

GNG 2101  
**Design Project User and Product Manual**

**Accessible Clothing – Bag Support**

Submitted by:

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# 1 Introduction

This User and Product Manual provides the information necessary for wheelchair users to effectively use the support bag design and for prototype documentation.

Welcome to the 'Bag Support' User Manual, designed to enhance your shopping experience and provide a reliable solution for wheelchair users. This document serves as a comprehensive guide, offering insights into the functionality, usage, and care of your Bag Support Shirt.

In response to the challenges faced by wheelchair users during shopping, we have developed a unique T-shirt with integrated straps and buckles designed to secure bags on your lap. Recognizing the importance of comfort, practicality, and style, our product aims to seamlessly blend into your daily life, offering a reliable solution to keep your belongings secure while maintaining your freedom of movement.

Throughout the development process, we have assumed that our users are familiar with T-shirt/shirt wear and basic fastening mechanisms. Additionally, it is assumed that users have a basic understanding of the weight distribution capabilities of the product, which only allows a weight of a maximum load of 20lbs.

This User Manual is organized as follows:

- 1) Introduction
- 2) Overview
- 3) Getting started
- 4) Using the system
- 5) Troubleshooting and Support
- 6) Product documentation
- 7) Conclusions and recommendations for future work
- 8) Bibliography
- 9) APPENDIX I: Design Files
- 10) APPENDIX II: Other Appendices

This document aims to help users with the knowledge needed to maximize the benefits of our product (Bag Support). Whether you are a wheelchair user or assisting someone who is, this manual is your main resource for understanding the product's features, ensuring proper usage, and maintaining its longevity. Our intended audience is directed towards wheelchair users, caregivers, and anyone involved in the support and well-being of individuals using our bag support product. Also, as for privacy, this manual emphasizes the personal and non-intrusive nature of the product, ensuring that your shopping experience remains discreet and comfortable.

Thank you for choosing our Bag Support product. We trust that this User Manual will contribute to a more convenient and enjoyable shopping journey.

## **2 Overview**

Shopping poses unique challenges for wheelchair users, particularly the risk of bags falling off their laps, hindering mobility, and causing discomfort. It's crucial to address this issue as it directly impacts the independence, convenience, and dignity of individuals using wheelchairs. Our product, the bag support, aims to revolutionize the shopping experience for wheelchair users by providing a secure solution to carry bags effortlessly.

Furthermore, the fundamental needs of wheelchair users during shopping should include stability, freedom of movement, and an effective way to carry belongings/bags. Our bag support will fulfill these needs by offering a secure, comfortable and a better method of carrying bags, ensuring an effortless and easy shopping experience.

What sets our bag support product apart is its innovative T-shirt design with integrated straps and buckles. Unlike other solutions, our product provides a comfortable and stylish alternative that blends into the user's wardrobe. The T-shirt supports up to 20lbs of bags and is washable, reusable, and user-friendly, making it a superior choice for wheelchair users who are looking for both functionality and fashion.



Figure 1: Final prototype

Our bag support product features an undemanding design, incorporating durable straps within the T-shirt. The system architecture is straightforward, utilizing adjustable straps with secure buckles. Our design also ensures stability and lessens the sway of the bags, while maintaining the comfortability. The user accesses the system by simply putting on the T-shirt, adjusting the straps as needed, and securing bags through the integrated buckles.

In addition, the primary user access mode is through the T-shirt itself. Users would unfold the frame of the T-shirt and put it on, securing the bags by threading the buckles through their handles. It is intuitive, consisting of adjustable straps on the shoulders with the buckles going through these straps, ensuring a user-friendly and efficient experience. This bag support product is designed to adapt to different conditions and is suitable for everyday use. It provides stability without compromising flexibility, allowing users to navigate different environments comfortably.

The T-shirt is built to withstand regular wear and tear while ensuring a secure and discreet solution for carrying bags.

## **2.1 Cautions & Warnings**

Before using the bag support prototype, it is essential to be aware of certain cautions and warnings to ensure a safe and optimal user experience:

Securing buckles properly: Always ensure that the buckles are securely fastened before using the T-shirt. Loose or improperly fastened buckles may result in a failure of the stability of the bags and could lead to accidents.

Weight limit Consideration: Do not exceed the recommended weight limit of 20lbs for bags. Overloading the bags will affect the T-shirt and will affect its performance and compromise user comfort.

Comfortability: Adjust the shoulder straps for a comfortable fit. If the T-shirt feels too tight or too loose, make the necessary adjustments to avoid discomfort.

