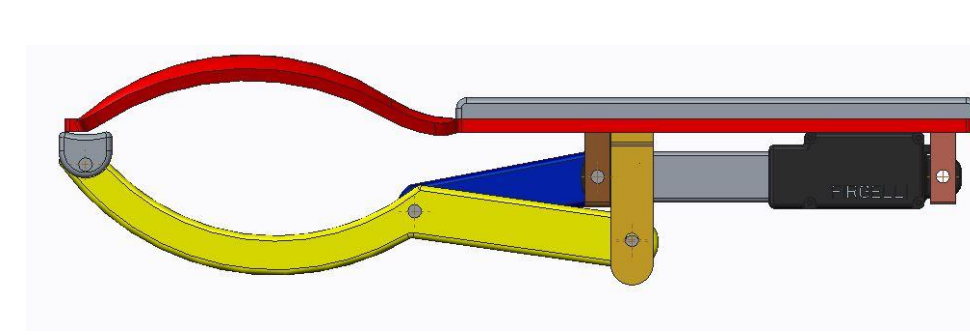
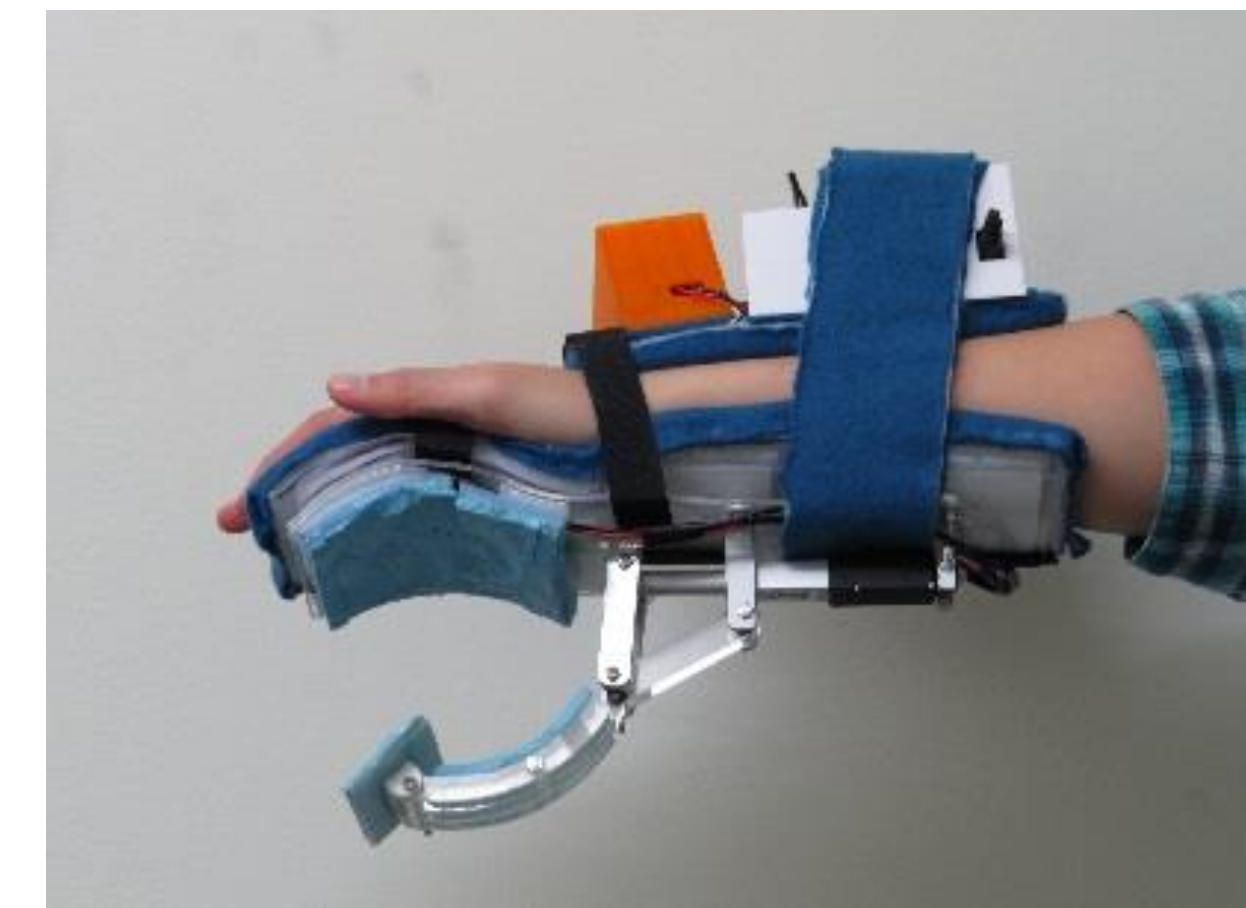
