

GNG 2101
Design Project User and Product Manual

Change and Go

Submitted by:

Group 1.4

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Table of Contents

Introduction	1
Overview	3
Cautions & Warnings	4
Getting started	5
Configuration Considerations	6
User Access Considerations	6
System Organization & Navigation	6
Exiting the System	7
Using the System	7
Mattress	7
Privacy Shades	8
Wheels	9
Troubleshooting & Support	10
Error Messages or Behaviors	10
Maintenance	10
Support	10
Product Documentation (Cecilia)	11
BOM (Bill of Materials)	15
Equipment list	15
Instructions	16
Testing & Validation	18
Conclusions and Recommendations for Future Work	19
APPENDIX I: Design Files	20

List of Figures

Figure 1. Final Prototype of the Change and Go	3
Figure 2. Block Diagram Representing The Setup of the Change N Go	4
Figure 3. Unfolding the table. The plastic holder mentioned in step 1 is circled in red	5
Figure 4. Change and Go Mattress	8
Figure 5. Change and Go Privacy Shades	9
Figure 6. Change and Go Privacy Wheels	9
Figure 7: Final CAD Concept Sketch before physical prototype	11
Figure 8: Folding table in a folded position. Wheels are opposite to the handles	12
Figure 9: Folding table set up, pipe holders and wheel castors are installed. One privacy shade can be seen.	12
Figure 10: Two of the 3D printed Inserts in one of the pipe hangers mounted.	13
Figure 11: Privacy Shades	13
Figure 12: Wheel Castors mounted to the edge of the table	
Figure 13: BOM List updated on April 9th, 2022	15
Figure 13: Equipment List updated on April 9th, 2022	15

List of Tables

Table 1. Referenced Documents

20

1 Introduction

This User and Product Manual (UPM) provides the information necessary for patients and caretakers to effectively use the Change and Go and for prototype documentation.

People who have physical disabilities are often faced with additional difficulty in day to day tasks. One of these tasks is using a toilet. Some physical disabilities prevent the pelvic floor muscle control that is necessary to use a toilet, so they rely on using diapers. Also, some people do not have the mobility or core strength required to change their own diaper, so they rely on caretakers. Adult diapers are easy to change when at home and adequate equipment is available. However, almost no public bathrooms or change rooms are equipped with the equipment needed to change an adult diaper. This is a problem because it has led to caretakers changing their patients on bathroom floors, in their wheelchairs, and/or in the back seat of cars. This is unsanitary, and there is no privacy or dignity for the patient. Another consequence is that not having a dignified sanitary place to get changed stops these people from wanting to leave the house for more than a couple of hours, which decreases their quality of life.

The main demand for this product comes from people with disabilities who would find this product useful for them, and people who are caretakers of patients who could use this product. The client needs a product that can lift and support at least 45 kilograms, can be assembled and disassembled in no more than 90 seconds, provides 360 degrees of privacy, and can be sanitized with wipes.

Over the course of the past four months, the team drew, made CAD models, and built the Change and Go, while testing for efficacy with each iteration.

The purpose of this document is to provide adequate instructions and precautions to anyone wanting to use the Change and Go. There is information on how to assemble, use, and disassemble the Change and Go, and safety information for all parties involved. This document also highlights key features, troubleshooting, budget information, and recommendations for future work. The User Manual will highlight any considerations that need to be stated before moving forward. Then, the Manual walks the reader through the entire process of using the Change and Go for the first time, and for all subsequent times. Next is troubleshooting, where common problems and their solutions are stated, product documentation, and a conclusion.

The intended audience for this document is anyone who wants to use the Change and Go, or anyone whose loved one, or patient wants to use the Change and Go.

2 Overview

The demand for a portable change table has not yet been met with an adequate solution that is portable, lightweight and comes with privacy features. Current ‘portable’ change tables available on the market simply do not meet basic expectations. For example, current options are either too bulky, non-portable, overpriced, or simply do not come with privacy features. This is crucial since these are the basic fundamental needs of the average user. What makes the Change N Go stand out from the other options is the inclusion of the basic needs all into one portable table, as a product like this does not currently exist with the same price tag.



Figure 1: Final Prototype of the Change N Go

Key features on the Change N Go include privacy curtains that allow for the person being changed to be covered from various different angles. Depending on the location, different levels of privacy may be needed which can be adjusted from the privacy curtains. Additionally, the change N Go supports being folded in half while carried away similar to carry-on luggage since the table features two castor wheels and a handle for easy transportation. Lastly, the table features

a comfortable mattress covered by a replaceable plastic sheet, which is used to protect the mattress from getting dirty.

