

Folding Shopping Cart Design Report

EDSGN 100 Section 010, Team #4

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Group Image with Prototype

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(in order of appearance)

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http://www.personal.psu.edu/mbb5177/files/Folding_Shopping_Cart_Design_Report_final.pdf

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***Note-** Although it does not appear as though Burgess had a significant role in the making of this Design Report, he is responsible for taking all pictures of the prototype, designing the entire model in Solidworks (which took hours!) and creating the working drawings.

Abstract

This design report covers the entire process that Team 2 went through in order to imagine, design, then create and present our version of the ideal folding shopping cart. Our report contains everything from the consumer surveys, project schedule, and initial brainstormed-ideas, to final design, prototype pictures, and cost analysis.

Introduction

The shopping cart is a simple product that everyone is familiar with. Currently, there is not much variety of carts available at most stores. Our team was given a project to come up with a better shopping cart that would be more efficient, convenient, and easy to use. The team came up with the simplest and easiest shopping cart idea for the customers. It has successfully introduced the customers with tri wheels and multi-level folding shopping cart that can easily climb the stairs, or can be easily folded in storeroom. Our design for the shopping cart was mainly focused on people with a lack of transport, such as college students. After brainstorming and surveying our customers the team has come up with the best ideas, which can be carried easily and folded up. This is the project report that explains our project and design for the entire project.

Description of Tasks

Problem Statement:

There is a need for a shopping cart that is foldable, has multi-levels, is cost efficient, is ideal for groceries, and can climb stairs. The most challenging task for this team is to put all of our ideas together, prioritize features, and come up with a final design.

Mission Statement:

This team will create a compact foldable shopping cart that meets all the criteria that is desired by customers, while remaining cost effective.

Design Specification:

- A multi-level shopping cart that can be easily adjusted to different user heights.
- A shopping cart that can climb the stairs.
- Easy to use and can easily fold up.
- A shopping cart whose weigh should not exceed 50 pounds.
- A shopping cart consummate for transporting grocery goods.
- A shopping cart that will cost less than 50 dollars.
- A shopping cart that can hold at least 100 pounds of goods.

Design Approach

Gant Chart

Task	Week I	Week II	Week III	Week IV	Week V	Week VI	Week VII
Information Gathering							
Customer Needs Assessment							
Brainstorming							
Design Concept Gathering/Creating							
Working Drawings							
Prototype Construction							
Testing and Evaluation							
Design Documentation							
Demonstration and Presentation							

Table 1- Gantt chart (project management)

Customer Needs Assessment

In order to gain insight into what customers would desire for a folding shopping cart, our group decided to design a consumer survey. We targeted the average college student because we considered this market segment to be the most likely consumers of this product. From this survey, we got some valuable information that would help us decide on the final design. The following is the actual survey that our group used to collect research. The responses are listed under each question.

Shopping Cart Survey

Question 1: What are some of the issues you have getting home with groceries?

Answers:

- 1. Difficulty with stairs, bags rip, and rain gets the groceries wet.*
- 2. Heavy, long walk back.*
- 3. Too many bags to carry, long distances, difficulty with stairs.*
- 4. Hurts to have to carry them, my wife sometimes won't go to get them.*

Question 2: What are some of the issues that you have with store provided shopping carts?

Answers:

1. Lack of maneuverability, heavy and unwieldy.
2. Carts too wide for isles, not versatile, lack of maneuverability.
3. Unstable, unsanitary, and broken components
4. Nothing, they are free to use, can't take them home.

Question 3: How much would you be willing to pay for a portable shopping cart that you can own and use to make your traveling easier?

Answers:

1. \$60
2. \$40
3. \$70
4. \$30

Concept Generation

The following pictures show the collection of brainstormed designs that our group came up with while trying to satisfy the consumer's needs from the survey.

