GNG 2101

Design Project User and Product Manual

Hockey Stick Holder

Submitted by:

Team Stick Gripper, Group B03.2

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Table of Contents

List of Figures

List of Tables

1 Introduction

The purpose of this document is to give a detailed explanation of how to use our device for those who wish to have a hockey stick holder that will attach to a power chair.

This document is a user manual for those who wish to use our hockey stick holder which is designed for a power chair for wheelchair hockey. In section 2, one will find the overview and general description of the product as well as safety concerns of the product. In section 3, one can find descriptions on how to use the product including a step-by-step guide which may be followed to use the product. Section 4 consists of details on using the product and section 5 consists of any details needed to be known for maintenance of the product. Section 6 contains product documentation and section 7 contains details on future work and conclusions. We are not liable for any injuries or damages to personal property with the use of our product and user manual.

2 Overview

Our client plays wheelchair hockey in their power chair and currently uses zip ties in order to attach their hockey stick to their chair. They want a more permanent and efficient solution as using zip ties leads to plastic waste and is inefficient. The fundamental needs our client told us were that it must be durable, and it must be easy to use. There are currently no real products like ours on the market and ours is fully functional, efficient and meets all our client's needs. There was another group who designed a product during this semester and their design was very similar to using zip ties. They essentially made a watch strap and would attach the stick to the chair using this strap. Our solution is a more permanent, durable and efficient solution to our client's issue. Our product stays on the chair and only requires the insertion of the hockey stick every time it is used.

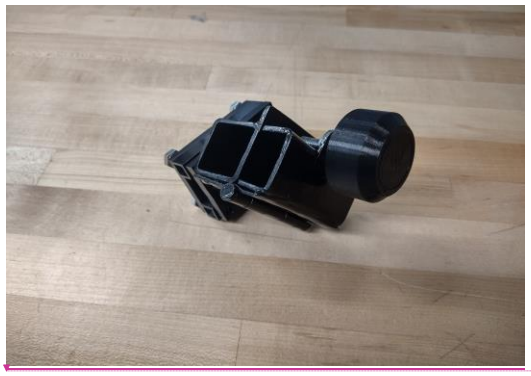

Figure 1

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Our product consists of two subsystems. Subsystem 1 which attaches to the chair itself and subsystem 2 which holds the hockey stick in place. Subsystem 1 is attached onto a rectangular bar on the power chair via four hand screws and can remain on the chair for as long as the user wishes. Subsystem 2 consists of a knob, screw, hinge and a sheet metal component which goes around the stick. To open the subsystem to insert the stick, the user must turn the knob to the left and this will turn the screw thus opening the subsystem once turned enough. To close the system, you simply close the subsystem and turn the knob/screw to the right.

Conventions

Subsystem 1 is the subsystem containing the two sheets of metal that clamps onto the chair itself and subsystem 2 is the subsystem which the hockey stick attaches to.

Cautions & Warnings

Our product contains four decently small screws thus it should be handled by adults and should be considered a choking hazard for small children. Additionally, the product is made of steel thus can be a hazard if dropped on the floor or on the user themselves thus it must be handled with care.

3 Getting started

Step 1: Attach subsystem 1 onto the rectangular part of the power chair via the four hand screws. To open/remove the subsystem turn the four screws to the left using your hand or a socket wrench. To close/attach the subsystem turn the screws to the right using your hand or socket wrench.

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Figure 2

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Step 2: Once attached to the chair, open subsystem 2 by turning the knob to the left to unscrew the screw.