The Change N Go is very easy to set up, as it houses minimal items. The table features a metal frame, a foam mattress, and attachable privacy curtains which can be held by metal straps attached to the plastic frame.

A block diagram found below demonstrates how the table can be used / set up.

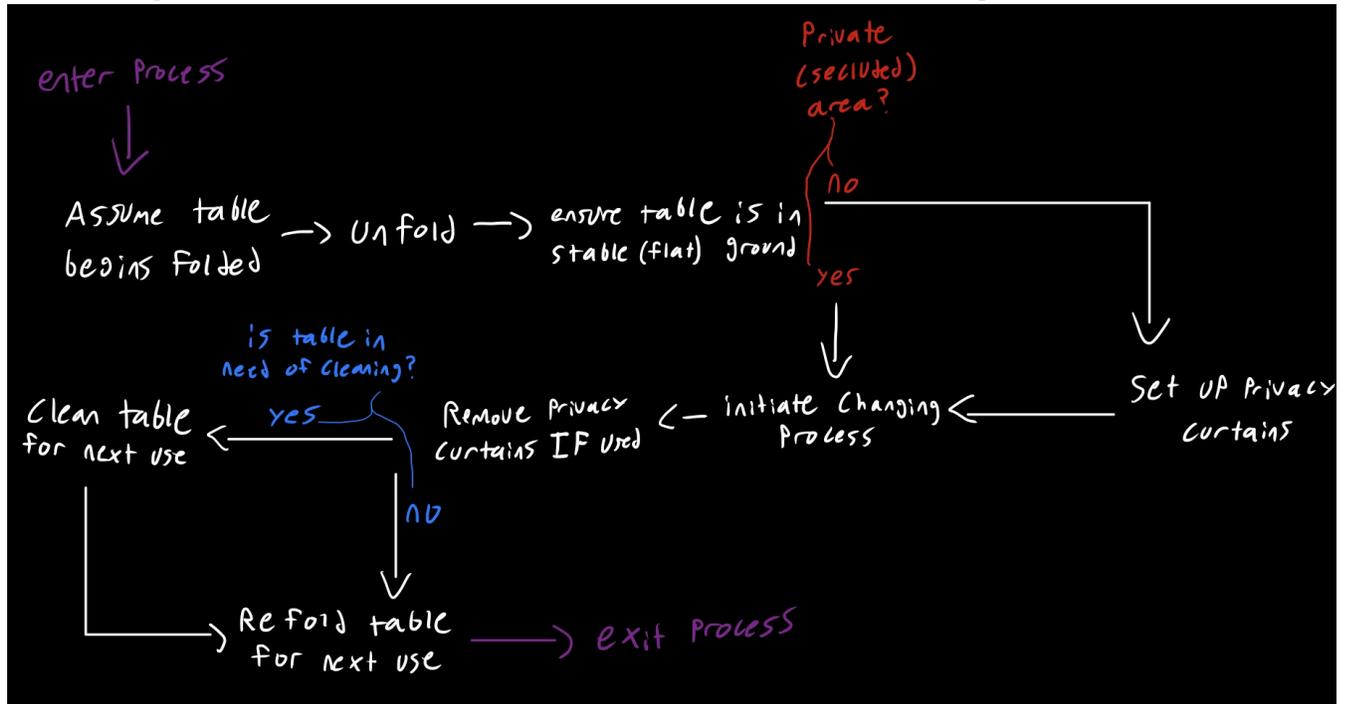


Figure 2: Block Diagram Representing The Setup of the Change N Go.

2.1 Cautions & Warnings

Warning: Make sure to enable the lock when setting up the table. Failure to do so may result in the table collapsing.

3 Getting started

Refer to the video attached with this document for a step by step demonstration setting up the product.

1. Unfold the table by detaching the table legs from the two plastic holders.



Figure 3: Unfolding the table. The plastic holder mentioned in step 1 is circled in red.