Use in the designated Manner: Use the T-shirt only for its intended purpose of supporting bags during shopping. Do not use it for any other activities or purposes.

By following these steps, you can ensure that the use of the bag support prototype aligns with applicable permissions and regulations.

## **3 Getting started**

Setup and Usage Walkthrough: Bag Support T-Shirt Prototype

## Section 1: Overview



**Figure 2: The components of the prototype**

A picture of the prototype.

Ensure all components are present and in good condition. Take a moment to read the included instruction manual for a brief overview of the product's features.

## Section 2: Preparing the T-Shirt

**Figure 2: Identifying Key Components**

Identify the key components of the T-shirt, including the integrated straps and buckles. Lay the T-shirt flat and ensure the straps are easily accessible.

## Section 3: T-Shirt Application

Put on the T-shirt like any regular shirt, ensuring that the straps are comfortably positioned over the shoulders.

**Getting started**

#### Section 4: Attaching Bag



**Figure 3: Bag attached to straps**

Secure bags to the integrated straps using the provided buckles as shown. Adjust the straps as needed to distribute weight evenly and ensure a comfortable fit.

#### Section 5: Exiting and Cleaning

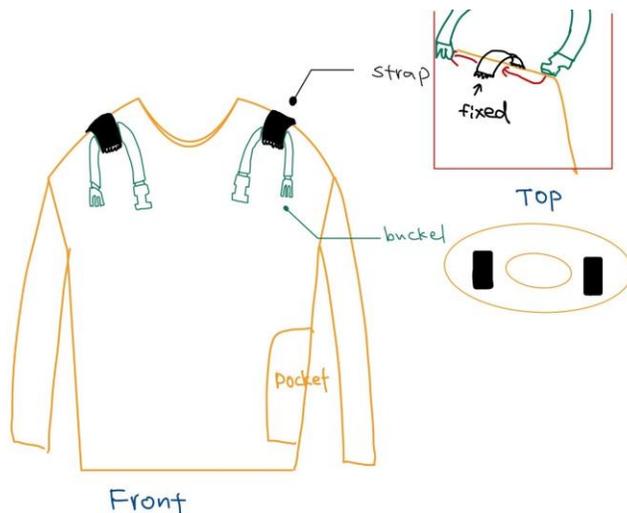
When finished shopping, remove the T-shirt by following the provided steps. Machine wash the T-shirt for easy cleaning and reuse.

This manual provides a clear, visual guide for users, making sure that the bag support shirt prototype is easy to set up, use, and maintain. The step-by-step instructions, accompanied by images, make the manual accessible and user-friendly for individuals who may not have a technical background.

### 3.1 Configuration Considerations

The Bag Support physical prototype is a solution designed to enhance the shopping experience for wheelchair users. Here's a non-technical overview of the system configuration:

The adjustable shoulder strap allows users to customize the fit according to their comfort. This feature ensures a snug and personalized experience. The buckles are strategically placed on the hands, forming a connection point for bags. These buckles are designed to hold bags securely in place, preventing them from falling off the user's lap or swaying around whenever the user is moving around.



**Figure 4: Diagram of the prototype**

In addition to the non-technical overview, no specialized tools will be required for the configuration of Bag Support. Users only need their hands to adjust the shoulder straps, securely

fasten the buckles and adjust the straps to their comfort. The design is intentionally user-friendly, allowing for easy and tool-free setup.

So, the Bag Support is a standalone solution that will integrate with the user's existing clothing collection and wheelchair. It does not require any connections to external devices or items. The focus is on providing a simple and self-contained system for enhancing the shopping experience for wheelchair users.

In conclusion, following these simple configuration considerations, users can easily incorporate the bag support product into their daily routine, ensuring a secure and comfortable solution for carrying bags while shopping.

### **3.2 User Access Considerations**

The Bag Support prototype is designed to cater to a diverse range of users, primarily focusing on wheelchair users facing challenges while shopping. Here are considerations for different user groups and any associated restrictions:

Our Primary Users are wheelchair Users. The bag support design is specifically tailored for wheelchair users who encounter difficulties in carrying bags while shopping. So, our targeted primary users are those who must rely on a wheelchair for mobility. But there are no restrictions since the bag support is designed to be inclusive, providing an accessible and practical solution for wheelchair users without imposing restrictions on accessibility.

Furthermore, caregivers can assist in putting on the Bag Support T-shirt and securing bags, enhancing the overall shopping experience for the user. The design allows for collaboration between the user and their caregiver without constraints. Also, this product is designed to

accommodate users of various ages and body types since the adjustable shoulder straps and user-friendly design make Bag Support suitable for a wide range of users, making sure that flexibility and adaptability to different body shapes and sizes are met.