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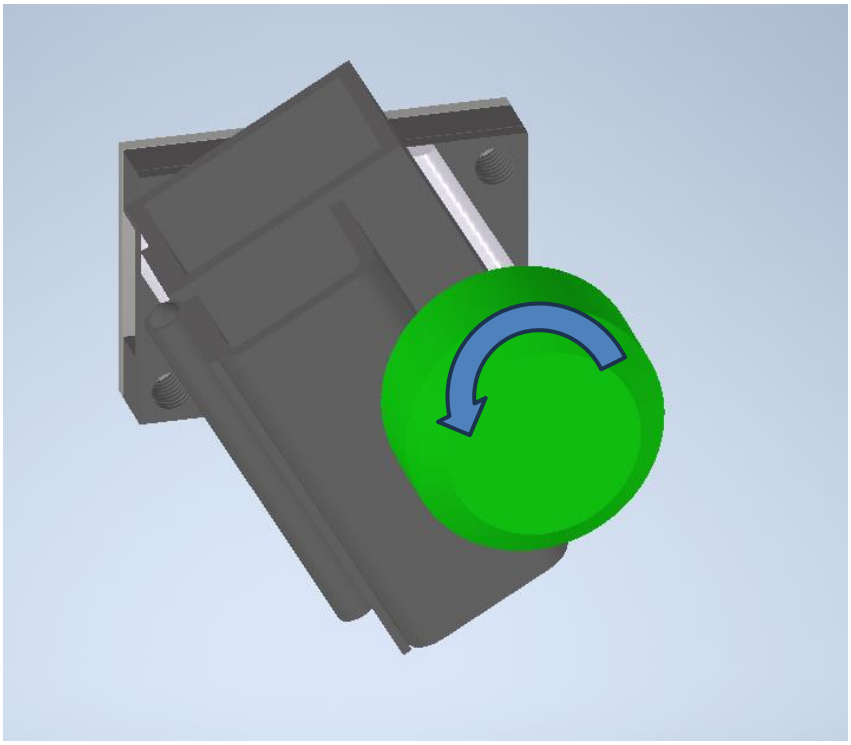

Figure 3

Step 3: Once the subsystem is opened, insert the hockey stick at its desired height so that the stick is touching the ground once the subsystem is closed.

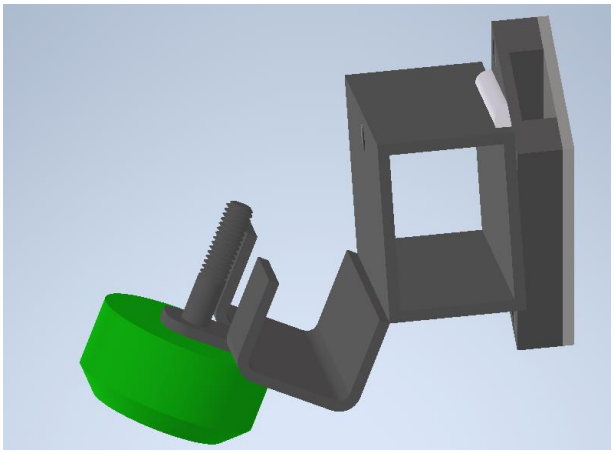

Figure 4

Step 4: Close the subsystem and turn the knob to the right to tighten the screw thus locking the hockey stick in place.

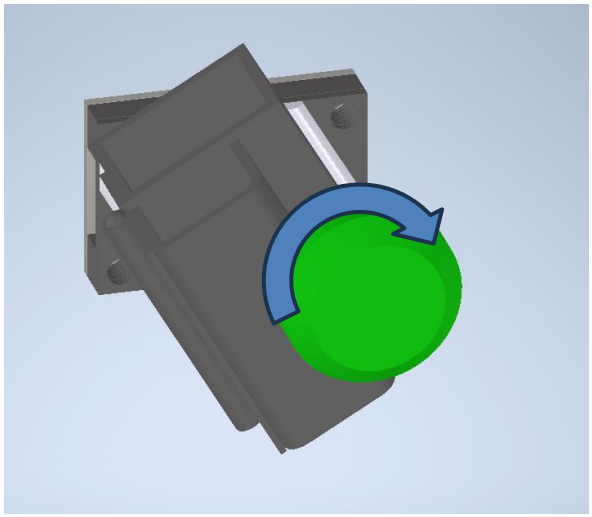

Figure 5

Step 5: Have fun playing hockey!