2. Once the table is unfolded to 180 degrees, lock the table rotation by flipping the switch in the middle.
3. Detach the legs on either side of the table from their plastic holders.
4. Lock the table legs by sliding the metal bracket down till resistance.
5. Flip the table upright, rotating it 90 degrees so that the table legs are perpendicular to the ground.
 - a. The table is heavy and the user should not just depend on upper body strength.
 - b. The user can use a lift and jerk method. This can be done lifting the table slightly and bringing their knee upwards.
 - c. This will use the lower body strength with the knee to bring the table upright.
6. Once the table is set up, the user can then unfold the mattress by pulling apart the two hook and loop attachment.
7. Attach the loop attachment on the back of the mattress to its corresponding hook attachment on the other end of the table.
8. Ensure that each loop attachment is hooked to its corresponding hoop attachment under the mattress, this is important to ensure that the mattress will not move.

9. Remove the privacy shades from its mesh bag holder.
10. Insert the pink insert of the privacy shades into the metal brackets on the sides of the table.
 - a. Ensure that the flat end of the pink insert is facing the table.
 - b. The user may choose how many shades to put up depending on the circumstances.

3.1 Configuration Considerations

No tools will be required to set-up this device. This device is designed to function in a range of environments, however, it will work the best on a relatively flat surface. The user on the table should be oriented so that the head is at the loop side of the hook and loop attachment on the surface of the mattress. This will prevent the user's hair from being caught in the hook attachment.

3.2 User Access Considerations

The product is designed to be used by an adult or adolescent individual with limited mobility who would require care such as diaper changing or help changing their clothes and their caretaker. This product requires an individual who is likely the caretaker to be able to lift at least 12kg to set up. This individual should have a flexible range of motion as setting up the table would require bending and squatting of the person.

3.3 System Organization & Navigation

Table

The main component of the assembly is the table. It serves as the structure of the assembly. It has foldable legs and the table can be folded in half. It comes with a locking mechanism in the middle and on the legs. The edges of the table have metal brackets mounted to support the privacy shades in place. Wheels are attached to the bottom edge of the table opposite to the handle. Both features allow for ease of use.

Mattress

The mattress is attached to the table through hook and loop attachments. The mattress is there to ensure the comfort of the user lying on the table. The mattress is covered with a fabric cover which is a twin size fitted sheet. This allows a layer of protection for the mattress and serves as aesthetics. It can be removed and replaced as needed. On top of the mattress is a waterproof cover that is secured through hook and loop attachments. This waterproof cover allows for easy wipe clean up. This cover can also be replaced if needed.

Privacy Shades

The privacy shades ensure the user on the table's privacy. There are 6 privacy shades which can be put up depending on the user's needs. They have pink inserts on the bottom which allows for easy attachment to the table.

3.4 Exiting the System

1. Detach all of the privacy shades from the metal brackets
 - a. This can be accomplished with ease by pushing the bottom of the pink inserts up.
2. Store the privacy shades in the mesh bag.
 - a. The privacy shades are flexible. Once stacked, the ends of the shades can be brought towards each other to create an oval shape which will make it easy to be inserted into the bag.
3. Fold the mattress in half by bringing the end of the mattress opposites to the wheels to the other side.
 - a. Ensure that the hook and loop attachment on the non-wheel side is completely detached.
4. Secure the mattress by attaching the hook and loop attachments on the surface of the mattress together.
5. Flip the table 90 degrees, ensuring that the table edge with the wheels are on the ground.
6. Unlock the table by flipping the switch in the middle of the table, retract the metal brackets on the table legs.
7. Fold the table legs in, ensuring that they click into the plastic holders.
8. Fold the table by bringing the non-wheel end of the table to the other side, ensure that the legs click into the plastic holder.

4 Using the System

The following section provides you with information you may need in your everyday use of the Change and Go.

4.1 Mattress

The change table is composed of a removable mattress covered with a bedsheet and a waterproof plastic table cloth to protect it. The bedsheet can be removed and replaced by simply taking the plastic cover off. This plastic protection stays in place with the help of small velcro strips. Long velcro strips on the table ends also connect the waterproof cover to the table.



Figure 4: Change and Go Mattress

4.2 Privacy Shades

The Change and Go is also composed of 6 privacy shades. They are made of a thick and opaque fabric to ensure the user's privacy. The shades can be set up by simply inserting them in the brackets attached to the table. Depending on the level of privacy wanted, the user can select the number of shades they want to use and their location.



Figure 5: Change and Go Privacy shades

4.3 Wheels

To facilitate the use of the change table, 2 wheels have been added. When the table is folded the user can easily transport the table by rolling it.



