

TECHSAGE COMPETITION: Phase 2

The Releaf Glove

Assistive-wearable to increase grip strength, reduce hand fatigue, and be easy on the joints



Conceptual Thinking

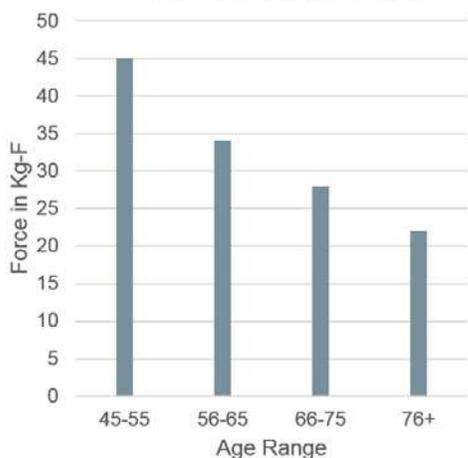
The Releaf glove stemmed from numerous stories about elderly gardeners wanting to garden, but who were unable to do so due to decreasing grip strength and increasing hand disabilities.



“Just when you’re getting good at everything that happens.”

-Joe, age 67, in reference to sustaining an injury that left him unable to garden for a time. Our research included observing seniors gardening then building empathy gloves to better understand the problems seniors can have.

Grip Strength & Age

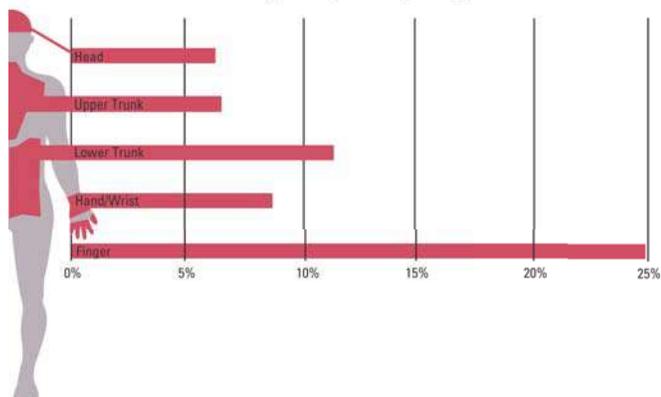


Our 3 key insights

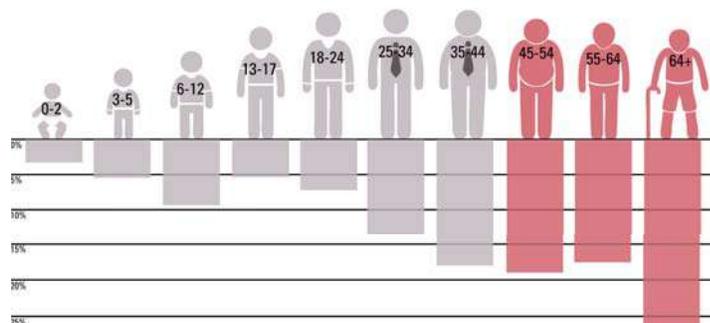
- Gardeners have the DIY mentality, They will use tools the way they see fit and adapt to their changing circumstances.
- Gardening is fulfilling in two ways: 1) Doing something reflective on how well they take care of the garden and 2) Gardening fulfills a moral obligation to the environment.
- Despite their declining Physical abilities seniors continue to garden and physically exert themselves because it outweighs the physical risk.

The rewards from gardening outweigh the risks so seniors will continue to do so.