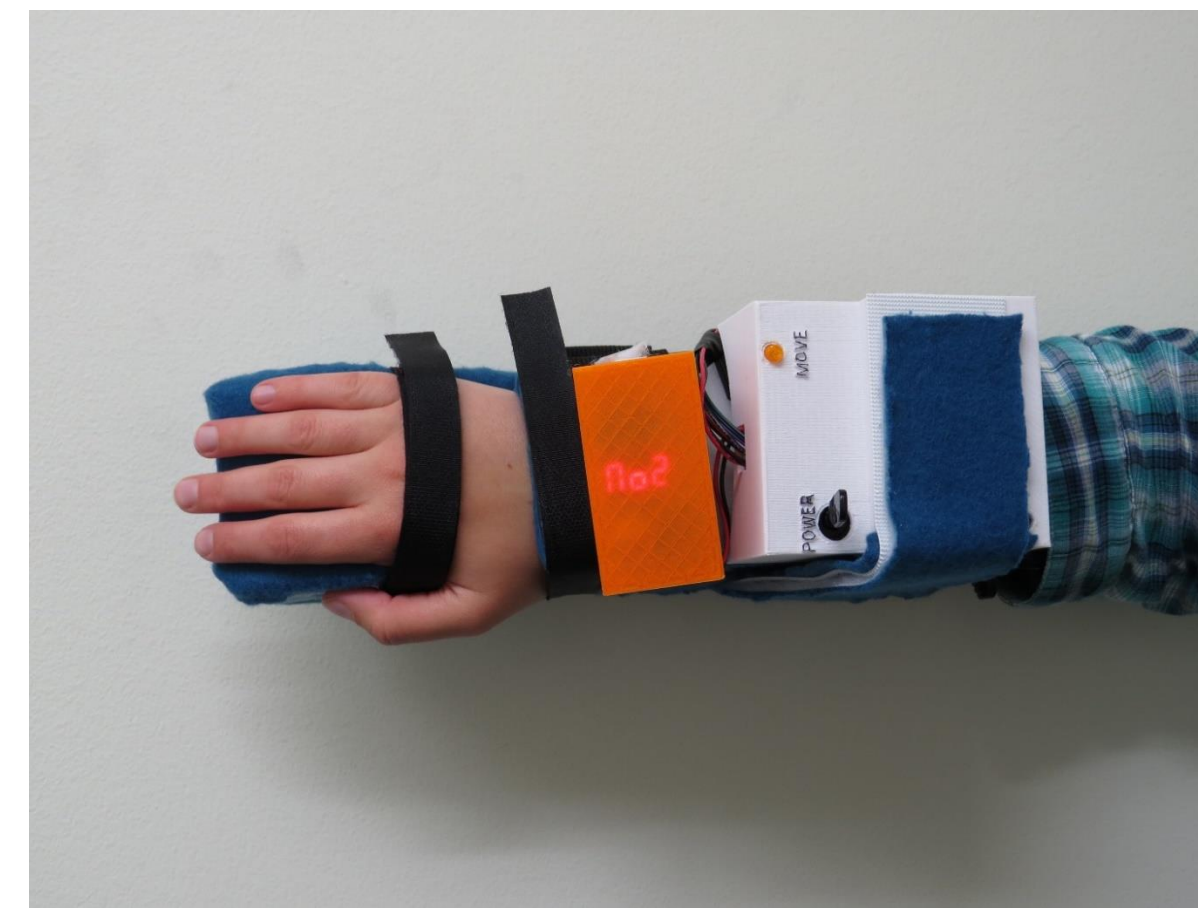