Figure 6: Change and Go Wheels

5 Troubleshooting & Support

5.1 Error Messages or Behaviors

Due to the mechanical nature of this product, there are no error messages that will be visible but rather peculiar behaviours. The peculiar behaviour that may occur is the bending of the table from the middle. This indicates that the support metal underneath the table is bent. This may warrant the table for a replacement or it can be fixed manually by applying pressure on the metal support bar via a hammer or a mallet.

5.2 Maintenance

From time to time, it is important to clean the table to prevent it from getting very dirty. This can be done by cleaning the plastic cover sheet or replacing it entirely in extreme circumstances.

5.3 Support

For unknown errors occurring with this product a help line may be reached at +1-(800)-123-4567 which is the customer support group for the Change N Go as outlined earlier.

6 Product Documentation (Cecilia)

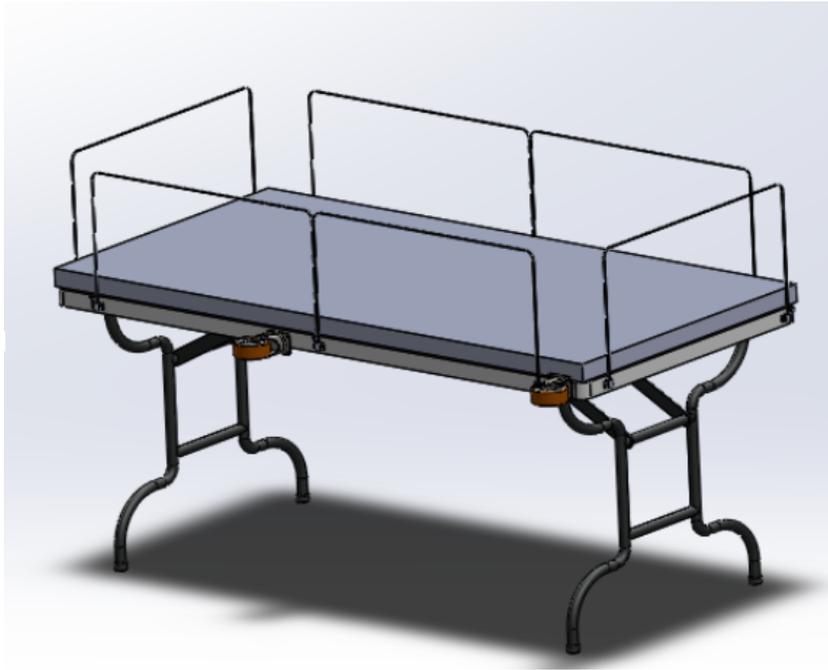


Figure 7: Final CAD Concept Sketch before physical prototype

The main component of the assembly, the foldable plastic table was purchased from Canadian Tire. The decision was made to purchase the table instead of building it based on the advice of experienced design professionals at CEED. The effort and money needed to build a table from scratch was not worth it as our team would not have been able to produce a table much better than what was purchased. We also could not guarantee that our design would support the load required for the need. In the end comparing our design to the table available commercially, we concluded that there were no additional features that our design would deliver that would justify the uncertainty of our design.



Figure 8: Folding table in a folded position. Wheels are opposite to the handles.



Figure 9: Folding table set up, pipe holders and wheel castors are installed. One privacy shade can be seen.

The table we chose to buy is a For Living Folding Table from Canadian Tire. We chose this product because it fits within the target specifications we had decided on. It was easy to assemble, relatively lightweight (around 12kg) and the dimensions are within acceptable tolerances both assembled and folded. We tested these specifications with a similar table available to use provided by CEED. Our team sat on the table and ensured it could support the load required for the assembly. After realizing the specifications were met, we made the purchase. Most

importantly it fit within the budget we had available. Due to the limited options, we did not choose the material of the table. The table has a hollow steel frame and a plastic table top.

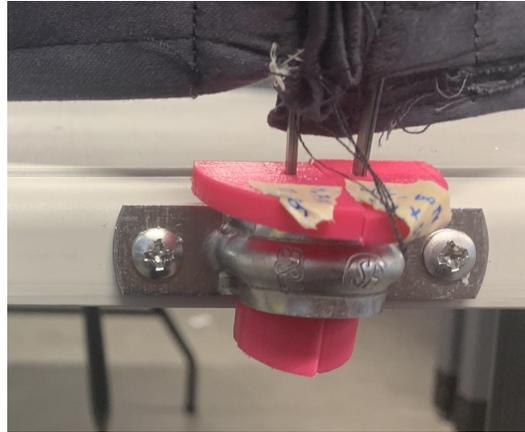


Figure 10: Two of the 3D printed Insert in one of the pipe hangers mounted.



