

Design Project User and Product Manual

**GNG2101 - Introduction to Product Development and
Management for Engineers**

Submitted by:

Section A, Team 7

Aaron MacNeil, 300199522

Andro Hanna, 300211677

Jacob Charron, 300175263

Jake Ratkovic, 300190849

Praise Ebirim, 300081723

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University of Ottawa

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Table 1. Acronyms

Acronym	Definition
F.C.T	Foldable change table
UPM	User and Product Manual

1 Introduction

This User and Product Manual (UPM) provides the information necessary for caretakers to effectively use the F.C.T. and for prototype documentation.

2 Overview

The client is in need of a change table for a teenager with cerebral palsy. The change table has to be portable, quick to assemble, compact, and lightweight to accommodate the user and client's needs. Individuals with cerebral palsy have more specific needs than individuals without cerebral palsy. Part of these needs involves a change table for changing and stretching when out in public for extended periods of time.

- Need to support 60 kg
- Safety belt around mid table
- No latex (allergy)
- The height of the change table should be in-line with the wheelchair seat
- No hard plastic material

Our product is tailored for the client's needs. It is easily transported with the help of the wheels and handle. It also has an easy assembly and disassembly while keeping a quick set up time. Finally it is also compact enough to fit in a car trunk.



This table is foldable and can be rolled around like a suitcase. Latches are used to prevent the table from unfolding when moving. When it needs to be used, the table can be folded out, and set up like the images above. The legs and middle section are supported with barrel bolts.

2.1 Conventions

F.C.T- Foldable change table

2.2 Cautions & Warnings

This product does not support more than 60 kg. Make sure all the legs are perpendicular to the frame and deadbolted in place before transferring the person from the wheelchair to the table.

Ensure all latches are in place, securing the folded table in its collapsed state, before transporting the table.

3 Getting started

Here are the steps that are needed to follow in order to use the portable change table:

1. Release mid frame latches
2. Extend and lay down the table on the floor
3. Unlatch the legs
4. Lock the legs in place using the deadbolts
5. Lock the frame in place using the deadbolts
6. Flip the table around so that it stands on the legs
7. Make sure everything is in-line

3.1 Set-up Considerations

Not applicable

3.2 User Access Considerations

The intended users are persons who suffer from muscular disorders, elderly persons, or other persons who are unable to change themselves without the assistance of a caretaker. Use of the F.C.T does not change based on the user type.

3.3 Accessing the System

Not applicable.

3.4 System Organization & Navigation

Not applicable.

3.5 Exiting the System

Not applicable.

4 Using the System

The following subsections provide detailed, step-by-step instructions on how to use the various functions or features of the F.C.T.

4.1 Folding system

The frame and the legs are able to fold/unfold from 0 degree to 90 degrees.

4.1.1 Latches

When the legs are folded they are held by latches that are screwed in the frame . When the frame is folded both ends are latched together in order to keep it enclosed.

4.1.2 Deadbolts

When the table is fully unfolded , all moving parts are deadbolted in order to secure them and to avoid them from folding back.

5 Troubleshooting & Support

5.1 Error Messages or Behaviors

N/A

5.2 Special Considerations

Not applicable.

5.3 Maintenance

Lubrication of hinge joints with WD-40 on a two week schedule

Store in a cool, dry environment when not in use.

5.4 Support

For any inquiries please contact this email address : ahann084@uottawa.ca

6 Product Documentation

6.1 <Subsystem 1 of prototype>

6.1.1 BOM (Bill of Materials)

Here is the bill of materials for the portable change table.

Piece Name	Piece Description	Number of Pieces	Price of Piece (without taxes)	Link
8 ft 2"x2" wood planks	This is a 2"x2" inch plank that is 8 ft long. These planks were cut into four 2 ft long planks each that serve as the support beams of the change table.	2 planks	8.47\$/each	https://www.homedepot.ca/product/micropro-sien-na-2-x-2-x-8-pressure-treated-wood-above-ground-use-only-/1000791632
8ft 2"x4" wood planks	These are 2"x4" inch planks that are 8 ft long. Two of these planks were cut into two 2.75 ft long planks each that serve as the frame of the change table. The other two planks were cut into 2 ft long planks that served as the legs and the frame of the change table.	4 planks	11.14\$/each	https://www.homedepot.ca/product/micropro-sien-na-2-x-4-x-8-pressure-treated-wood-above-ground-use-only-/1000789777
Paulin #12 x 3 -inch Flat Head Screws (9 pcs)	These are the screws that were needed in order to assemble the wood together to make the change table.	1 pack	2.97\$/each	https://www.homedepot.ca/product/paulin--12-x-3-inch-flat-head-square-drive-wood-screws-zinc-plated-9pcs/1000120047

Paulin #12 x 3 -inch Flat Head Screws (50 pcs)	These are the screws that were needed in order to assemble the wood together to make the change table.	1 pack	13.55\$/each	https://www.homedepot.ca/product/paulin--12-x-3-inch-flat-head-square-drive-steel-wood-screws-zinc-plated-50pcs/1000141506
Screws (Shorter ones)	These are the screws that were used in order to assemble the hinges and wheels to the change table.	1 pack	5.60\$/each	https://www.homedepot.ca/product/paulin--10-x-5-8-inch-pan-head-square-drive-steel-metal-screws-zinc-plated-100pcs/1000139913
Handle	The handle was used in order to easily move the change table when necessary.	1	5.79\$	https://www.renodelpot.com/fr/poignee-pratique-orientable-zinguee-acier-5-po-l-x-1-9-32-po-l-46xv-3505632
Wheels	The wheels are used in order to move the table around to the destination required.	4	3.19\$/each	https://www.renodelpot.com/fr/roulette-fixe-sans-frein-0101200
Hinges (middle legs)	These hinges are used to attach the middle legs to the change table. Two hinges come in one pack.	1	6.41\$/each	https://www.homedepot.ca/product/everbilt-1-1-2-inch-zinc-plated-utility-hinge-2pk/1000773371
Hinges (frame+legs)	These are the hinges that are used to attach the legs to the frame as well as the two frames together.	6	4.26\$/each	https://www.homedepot.ca/product/everbilt-4-inch-zinc-plated-heavy-duty-strap-hinge-1pc/1000773464