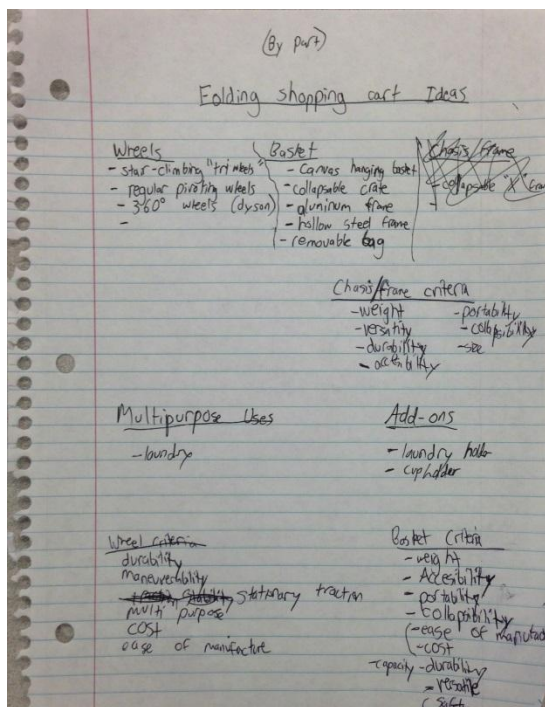


Figure 2- Concept Generation

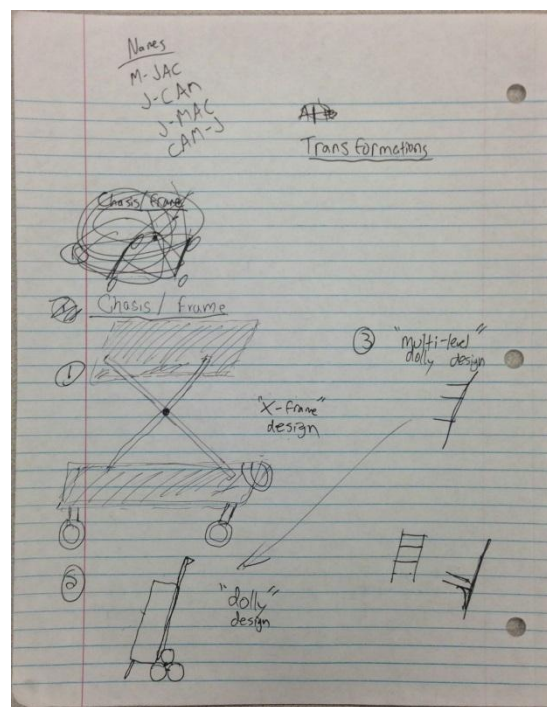


Figure 3- Concept Generation

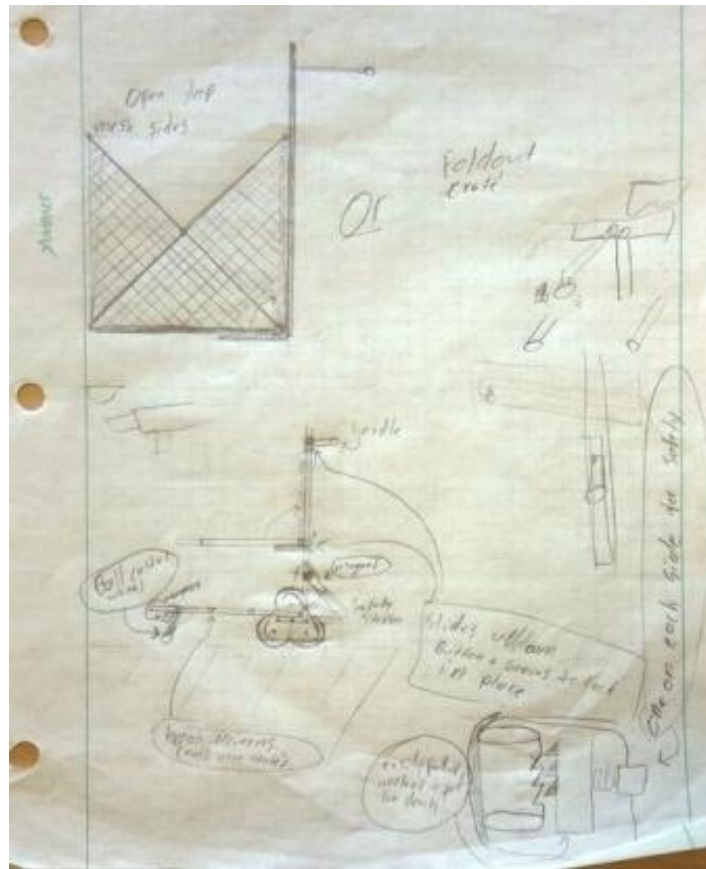


Figure 4- Concept Generation

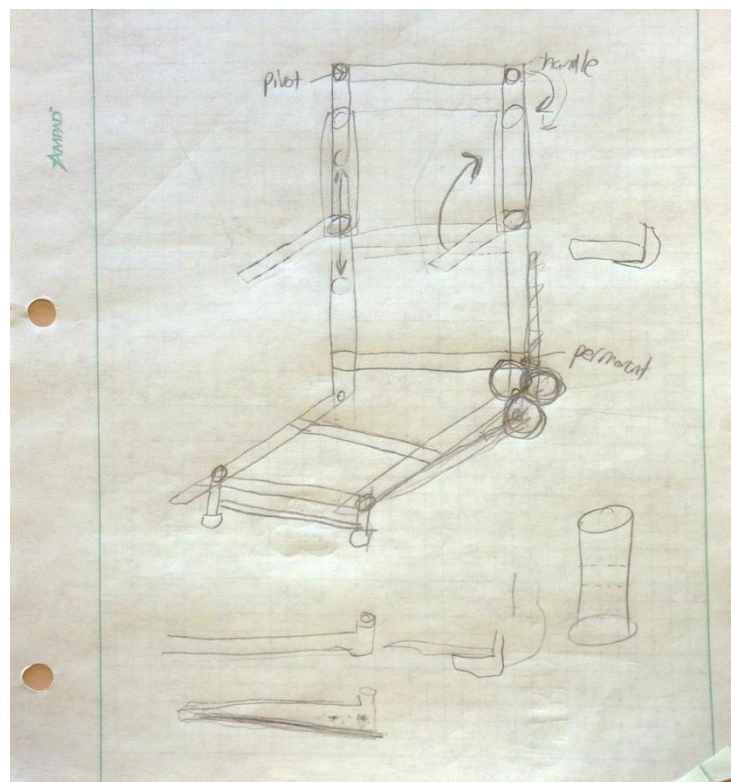


Figure 5- Concept Generation

Design Selection Matrix

	Cost	Durability	Ease of Manufacturing	Size	Safety	Versality	Weight	Capacity	Total Points	
Cost	0 +	-	-	+	-	-	+	+	1	
Durability	-	0 -	-	+	-	-	-	-	-5	
Ease of Manufacturing	+	+	0 +	+	-	+	+	+	5	
Size	-	-	-	0 -	-	-	-	-	-7	Least Important
Safety	+	+	+	+	0 +	+	+	+	7	Most Important
Versality	+	+	-	+	-	0 +	+	+	3	
Weight	-	+	-	+	-	-	0 -	-	-3	
Capacity	-	+	-	+	-	-	+	0	-1	

