



NORTHERN
ARIZONA
UNIVERSITY



Final Presentation

Hozhoni Cleaning

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Overview

- Introduction
- Project Description
- Customer/Engineering Requirements
- Benchmarking/Brainstorming
- Final Design Considerations
- Design of Experiment
- Results/Conclusions



Client Information

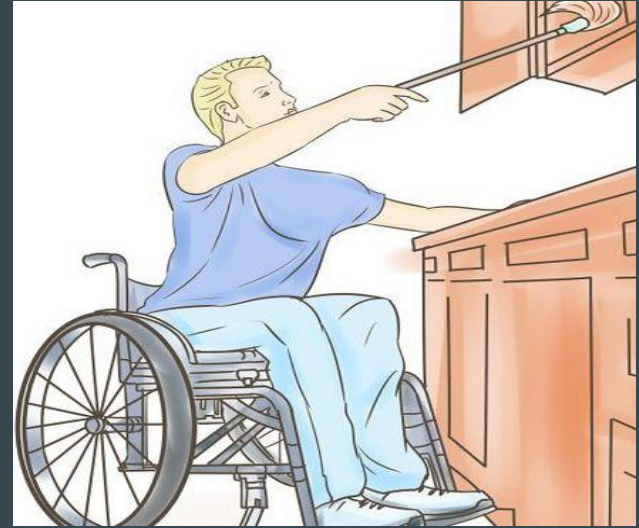


- Hozhoni (ho-sho-nee) Foundation company.
- This Foundation works to help provide independent living for those with disabilities.
- Client: Ms. Charlene Turman from the Hozhoni Foundation.



Project Description

- Required to create a device that can help disabled people in carrying cleaning supplies.
- Device must be storable and be compatible with different wheelchairs.
- The solution must be adaptable for different sizes or types of wheelchairs and be lightweight.



Project Needs and Goals

Projects need:

- The client has expressed a desire in making a device that could help individuals with disabilities transport cleaning supplies.

Projects Goals:

- Our goal was to design a systems that meets all customer requirements and can also be easily manufactured.

Customer requirements

- Safe for users
- Low cost
- Adaptable to different applications
- Portable and modular
- Lightweight

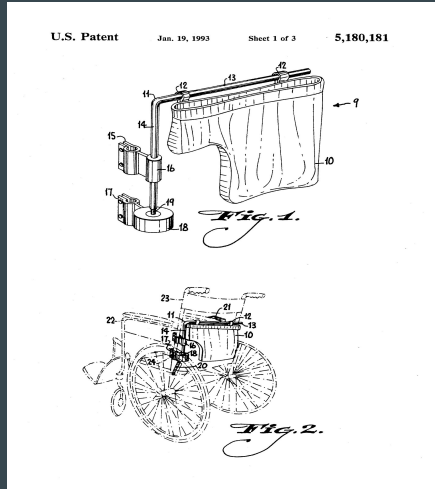


Engineering requirements

Engineering Requirement	Target
Weight	<7lbs
Size (width)	5-10in
Size(Length)	15-20in
Cost	<\$200
Storage Size	0.25-0.5ft ³
Lifespan	5 years
Weight Capacity	>15lbs

Benchmarking

Movable Pouch[1]



Winnie Wagon[2]

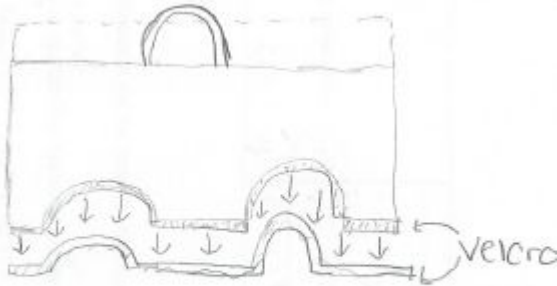


Scooter Trailer[3]

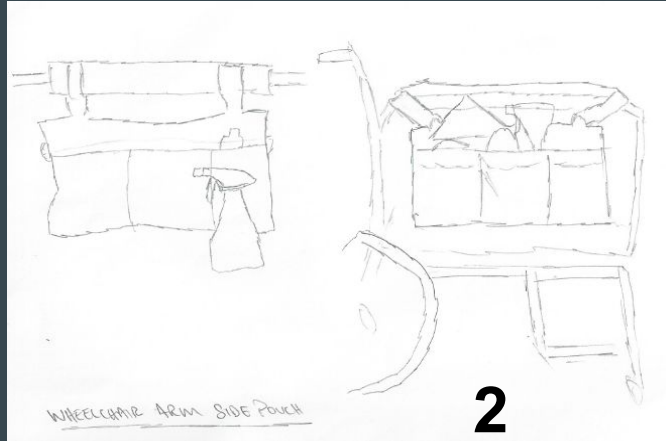


Top 3 Designs from ME 476C

- First selected design: Side Pouch.
- Second selected design: Lap Organizer.
- Third selected design: The Vest.
- Customer approval/preference is needed.