Percentage of Injuries by Bodypart

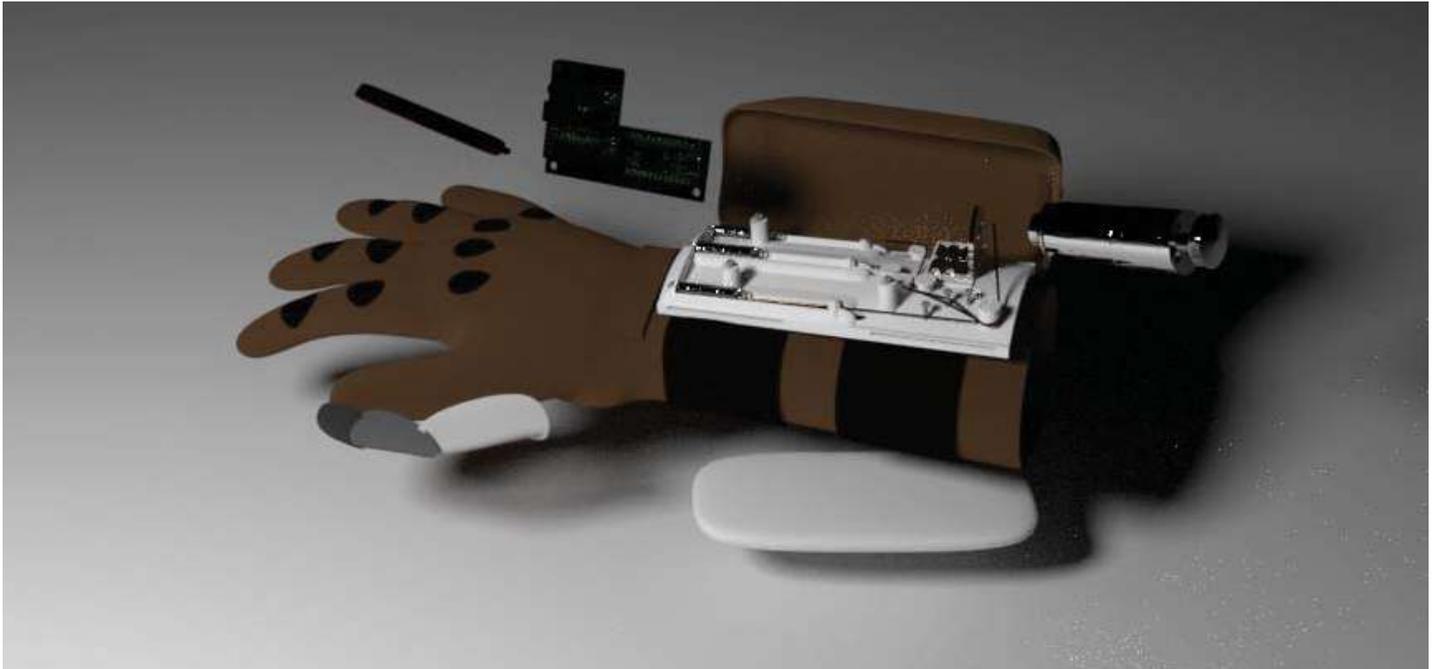


Percentage of Injuries Based on Age



3D Representation

The Releaf glove has been designed carefully to convey a beautiful aesthetic that seniors would want to garden with. It has carefully been put together to avoid looking like a medical or rehab device and instead to look like the rugged gardening glove that it is.



Releaf has a motor connected to cables which assist in finger actuation when the flex sensor is bent signalling that the pinky is curling around an object, such as the handle of a tool. When the motor turns the cables are pulled, stretching on the springs and then engaging in the tip of the finger to curl it in against the thumb brace. Future models will be able to deliver a sustained 10kg/lb. force.



Storyboard

Joe is a gardener that wants to continue gardening, but because of decreasing grip strength is finding it more difficult than it used to be for basic tasks such as holding tools for periods of time.



Joe purchases a releaf glove for his dominant hand, it comes in standard glove sizes and forms a custom fit thanks to the adjustable straps.

Joe turns on the glove and initializes the grip assistance with sensors in the pinky.



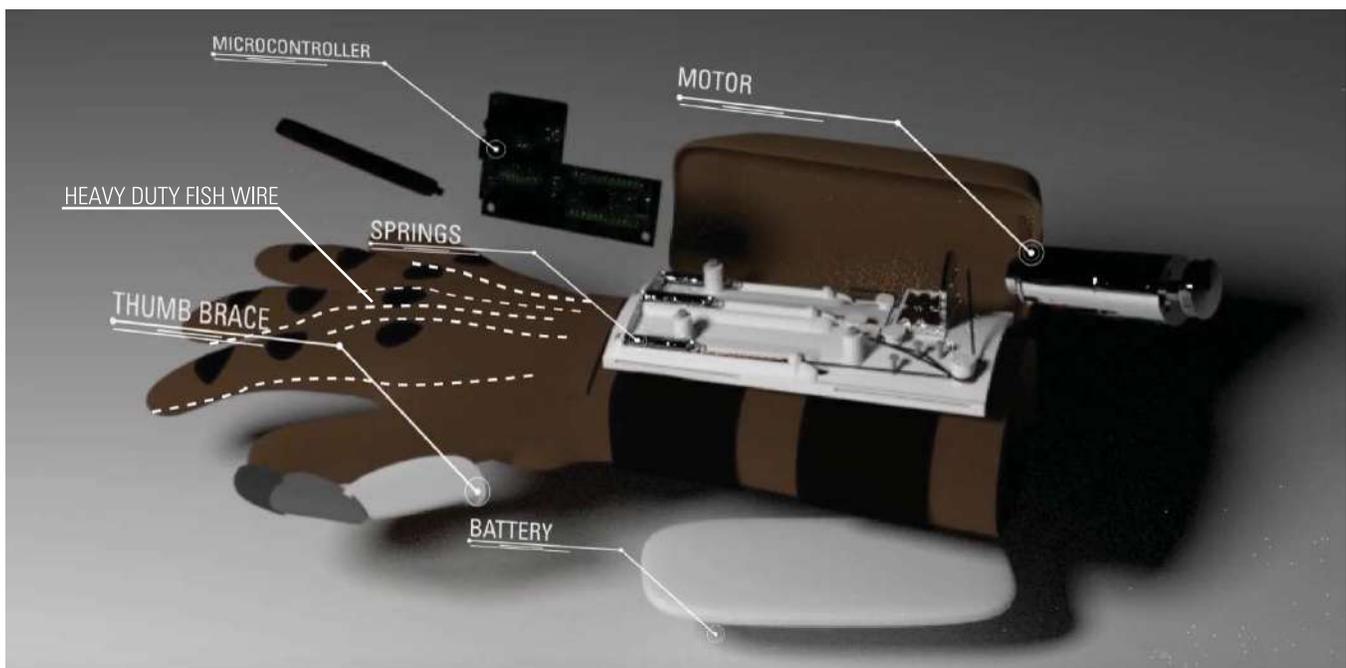
Joe can now get back to doing what he loves and grasping his tools with certainty that he can finish his gardening work with little to no pain in his hand.