Table 2- Design Selection Matrix

Final Design/Prototype

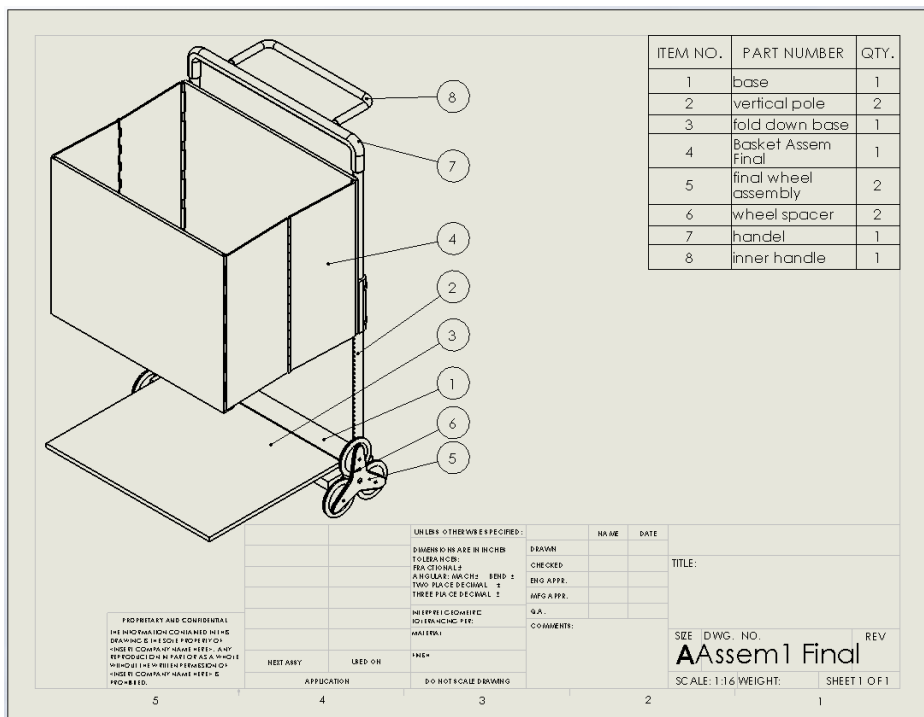


Figure 6- Final Design

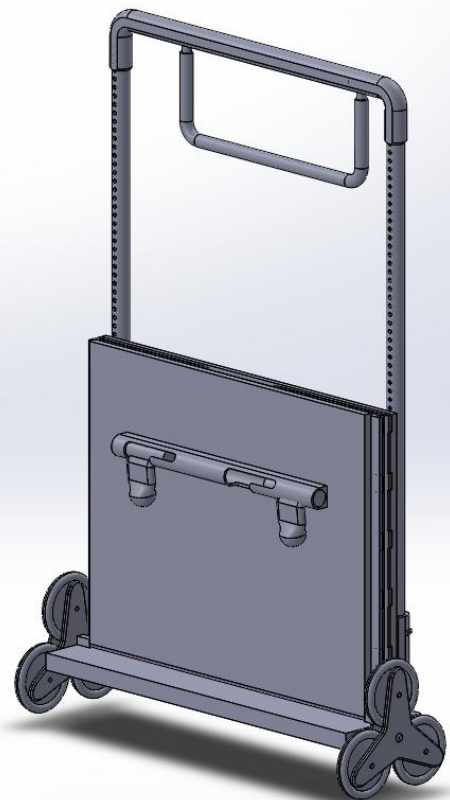


Figure 7- Final Design

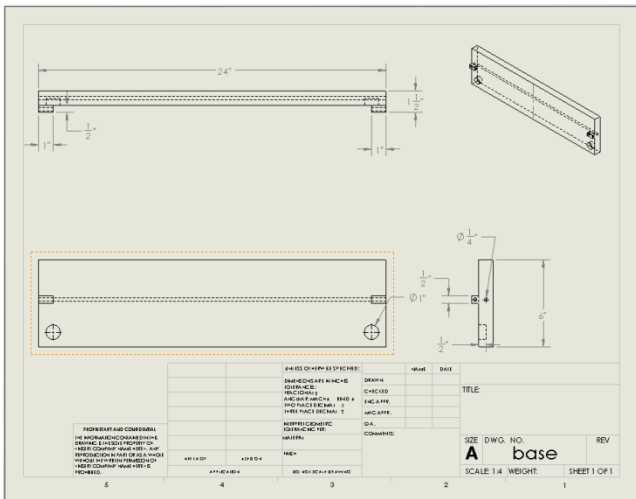


Figure 8- Final Design (base)

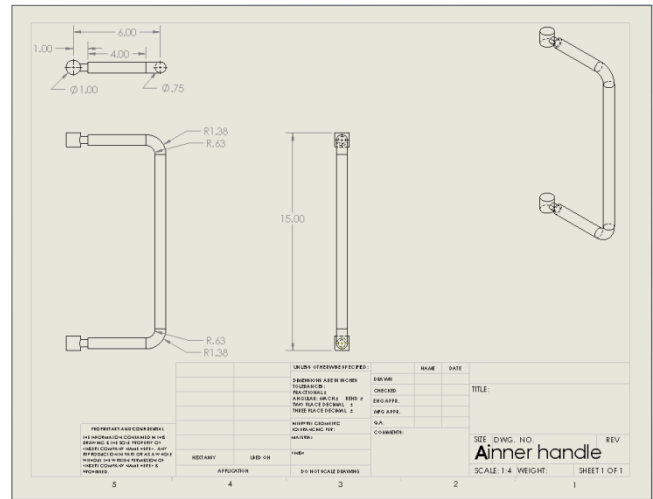


Figure 9- Final Design (handle)