1



2



3

Decision Matrix

Criteria	Cleaning Vest	Lap Organizer(Final Design)	Side Pouch
Adaptable	7	5	7
Light Weight	5	5	10
Portability	9	5	6
Ability to store easily	4	2	4
Attach/Detach Ability	6	5	7
Cost	3	5	5
Total(out of 60)	34	27	39

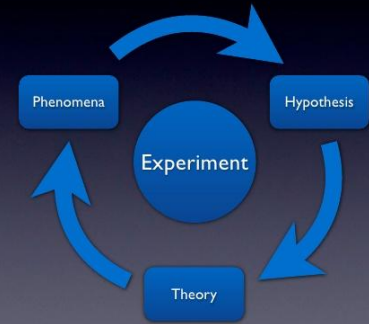
Final Design- Lap Organizer

- The final system was selected by our Client based of its ease of construction and use.
- The system is comprised of two pieces; Box and Hook.
- The box is secured to the hook through velcro.

Design of Experiment

- Tested the parameter of storage space.
- Internal area of oval, rectangular, triangular, and trapezoidal shaped boxes were analyzed.

Design of Experiment

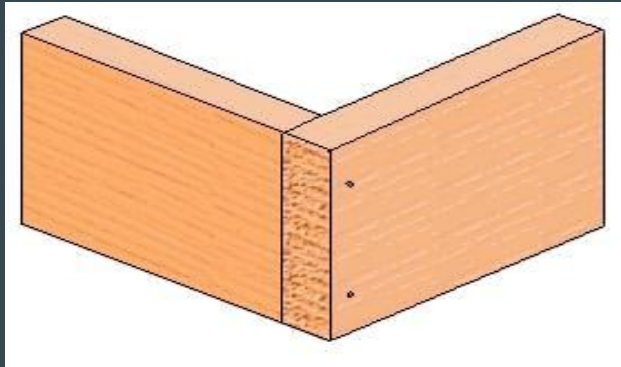


Oval	88.27in ²
Rectangular	96in ²
Triangular	48in ²
Trapezoidal	90in ²

Manufacturing Process-Box

Prototype:

- Started with ¼" particle board
- Butt joint seams
- Glued joinings



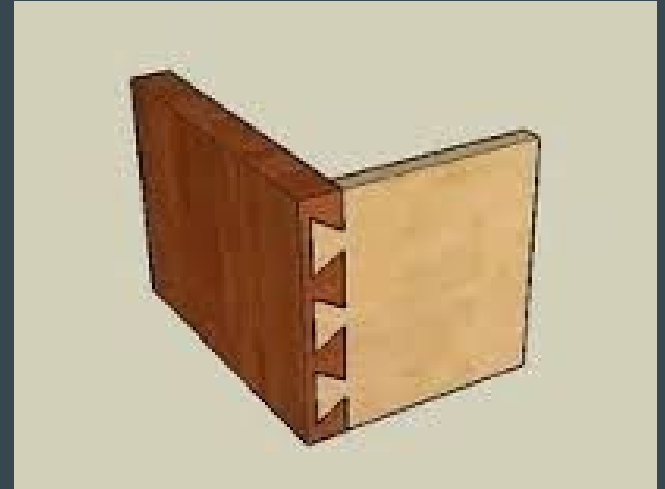
Complications include:

- Material too thin to fasten back to itself
- Weak joints won't work for final
- Metal hardware may corrode

Manufacturing - Final

Iterations evolved through engineering:

- Material: $\frac{3}{4}$ " Red Oak planed to $\frac{1}{2}$ " thickness
- Exterior finish creates protection
- Joints: Dovetail with reinforced glue
- Only hardware: brushed nickel handles
- Alternative shapes considered



Initial Design- “Hook”

- Originally Elastic belt that velcroed together at the ends
- Changed to aluminum sheet metal to allow for easier fastening to user

Manufacturing- Hook

Required Materials:

Aluminum sheet metal -2 ft

Material (Nylon/Polyester)- 0.5 yd

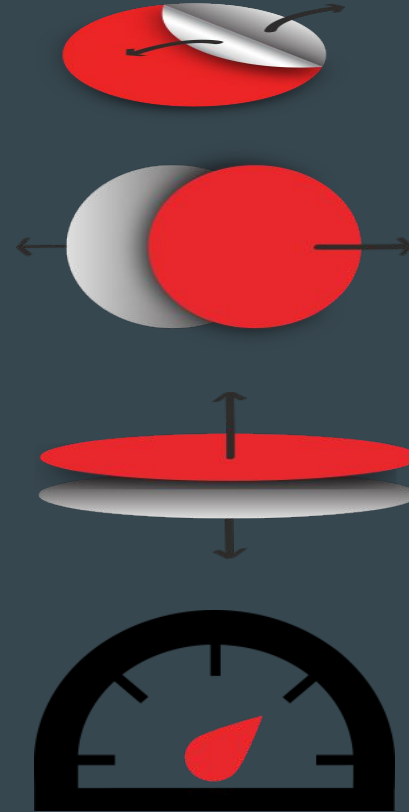
Black Thread



- 1) Cut a 1.5-2 ft length of sheet metal. The length depends on individual lap lengths.
- 2) Cut fabric to cover sheet metal.
- 3) Sew together down the center of the metal piece.
- 4) Sew edges closed and glue down excess material at the ends.
- 5) Bend ends to form hooks for the legs to rest in.

Velcro strengths. [4]

- Closure Peel Strength: 1.2 psi
- Closure Shear Strength: 14.0 psi
- Closure Tension Strength: 6.5 psi
- Withstand Temperatures up to 300 F



Alternate Manufacturing

Box: The box can be fastened together with nail, screws, or epoxy instead of using the dovetail joints

Hook: Fastened together with epoxy (Fabric glue or super glue) instead of sewing the fabric together

Design Solution- Final Product



Figure 1: Lap Organizer

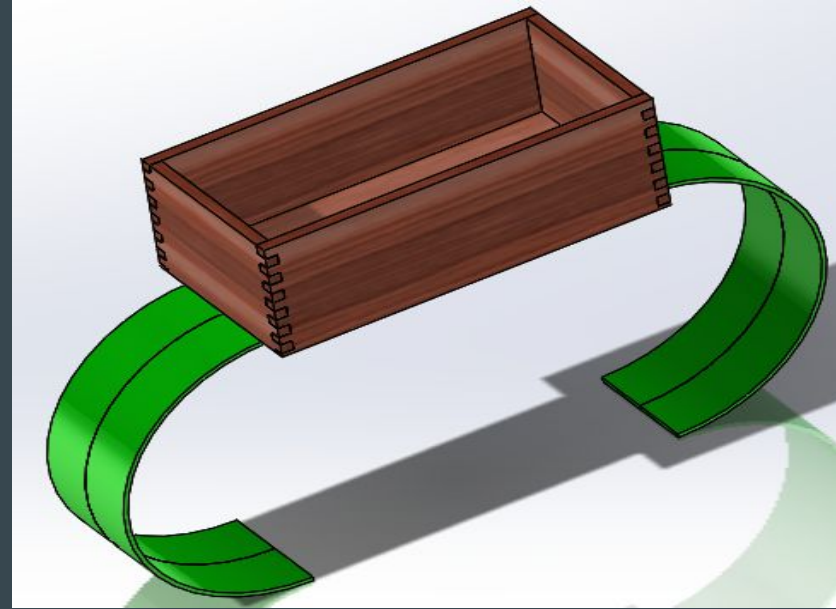


Figure 2: Assembly Design

Final Cost

Nylon-Polyester material	0.5yd	\$3.75
Thread(Black)	5ft	\$0.50
Aluminum Sheet metal.	2.5ft	\$1.60
Oak wood	2.5ft ²	\$75

Results

Weight	4.85lb
Dimensions(Exterior)	16.185inx6.18inx7in
Dimensions (Interior)	15.185inx5.18inx7in
Cost	\$88.85
Weight Capacity	>15lbs



References:

- [1] Letechipia, Jorge. "Motorized movable storage bag for use on a wheelchair." U.S. Patent No. 5,180,181. 19 Jan. 1993.
- [2] Rehab Mart. (1998-2016). Winnie Wagon. [Online]. Availble: <http://www.rehabmart.com/product/winnie-wagon-11268.html>
- [3] Activecare. (2007) ActiveCare Power Scooter Trailer. [Online]. Available: https://m.alibaba.com/guide/shop/activecare-power-scooter-trailer-at1000-scooter-accessories-ne_9094331.html
- [4] "Hook And Loop Straps With VELCRO® Brand Fasteners". *HookandLoop.com*. N.p., 2017. Web. 27 Apr. 2017.

Questions?