Material and Electronics

Materials



Electrical Components

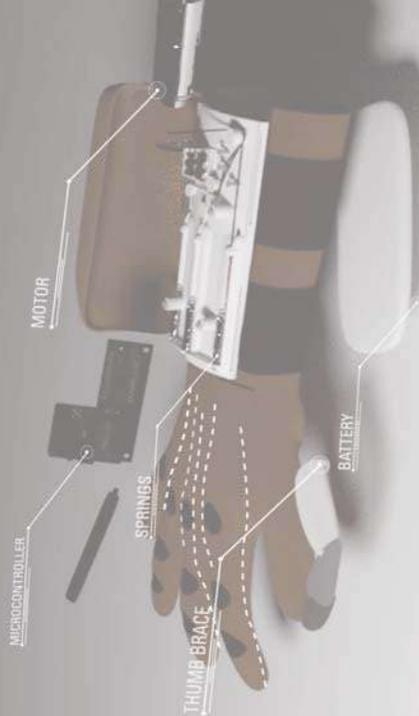


Implementation Plan

6-Month Current Development Timeline

MONTHS 1-2

REFINE MOTOR AND WIRING MECHANISMS



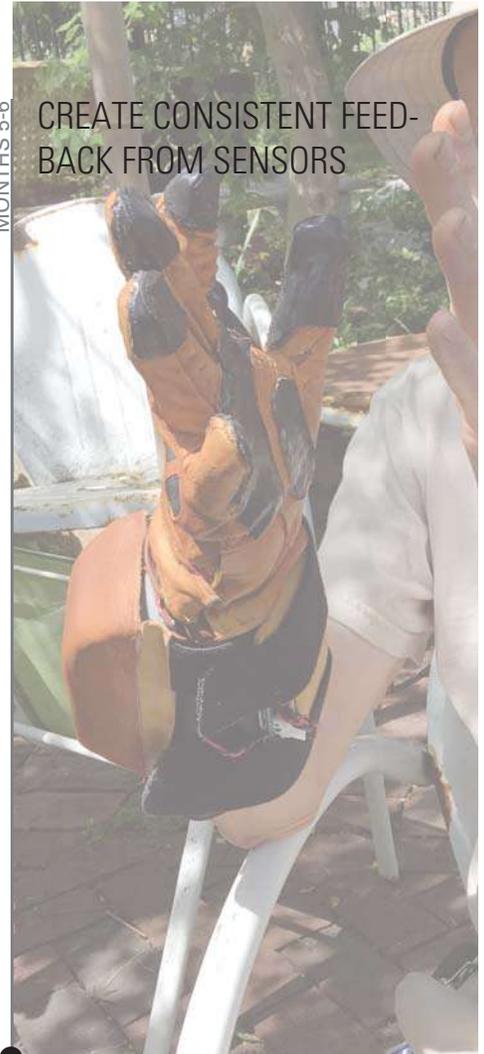
MONTHS 3-4

INTEGRATE DESIGN AND ENGINEERING



MONTHS 5-6

CREATE CONSISTENT FEED-BACK FROM SENSORS



5-Year Key Activities Timeline

YEAR 1&2

DEVELOP PRODUCT & PENETRATE MARKET

- Local Community Garden and Senior Citizen Communities
- Media Coverage (ie: TechCrunch and AARP)