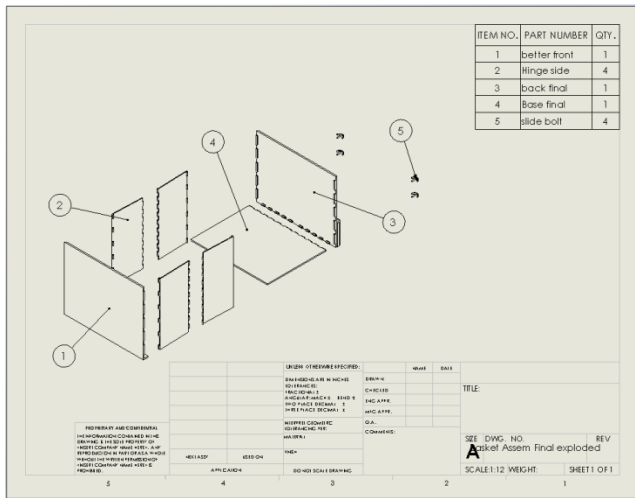


Figure 10- Final Design (basket)

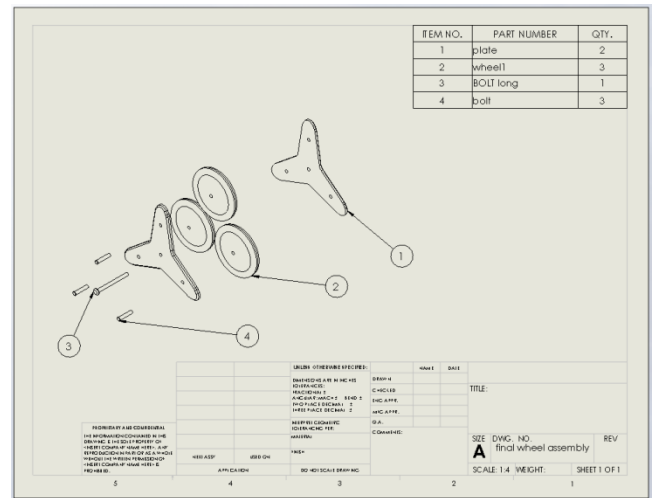


Figure 11- Final Design (tri-wheels)

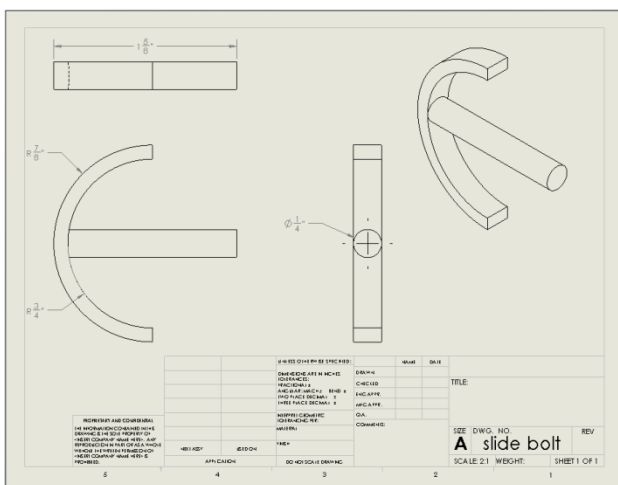


Figure 12- Final Design (slide bolt)



Figure 13- Final Prototype

Final prototype scale is approximately 1:1



Figure 14- Final Prototype (folded up)



Figure 15- Final Prototype (tri-wheels)



Figure 16- Final Prototype (base)

Prototype Design, Features, and Operational Instructions

Front wheels: The front wheels are the standard 360 degree rotation wheels found on standard shopping carts.

Back wheels: The Tri-wheel design of the back wheels allows the cart to be pulled up stairs and across uneven terrain. They are able to rotate both on each individual wheel or all together to cross any average obstacle.