We made sure that users with varying levels of mobility, including those with limited upper body strength can easily use the bag support since it is engineered to be user-friendly, allowing individuals with diverse mobility levels to comfortably use the prototype without significant restrictions. The product is also made from comfortable and breathable materials, and there are no inherent features that would negatively impact users with sensory sensitivities.

Moreover, users who prioritize style and wish to integrate the bag support shirt into their wardrobe will have no problem with this design... The T-shirt's design emphasizes style and discretion, ensuring that fashion-conscious users can enjoy the benefits of bag support without having to 'damage' or change their personal style.

In summary, the bag support product is designed with inclusivity, ensuring that a broad spectrum of users, including wheelchair users, caregivers, and individuals with different abilities, can benefit from the prototype without significant restrictions on accessibility. The adjustable and user-friendly features contribute to a versatile solution for a diverse user background.

### **3.3 Accessing/setting up the System**

Setting up the bag support is a simple process designed for user convenience. Begin by unpacking the product and identify the adjustable shoulder straps and put on the T-shirt, adjusting the straps for a comfortable fit. Then, secure the buckles on your hands, and thread your bags through them,

ensuring a snug attachment. After that, confirm the bags are securely fastened and make any necessary adjustments to the shoulder straps for a personalized experience.

For personalization, users can tailor the length of the shoulder straps to their comfort.

Additionally, be mindful of the weight distribution of the bags, keeping in mind the 20lbs maximum capacity. Bag Support is versatile and suitable for various settings, offering a simple solution for users facing challenges while shopping.

### **3.4 System Organization & Navigation**

The bag support shirt prototype comprises a central component, featuring integrated straps and buckles designed to securely hold bags during shopping for wheelchair users. The garment, constructed from durable and washable materials is basically the system.

In addition, key accessories include adjustable straps and user-friendly buckles, enabling the attachment and detachment of bags with ease. The integrated straps connect easily to the T-shirt fabric, strategically positioned to evenly distribute the weight of attached bags, to reduce as much sway as possible for the user.

Meanwhile, the buckles provide a secure and adaptable linkage between the shirt and carried items, with reinforced connection points capable of withstanding weights up to 20lbs. The overall system is designed for an easy integration into the user's daily routine, prioritizing simplicity, durability, fashion and user-friendliness to enhance the shopping experience for individuals using wheelchairs.

### **3.5 Exiting the System**

Exiting the Bag Support system is a simple and straightforward process. Start by removing any bags attached to the secure buckles. Unfasten the buckles to release the bags and allow for easier removal of the T-shirt. If needed, make any necessary adjustments to the shoulder straps to ensure comfort during the process. Once the bags and buckles are detached and adjustments are made, gently slip your arms out of the T-shirt sleeves to remove it. You can then decide to wash the shirt or store it according to your preference. Store the T-shirt in a safe and easily accessible place, ensuring it is kept away from potential damage or crushing.

This simple and efficient process allows users to seamlessly exit the bag support system and store it for future use.

## **4 Using the System**

The following sub-sections provide detailed, step-by-step instructions on how to use the various functions or features of the bag support shirt.

### **4.1 Buckle attachment system**

The buckles loop through the bag straps and the shoulder straps to ensure a secure attachment to the user's shoulder. The buckle length can be adjusted to accommodate the user's shopping bag. Looping the buckle through the shoulder strap can take some time to perfect. The attached bag rests on the user's lap while the buckle strap system keeps it open and secured.

### **4.2 Using Instruction**

This part is the step-by-step instructions of setting up the prototype to use.

Step 1: Put the prototype on, find 2 straps on the shoulders showing in figure 5.



**Figure 5: Shoulder straps**

Step 2: Loop buckles through the straps showing on figure 6.



**Figure 6: Buckle loop through straps**

Step 3: loop the buckle through the bag.



**Figure 7: Buckle looped through bag**

Step 3: Adjust the length of the buckle if necessary.



Figure 8: Result

## 5 Troubleshooting & Support

This part will describe all recovery and error correction procedures.

### 5.1 Straps Broken

Except accidents that tore straps off its position, straps might be broken because of

- Overloaded goods inside bag.

The maximum capacity of the two straps is a total of 20 lbs. We do not suggest users attach over 20 lbs. bag onto the buckles.

- Over washing

Straps might be broken because of vigorous washing. We recommend that users use the regular mode of the washing machine for cleaning and not use the strong dirty remove mode of the washing machine too frequently.