YEAR 3

SCALE UP

- Expand Nationally
- Crowdfunding
- Find Manufacturers to mass produce

YEAR 4

EXPAND PRODUCT LINE

- Create variations of products
- Explore other applications for technology (ie: farming, construction, factory/warehouse)

YEAR 5

REFINE COMPANY OPERATIONS

- Establish corporate hierarchy
- Maintain distribution channels and professional relationships

Approximation of Cost of Goods Sold

PRE-MASS PRODUCTION & DEVELOPMENT COSTS

- \$150/pair to Manufacture
- \$7,200 for 6 Months of Workspace
- \$5,000 for Travel/Marketing
- \$10,000 for Professional Services

POST-MASS PRODUCTION & BUSINESS COSTS

- \$103/pair for Manufacture
- Approximately 35% of COGS for HR, Administrative, R&D, Marketing, and Sales

Glove Iterations



1 Empathy Gloves

These gloves were designed to mimic arthritis, joint pain, and muscle/grip fatigue that seniors typically experience. We created these by putting two layers of thin ABS on the top of the hands. This causes pressure on the finger joints as well as causing muscle fatigue when gripping. In addition, duct tape was placed over the grips to make it more slippery and difficult to grip tools.

2 Releaf Grip Gloves v.1

These gloves were made to test out the different placements of the joint relief flex-fit spandex. This glove let us come up with good positioning of the spandex sections as well as experimented different customizable options - glove palm adjustments & wrist support. In addition this was one of the first gloves that we tested different silicon grip placements.

3 Mech v.1

This was the first glove that we tested out a mechanical system for the glove. This version also used a spring mechanism to account for wrist movements. We used a motor for this iteration using torque control and a pinky sensor.

4 Mech v.2

This mechanism actuated all of the fingers using three low-profile servos. This was supposed to be controlled through a pinky sensor and position control.

5 Releaf Glove v.1

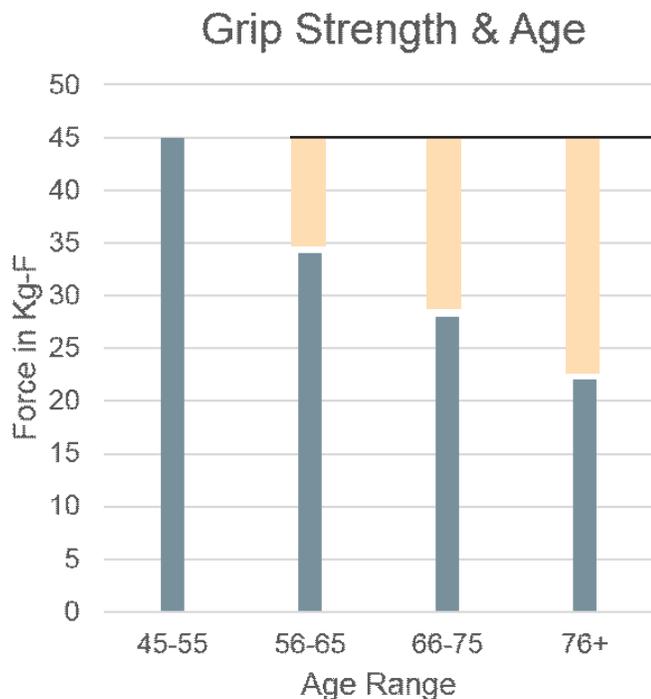
This was our first fully-functional prototype. This had the full gauntlet with a prototype motor attachment, the final flex-fit spandex placements, and final grip placements. This glove was also made of our final glove materials as well as the leather cover.

6 Releaf Glove v.2

This was our final glove. This glove matched our industrial design aesthetic as well as a wet-formed leather shell. The leather was also fully dyed to give a more garden aesthetic. This model also included a wooden induction charger and a wooden storage box and stand. This glove also used a stronger motor and a new spring constant-tension system so the strings wouldn't unravel. This was our highest fidelity model that took into account user interaction, interface, durability and software.

Testing and Validation

Grip Strength Test



GOAL: Give back strength lost after the age of 55

TEST: Do grip strength tests with a grip strength tester with and without glove for max grip strength



Mechanisms of Ageing and Development & Annals of Epidemiology

Grip Endurance Test

GOAL: Allow seniors to hold tools for longer periods of time

TEST: Do repetitive motion tasks, such as raking and digging, until arm and hand gets tired and time it with and without glove

TEST: Squeeze grip strength tester until grip strength reaches less than 50% and see how long it takes to get there with and without glove