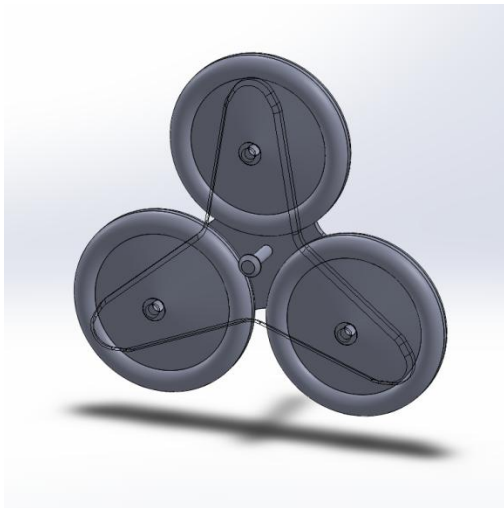


Image 1- tri wheels

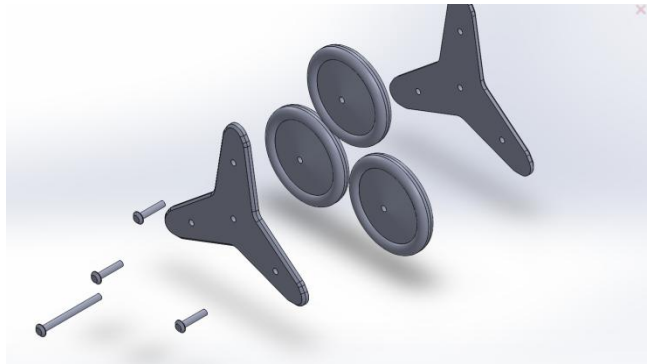


Image 2- tri wheels (exploded view)

Basket and Tray: The basket folds out to accommodate large quantities of groceries. It has a base that is supported by straps on the top and a slot to fit into on the bottom. The basket can also be raised to allow access to the tray underneath, which can accommodate larger and heavier items. The tray also folds away for easy storage. Note: It is not recommended that the tray be in use while attempting to climb stairs.

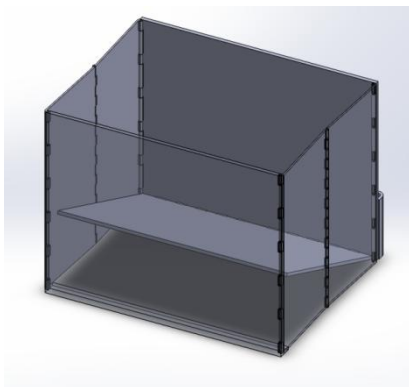


Image 3- basket

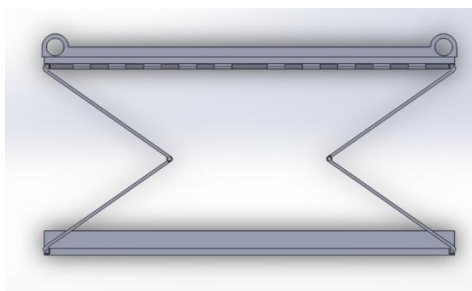


Image 4- basket (shows collapsibility)

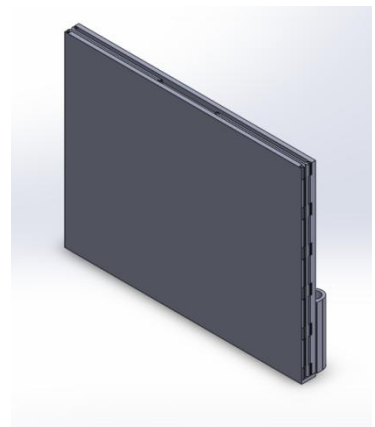


Image 5- basket (fully collapsed)

Handle: The handle is adjustable and can fit anyone's body height. It can be moved up and down with the push of two buttons.