Figure 11: Wheel Castors mounted to the edge of the table.

To make the table more portable, we installed wheel castors on one of the edges of the table. This table edge is opposite of the handle as such it allows the table to be transported like a suitcase. We secured the wheels using screws and nuts that traveled through both the metal frame and the plastic edge. The castors were mounted diagonally so that the screw holes on either corner are parallel to each other in order to fit the table edge (See *Figure \$\$*). As such the edge protruding to the bottom of the table edge had to be bent outwards using pliers to ensure it would not affect the table through its folding assembly process. We also installed metal pipe holders along the edges in similar fashion. These pipe holders are about an inch and a half in diameter. These were the smallest pipe holders we can find commercially. They serve as the holders for the privacy shades we made. We used six holders for six privacy shades. They were placed about 30 inches apart on

the edge of the table. We adapted our design so that a full shade would cover the middle of the table. This helps better ensure the privacy of the user but also avoids installing the holder over the middle of the table where the fold would be.



Figure 12: Privacy Shade

The privacy shades were made with a wired frame. The inspiration for the design comes from mesh foldable laundry baskets and foldable car sunshades. We realized the metal frame allows for the shades to be flexible and foldable to be stored away but keeps its shape to serve as sun shades. For the privacy shades it was important for the fabric chosen to be opaque. We chose to use pillow cases as the dimensions are exactly what we required. It also allows for a double layer of fabric to be used to ensure opacity. The pillowcase also saves labour time as we would only have to sew the path required to the wire to pass through. The ends of the shade were special made 3D printed plastic inserts. These inserts are a semi-circular shape with a lip edge on top. (See Solidwork File Attached). They would slot into the metal holders we mounted on the table edges. There would be a hole in the middle for the wires to be slotted into. We chose to secure the inserts by using super glue to glue the wire in the hole of the inserts.

On the table top would be a mattress. This mattress is a one and a half inch foam mattress topper. This is the mattress available to us free of charge. However, it serves its purpose of providing the user with additional comfort. We chose to cover the mattress with a twin fitted sheet which adds an additional layer of coverage for the mattress. This layer can also be easily swapped out and cleaned. On top of everything is a clear plastic sheet. This uses a plastic tablecloth. It is secured to the bed sheet through the use of hook and loop attachments. We chose to attach it to the bed sheet instead of the mattress because the mattress could not tolerate the force required to detach the hook and loop attachment. Through testing we realized that the use of the hook and loop attachment will tear the mattress. The hook and loop attachments are sewed on to bedsheets and glued to the tablecloth through adhesive. The complete mattress is attached to the table with six long strips of hook and loop attachments along the edges of the tabletop and the underside of the mattress. we ensured that the adhesive was stuck to the plastic tablecloth on the underside

instead of the mattress. Finally, hook and loop attachments were attached to the two ends of the table which allows the mattress to be folded in half so that the table can be folded.

6.1.1 BOM (Bill of Materials)

Item	Description	Quantity	Cost/Unit	Cost	Prototype Number	Bought or Not	Links
Table	A foldable table with carrying handles	1	59.99	59.99	2 and 3	Bought	https://www.canadiantire.ca/en/pdp/for-living-folding-table-with-carry-handle-6-ft-0688000p.html#srp
Laundry Hamper	A mesh laundry hamper with metal wiring used to hold its shape	1	3	3	2 and 3	Bought	Dollarama
Matress Topper	Twin size bed foam matress topper that's 1in thick	1	30	0	2 and 3	Not	https://www.walmart.ca/en/ip/spa-sensations-by-zinus-15-swirl-cooling-gel-memory-foam-air-flow-matress-topper-1-year-warranty-blue/6000200681006?skuld=6000200703722&offerId=6000200703722&utm_medium=paid_search&utm_source

