# SURESTEP

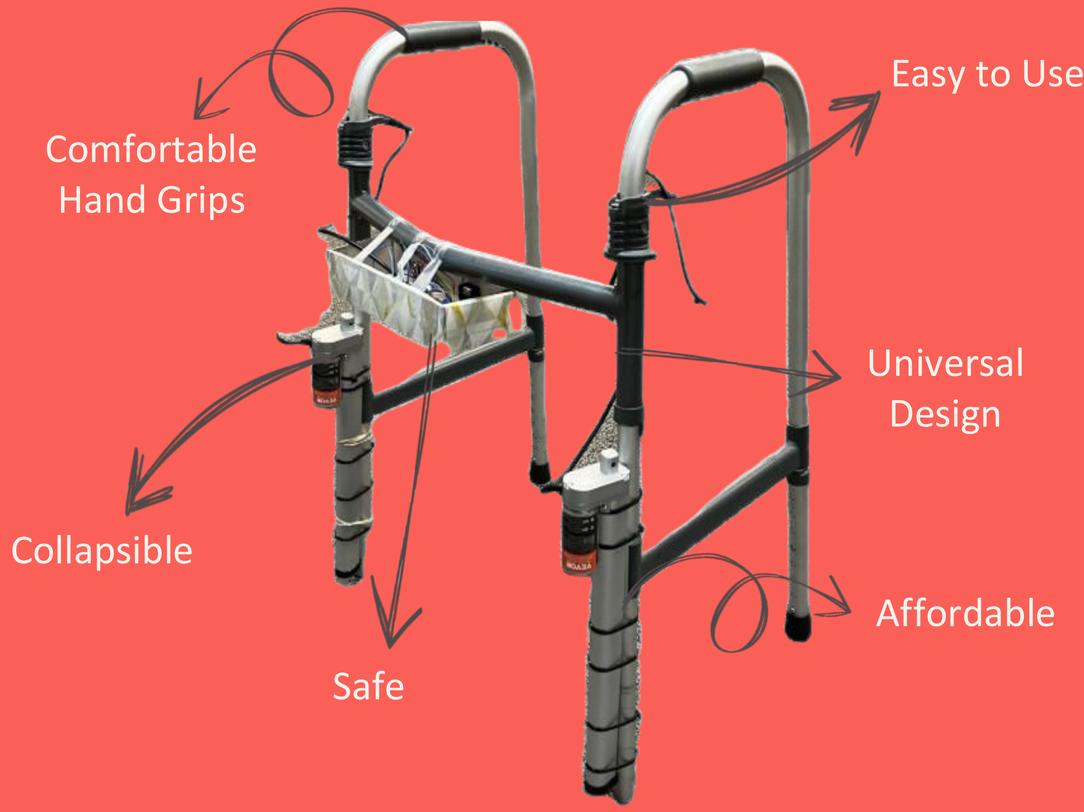



*Figure 1*. Current Prototype.

## Problem Statement & Engineering Goal

Traditional mobility-aid walkers are challenging for users to navigate stairs independently, requiring caretaker assistance and limiting autonomy. Our goal is to design an affordable walker that allows users to ascend and descend various types of stairs independently and comfortably.

**CEO** Ravena Arun, **CTO** Anika Sivasankar, **CMO** Maria Mishechkina, **CIO** Lilian Amer
**Advisor:** Kevin Crowthers, Ph.D. | **Consultant:** Mr. Pavel Loven

## DESIGN REQUIREMENTS

**Level 1 Requirements**

1. Allow the user to ascend and descend stairs without excessive movement
2. Be stable and safe for elderly persons use
3. Support a user weighing 300lbs or greater
4. Weigh less than 15lbs

**Level 2 Requirements**

1. Be stable across stairs of varying heights, widths, and surface textures
2. Be made of less than $120 materials
3. Be stable enough for one-handed level ground use to allow user to reach for and carry other objects

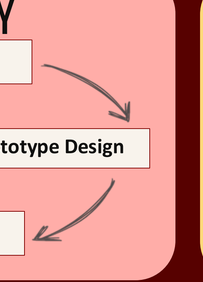
## DESIGN ITERATIONS

**1 Exterior Tube w/ Grippy Wheel Locking Mechanism**


**Pros:** Low cost, Accessible, Energy-efficient design
**Cons:** Doesn't provide enough friction to support a user over 300 lbs

*Figure 2.* First Design Iteration.

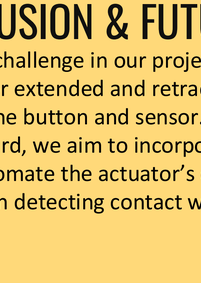
**2 Solenoid Locking Mechanism w/ Exterior Tube Extension**




**Pros:** Greater surface area and contact with ground, sturdier design
**Cons:** Less stable and requires more material

*Figure 3.* Second Design Iteration.

**3 Solenoid Locking Mechanism w/ Interior Tube Extension**




**Pros:** Affordable, Logical, Functional design
**Cons:** Requires gripping foot-end with greater surface area to provide stability

*Figure 4.* Third Design Iteration.

## DESIGN STUDIES

### MEASURING MOVEMENT REQUIRED

**Purpose:** To determine whether the walker can emulate the amount of bending that the user requires when relying on a caregiver.
**Independent Variable:** Main prototype design
**Dependent Variable:** Angle at the hip
**Procedure:** The angles will be measured using a goniometer placed at the hip joint.

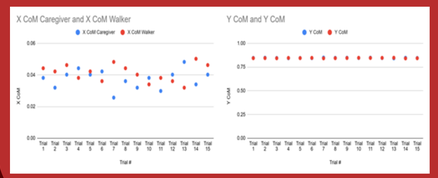



*Figure 5.* Measuring Movement Required Data.

### ASSEMBLY TIME

**Purpose:** To determine whether the walker requires more or less time to assemble than the button-activated extension.
**Independent Variable:** Main prototype design
**Dependent Variable:** Time taken to extend the legs
**Procedure:** The time taken to extend the legs of the actuator vs. the walker will be measured using a stopwatch.

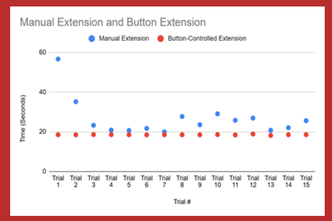



*Figure 6.* Assembly Time Data.

### VARYING FOOT TYPE

**Purpose:** To determine which foot type/design is most optimal for overall walker stability and support.
**Independent Variable:** The foot type (circular, triangular, or rectangular designs) and material (rubber or felt)
**Dependent Variable:** The force required to horizontally move the walker from rest.
**Procedure:** The static friction will be measured using a force meter spring scale.

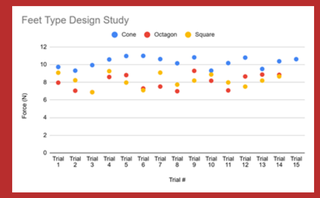



*Figure 7.* Varying Foot Type Data.

## METHODOLOGY




*Figure 8.* Methodology flow chart.

## CONCLUSION & FUTURE STEPS

The greatest challenge in our project was ensuring the linear actuator extended and retracted accurately in response to the button and sensor.
Moving forward, we aim to incorporate a motion sensor to automate the actuator's extension, enabling it to stop upon detecting contact with the ground.