Latches	The latches are used to prevent the pieces from moving	6	4.49\$/each	https://www.renodelpot.com/fr/crochet-et-anneau-a-barriere-3-paquet-de-2-zinc-3505106
Barrel Bolts (Home Depot)	Barrel bolts are used for the legs and the middle of the frame in order to prevent the table from bending or the legs from folding back in.	2	6.24\$/each	https://www.homedepot.ca/product/everbilt-4-inch-zinc-plated-barrel-bolt-1pk/1000773445
Barrel Bolts (Réno Dépot)	Barrel bolts are used for the legs and the middle of the frame in order to prevent the table from bending or the legs from folding back in.	4	5.89\$/each	https://www.renodelpot.com/en/barrel-bolt-3505329
Staples	The staples were used in order to staple the canvas to the frame of the table.	1	13.29\$/each	https://www.renodelpot.com/fr/agrafes-robustes-stanley-acier-inox-dable-1000-par-paquet-pointes-de-3-8-po-l-x-couronne-de-27-64-po-l-tra706sst-03055958
Canvas	The canvas is the material that is used to convert the support beams of the change table. It is also used to create a surface which the user can sit on. A 2 yard material was used to cover the entire table.	2	9.99\$/yard + shipping	https://lensmill.com/collections/fabric/products/northcott-canvas-basics?variant=40269012369588
Rectangular Felt Pads	The wood pads are used to prevent the			https://www.renodelpot.com/en/fle

	wood from being ruined. They also add balance to the table.	3	4.49\$/each	xi-felt-rectangular-wool-pads-self-adhesive-brown-4-per-pack-3-4-in-w-x-4-in-l-2980125-04466098
Total Price (with tax)				276.53\$

6.1.2 Equipment list

Tools:
Drill
Screwdriver
Bandsaw
Sandpaper

6.1.3 Instructions

1. Cut everything according to the measurements given by the client.
2. Align the wooden frame and screw the edges of the frame
3. Place the ribs at intervals of 6 inch and screw them in
4. Repeat step 2-3 for the other side
5. Screw the hinges on the edges of the frame and secure them to the other side
6. Flatten the folded parts and align the deadbolts
7. Screw them in
8. Flip the table over
9. Align the legs perpendicular to the frame
10. Screw the hinges on them and the frame
11. After screwing them, lift them up and align the deadbolt
12. Screw them in
13. Repeat steps 9-12 for all 3 outer legs
14. Keep the table into this position
15. Align the inner legs on the furthest rib from the outside
16. Screw the hinges in
17. Repeat steps 15-16 for the other inner leg

18. Flip the table around so that the legs face the floor
19. Cut the canvas in 2 straight down the middle, in order to obtain 2 squares
20. Align it with the borders of the frame (make sure it covers the ribs)
21. Staple it using the staple gun
22. Repeat steps 20-21 for the other side of the table

6.2 Testing & Validation

In order to test our product , we first started with the simulation function in SolidWorks software. This simulation crashed. After multiple attempts to simulate our test, we decided to perform our tests on the finished physical product. This test was a success, the table supported more than the specified load requirements.

7 Conclusions and Recommendations for Future Work

Lessons learned from the project include the following:

Start with more focused prototypes for the first or 2nd prototypes. When building the finished table , we encountered some challenges. Part of these challenges included leveling out the table , and keeping the legs locked in a perpendicular orientation to the table. A focused prototype on the leg hinge joint would have been helpful before building the completed table product. Another lesson learned would be not to rely on analytical models. Although the solidworks simulation would have been an asset, we were unable to complete this task. We were not able to troubleshoot solidworks to ensure a successful simulation; this was due to lack of experience with solidworks software. Regardless, our test on the finished physical product proved successful. This illustrates that analytical models are a bonus, but not a necessity when testing the project. Our time may have been better spent testing another physical prototype instead of the analytical one in solidworks.

Future project work would involve changing the material used for the frame and legs. Due to budget constraints and ease of manufacturing , we used wood for the current iteration of the product. Future projects would implement either aluminum or pvc piping material for the frame and legs. This material would be much more lightweight while allowing for the same structural integrity required. As well, a change of material for the mesh would be implemented. We used a canvas material for the mesh on our current iteration of the product. Future iterations would be optimized with a more water resistant material to aid in the cleaning process of the mesh.

8 Bibliography

9 APPENDIX I: Design Files

<https://makerepo.com/JakeCharr/933.gng2101-a7-team-7>

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Solidworks assembly	MakerRepo	N/A
Deliverable A	Brightspace/MakerRepo	September 16, 2021
Deliverable B	Brightspace/MakerRepo	September 23, 2021
Deliverable C	Brightspace/MakerRepo	September 30, 2021
Deliverable D	Brightspace/MakerRepo	October 7, 2021
Deliverable E	Brightspace/MakerRepo	October 13, 2021
Deliverable F	Brightspace/MakerRepo	November 4, 2021
Deliverable G	Brightspace/MakerRepo	November 18, 2021

Deliverable H	Brightspace/MakerRepo	December 1, 2021
Design Day Presentation	MakerRepo	December 2, 2021

10 APPENDIX II: Other Appendices

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