Nut	M4 diameter	20	0.1	2	2 and 3	Bought	https://educ-makerlab.odo.com/shop/product/nuts-metric-73?search=nut#attr=193,472
Elastic	3 yards of 6mm width elastic	1	2.97	0	2 and 3	Not	From Feryza's House
Patio waterproof cover	plastic hydrophobic sheet repelling water from the mattress	1	3	3	2-Jan	Bought	Dollarama
Bedsheet	A twin size bed fitted sheet	1	9.97	0	2 and 3	Not	https://www.walmart.ca/en/ip/mainstays-fitted-sheet-tan/6000204277002
Sewing Thread	1 roll of black thread	1	3	0	2 and 3	Not	From Feryza's House
Pipe hanger strap	These will help fasten the wheels to the table	6	2.38	2.38	2 and 3	Bought	https://www.homedepot.com/p/Oatey-1-2-in-Galvanized-2-Hole-Pipe-Hanger-Strap-10-Pack-33542/303434708#overlay
Air Dry Clay	clay that dries up after molding it into shape	1	4	4	2 and 3	Bought	Dollarama
Pillow Cases	light twin size pillow case	3	3.5	10.5	2 and 3	Bought	Dollarama
Table Cloth	Thicker waterproof cover alternative to Patio Cover	1	3.5	3.5	3	Bought	Dollarama

Velcro	Attaches to the table, in 4inch increments	5	1.25	6.25	3	Bought	Dollarama
M4 Screws	Screws to hold the brackets and wheels.	3	2.97	8.91	2 and 3	Bought	https://www.homedepot.ca/product/paulin-pan-square-machine-screw-m4-70-x-40-6pcs/1001588013
Mesh Bag	Holds all the privacy curtain together	1	1.25	1.25		Bought	Dollarama
Solidworks	To make the CAD diagrams and drawings	1	0	0			uOttawa VMWare

Total Cost Without Tax	With Tax
166.77	188.4501

Figure 13: BOM List updated on April 9th, 2022.

6.1.2 Equipment list

Equipment	Description	Prototype Number	Source	Cost
Sewing Machine	A machine used to sew thread through fabrics	2 and 3	uOttawa	0
Sewing needle (handsewing)	A hollow needle with a hole at the hop	2 and 3	Feryza	0
Drill	Used to make holes for the wheels	2 and 3	uOttawa	0

Drill Bits	1/4 inch	2 and 3	uOttawa	0
Screwdriver	To remove the frame of the table before drilling holes	2 and 3	uOttawa	0
Scissors	To cut the pillowcases and vinyl cover	2 and 3	uOttawa	0
Pencil	Used to mark the holes before drilling the table	2 and 3	uOttawa	0
Tailor's Pins	Used to align the edges of the pillowcases while sewing	2 and 3	Feryza	0
Seam Ripper	Used to fix our sewing mistakes	2 and 3	Feryza	0
Tailor's Chalk	Used to mark where to cut the pillowcases	2 and 3	Feryza	0

Figure 14: Equipment List updated on April 9th, 2022.

6.1.3 Instructions

Table Manufacturing

1. Remove the purchased table from its packaging.
2. Remove all the screws around the inner edge of the table.
 - a. Save the screws as they will be used again.
3. Mark all the drill holes required around the outer edge of the plastic table top.
 - a. For the pipe holders, use the pipe holder and mark the holes through the holes on the pipe holder, this will allow for proper dimension
 - b. Use pre-existing holes for one end of the pipe holder drill holes, this will allow for easier drill holes.
 - c. Each pipe holder should be 30 inches apart, this measurement can be helped using a finished privacy shade.
 - d. For the castor wheels, use the wheels to help mark the holes for proper dimensions.
 - e. Avoid pre-existing holes on either table edge and the center of the table. These are weaker areas of the table where the frame is folded.
4. Install the screws back in, avoid the ones going into the holes corresponding to the ones that are marked to be drilled.
5. Drill the marked holes using a size 16 drill pit.
 - a. Drill the holes through the plastic frame side first.
 - b. For better precision, one should punch the holes through using a scratch awl.
6. Install the wheel castors and pipe holders through drilled holes.

- a. Push the M4 screws through the holes from the outside edge in, so that the head of the screw is on the outside edge of the table.
- b. Screw the nuts on the M4 screws.