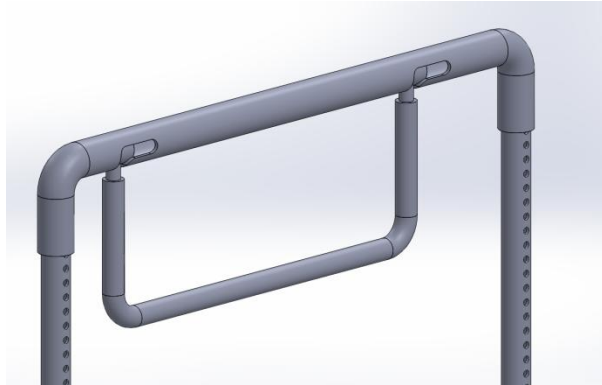


Image 6- handle (collapsed)

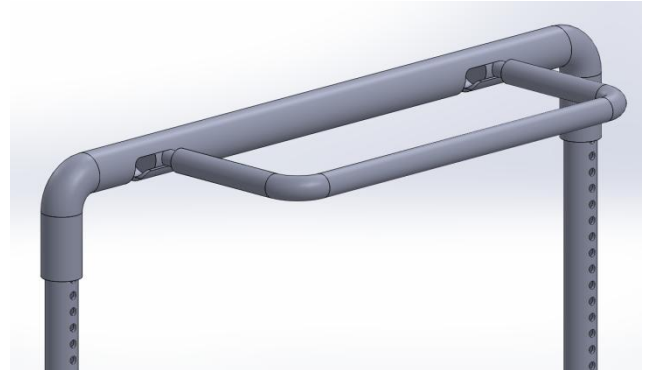


Image 7- handle (in use)

Engineering Analysis

Working Mechanism:

Our team wanted to create a shopping cart that would be ideal for shopping, but at the same time have the ability to collapse (or fold up) for convenient storage when not in use. In order to accomplish this desired collapsibility, we had to install multiple hinges that allow the entire cart to fold up into its storage position. The most important hinge systems on our design include: the “base-to-frame” hinge, the handle hinge, the wheel hinge, and the multiple basket hinges. The “base-to-frame” hinge is the one that allows the entire base of the cart to fold up from its perpendicular position, into a parallel position with the rest of the frame. The handle hinge is the one that allows for the handle to be folded into a parallel position with the rest of the frame. Images #6-7 show the functionality of the handle hinges. The wheel hinge is the one that

allows for the pivoting wheels to fold up so that they are flush with the base. Lastly, the basket hinge system is a combination of multiple hinges that allow for the basket to be folded into its collapsed position. Images #3-5 show the functionality of the basket hinge system. Ultimately, through the use of these multiple hinges, the shopping cart is able to collapse from its starting position (shown in Figure 6 & 13), into its storage position (shown in Figure 7 & 14).

Cost Analysis:

From a generalized standpoint, our team thinks that the entire design could be manufactured on a production line for an average cost of less than 30 dollars each. To estimate this figure, we did some research on material costs, such as aluminum, which would likely be the material of choice for the main frame, basket, and base of the design. Wheels and bolts would probably be the next highest cost, but buying the parts in bulk for mass production would significantly reduce cost.

Summary/Conclusion

There were several goals that our group set out to accomplish with our design of a foldable shopping cart. We wanted to create a unique design that would be highly maneuverable, suitable for all users, convenient for storage, yet reasonably priced. Ultimately, we are proud to say that we accomplished all of these goals. The prototype is highly maneuverable because of its front wheels that can rotate in 360 degrees. Therefore, the cart will be easy to turn between narrow aisles. Also, the unique tri-wheels allow the cart to conquer tough paths that ordinary carts are not capable of, such as stairs and curbs. The cart is suitable for all users, as it is designed to adjust to different user heights. Both the basket and the handle can be adjusted according to the consumers' preferences. The cart is also convenient for storage. This was, perhaps, the part which our

group focused on the most. Through the working mechanisms of the various hinge systems (explained above), the cart can transform into a collapsed version which is convenient for storage in small areas, such as a garage or closet. Lastly, all of these important features were designed within a reasonable budget, meaning that the price that would be offered to consumers is still within the acceptable range found through the study survey.

Looking back, if we had to do anything differently, I think we all agree that we would have liked to have been more organized during the idea generation phase of the design. Maybe we could have created more charts or something that would have organized our brainstorming results better. Overall, however, our group is very proud of our final design. This shopping cart is the culmination of weeks of hard work from each team member.