Soft Robotic Glove



Robotic 6<sup>th</sup> Finger

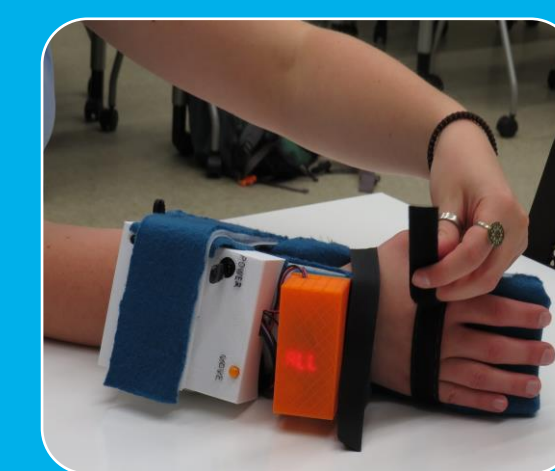
## Design Solution



## Device Fit & Operation

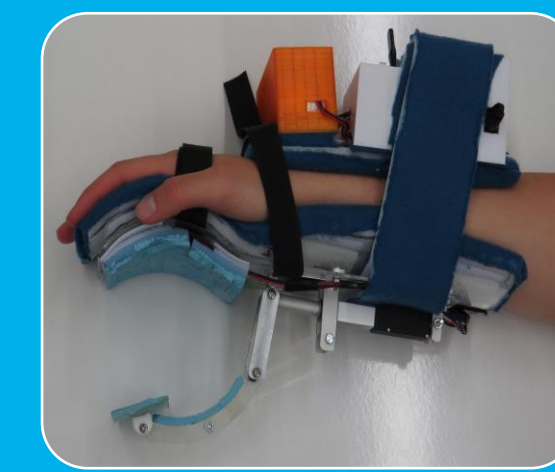
### Step 1

- Attach to Forearm



### Step 2

- Power On & Open



### Step 3

- Close Around Object & Tighten Grip if Necessary



### Step 4

- Complete Task



## Device Specifications

- Weight – 1.4lbs
- Grip Strength – 2lbs
- Lift Strength – 10lbs
- Max Grip Extension – 3.5"
- Linear Actuator Output Force – 150N (34lbs)

## Innovative Design Aspects

### Pressure-Sensing Fingers

- Detect when sufficient grip force has been applied

### Voice-Recognition Technology

- Pain-free user input method
- Responds to only user's voice
- Includes command which incrementally increases grip force

### Linear Actuator

- Actuates the slider which manipulates the 4-bar mechanism

### Fine-Grip Tip

- Rotates to increase grip contact area
- Improves grip strength and stability

### Dragon-Skin & Foam Gripping Surface

- Includes rubberized outer that increases contact friction
- Foam conforms to the shape of irregular objects

## Real-World Applications



- Brushing Teeth
- Drinking
- Using Eating Utensils
- Writing Using Pencil/Pen
- Carrying Groceries



## Key Takeaways

- Inexpensive (with bulk purchase & manufacturing, ~\$100 MSRP)
- Pain-free use for even the most severely disabled individuals
- Fits both right and left hands
- No device like it on the market today

1. "Age Distribution of Dupuytren's Contracture, Influence of Gender." *Age and Geographic Distribution of Dupuytren's Disease (Dupuytren's Contracture)*. Web. 01 Feb. 2016.

2. Carpal Tunnel Syndrome Fact Sheet. (2012, July). Retrieved February 01, 2016, from [http://www.ninds.nih.gov/disorders/carpal\\_tunnel/detail\\_carpal\\_tunnel.htm](http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm)

3. Arthritis: Addressing the Nation's Most Common Cause of Disability At A Glance 2015. (2015, July 22). Retrieved March 02, 2016, from <http://www.cdc.gov/chronicdisease/resources/publications/aag/arthritis.htm>

4. Seo et al. Delays in Grip Initiation and Termination in Persons With Stroke: Effects of Arm Support and Active Muscle Stretch Exercise. *Journal of Neurophysiology*, 2009; 101 (6): 3108 DOI: [10.1152/jn.91108.2008](https://doi.org/10.1152/jn.91108.2008)