Mattress Attachment

1. Cut the mattress topper to the dimensions of the table top.
2. Cover the mattress with the fitted sheet
 - a. Ensure that the mattress topper stays flat and the fabric under the mattress from the sheets on each side is even.
3. Place the plastic cover on the table.
4. Place the mattress in the middle of the plastic cover, with its underside facing up.
5. Place hook loop attachments around the bed sheet evenly apart.
6. Peel the adhesive tape off the loop attachments.
7. Fold the plastic sheet in one side at a time., and press down so the loop attachments stick to the plastic sheet.
8. Tuck the edges of the plastic sheet in and secure it using more hook and loop attachments.
 - a. The final product should fit the mattress topper perfectly.
9. Remove the mattress from the table.
10. Stick six 28 inch strips of hook and loop attachment evenly around the table, making sure to avoid the center edge where the table folds.
11. Place the mattress topper back on to the table making sure to align the mattress with the table.
12. Lift one edge of the mattress topper.
13. Peel the adhesive tape of the loop attachments of one of the pieces corresponding to the edge lifted.
14. Press down so that the adhesive sticks on the plastic cover underside of the mattress.
15. Repeat step 12-14 for all 5 other hook and loop attachments.
16. Stitch two 3 inch strips of the hook and loop attachment on the end of the table on the side of the wheel castors.
 - a. One of the strips should be along the top corner away from the wheel's edge and the other is about 5 inches away.
 - b. Both pieces should lay parallel to the width of the table, and collinear to each other.
17. Fold the mattress by bringing the other side of the mattress over so the mattress horizontal edge is parallel to each other.
18. Press the mattress down so that the loop attachment sticks to the other end of the mattress.
 - a. Orient the mattress so that the piece along the top corner away from the wheel's edge is now closer to the middle of the mattress and the other piece is on the bottom corner of this side of the mattress.
 - b. The mattress should be folded at a slight angle so that half that folded over is facing up towards the handle when folded.

Privacy Shades

1. Take elastic metal wires and shape them into a semi circle.
2. Take an opaque pillow case and cut the bottom side (length) following the fold.
3. Create a seam of approximately 1inch for the side that has been cut.
4. Pin the left or right shorter side that has an opening and sew it. There should now be an opening on the bottom length only.
5. Measure a 1.5 inch parallel line to all the sides except for the bottom one with an opening. Trace down the lines with pins.
6. With a sewing machine, sew the fabrics following the lines.
7. Take 2 elastic metal wires of a length of approximately 45 inches and attach them together with some tape.
8. Now insert the wires into the whole created and make it slide along the path sewed previously.
9. Pull out the other side of the wires from the fabric.
10. Insert both wires extremities into two 3D printed plastic inserts.

6.2 Testing & Validation

Various testing was done to ensure the validity of the final prototype. It was concluded that the table was safe for use as it had passed all testing stages. The testing stages the table went through included;

Stability Test: Tested the table by setting it up and laying on it and moving around to ensure that the table is not wobbly and that the table feels safe and sturdy for the user being changed.

Privacy Test: Ensure that the table could maintain dignity of the user being changed by having a test subject lay down on the table and set up the privacy curtains around them and take a 360° spin around the table and making sure that the test subject is not visible.

Comfort Test: The final test that was conducted was setting up the table and ensuring that the test subject laying down on the table remained comfortable for several minutes as a change of clothes is expected to last for this duration

7 Conclusions and Recommendations for Future Work

The biggest lesson the group learned is that designing a product is not always about making money. When it comes to things like disability care and management, there is a human side to it. By getting the chance to empathize with our client, the team experiences this firsthand.

The team also learned that listening to people who have more experience is paramount when designing. If it wasn't for the advice that the team received after designing the first prototype, the Change and Go would not be successful.

If given the opportunity to continue working on this endeavour, the team would receive feedback on the final prototype from the client after they have used the product for two weeks consistently. This is because testing wear and tear from repeated use has not been possible. Also, the team would make the Change and Go more aesthetically pleasing by changing the colours, and making everything match. The team did not have time to do this while building, and it would have been a waste of money and resources to rebuild prettier parts.

APPENDICES

8 APPENDIX I: Design Files

Table 1. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Solidwork Files	MakerRepo	March 6th, 2022
Bill of Materials	MakerRepo/Brightspace	April 11th, 2022
Deliverable A	MakerRepo/Brightspace	January 16th, 2022
Deliverable B	MakerRepo/Brightspace	January 23rd, 2022
Deliverable C	MakerRepo/Brightspace	January 30th, 2022
Deliverable D	MakerRepo/Brightspace	February 6th, 2022
Deliverable E	MakerRepo/Brightspace	February 17th, 2022
Deliverable F	MakerRepo/Brightspace	March 6th, 2022
Deliverable G	MakerRepo/Brightspace	March 20th, 2022
Deliverable H	MakerRepo/Brightspace	March 30th, 2022
Deliverable J	MakerRepo/Brightspace	April 7th, 2022