- End of life span.

Straps might be broken because of the end of lifespan.

## **5.2 Maintenance**

Please remove buckles out of the straps after finishing using, so that there are no potential causes of straps tore-off accidents.

Please do not put buckles into washing machines.

Please use the regular mode of washing machine to clean the shirt. Strong dirty remove mode not suggested.

We suggest washing the product at low temperatures.

## **5.3 Support**

If any damage occurred, users could contact [yli969@uottawa.ca](mailto:yli969@uottawa.ca) to ask for fixing.

# **6 Product Documentation**

## **6.1 Buckles**

The first subsystem, to be created is the buckles. These are made using polypropylene straps and plastic buckles. The materials chosen were used because they are commonly available and strong enough to meet the 20lb specification. The polypropylene fabric sections are 15 inches long since to accommodate all sizes of shopping bags. Clips or hooks were also considered for this system but were not used since the adjustable buckles were much more comfortable across a range of bag sizes.



**Figure 9: Buckles adjusted to 2 different sizes**

### **6.1.1 Instructions**

1. Cut 2 15in sections of polypropylene.
2. Attach the buckles as shown, with the left and right sides of the diagram being the ends of one section of polypropylene.



**Figure 10: Buckle assembly diagram**

## **6.2 Shoulder Straps**

The second subsystem is the straps sewn into the shoulders. Polypropylene was also used for these straps since it was already used for the buckles. This was the main consideration for this subsection, and it is possible other fabrics could be used. The straps are 2.5in long, as we found this to be the smallest length that could still easily be used. Keeping the length as small as possible is

important for the shirt to resemble an unmodified shirt as closely as possible. The shirt is made of cotton for comfort at the client's request and has a breast pocket for storing the buckles.



**Figure 11: Shoulder straps**



**Figure 12: Stitching on inside of shirt**

### 6.2.1 BOM

This BOM includes both subsystems, as the polypropylene used in the shoulder straps was also used in the buckles.

**Table 1: Bill of Materials**

No	Description	Quantity	Cost	Link
1	Cotton shirt with pocket	1	\$15.99	<a href="https://www2.hm.com/en_ca/productpage.0982659010.html">https://www2.hm.com/en_ca/productpage.0982659010.html</a>
2	Polypropylene fabric and buckles	2	\$14.99	<a href="https://www.amazon.ca/Buckles-Webbing-Release-Tri-Glide-Plastic/dp/B0B3J1GCVQ">https://www.amazon.ca/Buckles-Webbing-Release-Tri-Glide-Plastic/dp/B0B3J1GCVQ</a>
<b>Total cost</b>			\$30.98	

### 6.2.2 Equipment

A needle and thread are required to sew the shoulder straps onto the shirt. A sewing machine could also be used, though the prototype was assembled with hand sewing.

### 6.2.3 Instructions

1. Cut 2 2.5in sections of polypropylene.
2. Secure the straps 3in from the neck such that the back of the strap is just behind the shoulder seam of the shirt.
3. Sew the short ends onto the shirt.

### **6.3 Testing & Validation**

The polypropylene straps were tested with up to 50lbs of tensile force. They were not tested to failure as this is already 2.5x the maximum use force in the 2 straps combined, thus 5x the maximum use force in a single strap. They are advertised as holding up to 100lbs. The range of bag sizes the straps can accommodate was tested with increasing length of the fabric section, and 13 inches was found to accommodate the smallest shopping bags.

The shoulder strap length was tested at various sizes ranging from 3.5in to 2in, using tape as an easy, temporary way to modify the size. 2.5in was found to be the lower limit where attaching the buckles was still easy. They were then tested with up to a 20lb bag hanging from them without support at the bottom of the bag and withstood the force. The shirt was run through a washing machine 3 times with no damage, so it can be assumed to be fully machine washable.

## **7 Conclusions and Recommendations for Future Work**

Both we and our client are satisfied with the results of this prototype. The client wanted a shirt to aid in his shopping, appearing as close as possible to an unmodified shirt and we believe to have delivered that. Future work could involve improving materials, particularly on the shoulder straps. This could involve materials closer or identical to the shirt material to further hide the straps. Solutions for attaching the bag other than buckles could also be investigated. Buckles were used in this prototype for their easy adjustability, but it is possible other solutions could be used.

## APPENDICES

### 8 APPENDIX I: Design Files

The MakerRepo link below provides access to all relevant documents, including this user manual and a video summarizing the project.

<https://makerepo.com/joebot101/1865.accessible-clothing-bag-support>