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Configuration Considerations

This product may require a socket wrench but should be able to be used only with the use of hands. Additionally, the setup of this product requires a set of functioning mobile hands thus help may be needed to attach the product.

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User Access Considerations

Users who could be using the prototype are those who play wheelchair hockey in a power chair. The power chair must have a rectangular part on the right side of the chair that fits our product. We are currently working on a more accessible solution so that our product fits all types of power chairs. Accessibility issues for this product include the fact that attaching and using the device requires a lot of mobility in the hands thus a lot of users may require some help in attaching the device and inserting the hockey stick.

System Organization & Navigation

Our product is two subsystems, but they are both attached together via a weld. As described before subsystem 1 consists of the attachment to the chair which is attached via four screws. Subsystem 2 consists of the part that holds the hockey stick in place via a knob and screw feature. The subsystem is opened and closed using a knob which can be turned with the user's hands.

Exiting the System

In general, the whole product can be left on the chair and does not have to be put away. After the use of our product one can remove the hockey stick by turning the knob to the left and opening subsystem 2. Once the stick is taken out close subsystem 2 and turn the knob to the right. If the user desires to remove the entire product from the chair, unscrew all four hand screws using either hands or a socket wrench. Open subsystem 1 and take the whole product off. Finally, close subsystem 1 once again by screwing the four screws using hands or a socket wrench to ensure none of the screws are lost.

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4 Troubleshooting & Support

The holder of the hockey stick intended for the wheelchair hockey players is made for properly securing the stick during the game. Nevertheless, some occasional problems may exist. If the hockey stick does not stay put in the holder and tends to fall out or shake up, the first thing to do is examine the surfaces that come into contact during the clamping for some dirt or perhaps a worn out surface. Remove any dirt using a wet piece of cloth and make sure the knob has been tightened properly. If the stick remains loose, it is possible to reposition the holder or replace any worn components which are visible. If the holder is detached, check the alignment of the mounting bracket and make sure all screws and bolts are tight. It is advisable to pull them with the tools which are suitable for pulling them and to pull the mount as needed in order to be firm. Whenever possible, precaution before restarting the game always ensure that gentle pressure is applied to the attachment of the holder. For any problems concerning the knob or any adjusting system, look for rotation having been stripped or any other damage which may require the replacement of the knob. It is imperative that none of the threads be blocked by any dirt and it is necessary to apply some grease to threads in order to facilitate proper movement.

Possible Errors

The users of the hockey stick holder may face some drawbacks such as the wobbling or falling of the stick, failure of the holder to stay firm and difficulties while trying to tighten the adjustment knob. The reason behind wobbling is more often than not a loosely tightened adjustment knob, some foreign bodies stuck in between or damaged clamping surfaces, which can be solved quite

easily through cleaning, tightening or replacing the damaged part. Loosening of attachments is mostly caused by a loose bolt or an improperly angled mounting bracket; this can be corrected through screw tightening and ensuring correct positioning of the brackets. When the knob is 'frozen' or 'flicking', this may be a symptom of thread stripping or even cleaning dust trapped in the knob center, replacing, lubricating or even cleaning the knob might help.

Maintenance

To ensure the hockey stick holder remains functional and avoids failure, regular maintenance is essential. After each use, the holder should be cleaned with a soft, damp cloth to remove dirt, moisture, or debris. Care should be taken to avoid harsh chemicals that could corrode the metal. Monthly lubrication of the hinge with a small amount of machine oil or silicone grease will keep it moving smoothly and prevent rust; ensure the lubricant does not interfere with the grip on the hockey stick. Weekly, check all screws, bolts, and fasteners to ensure they are tight, as vibrations and use during play can loosen them over time.

Support

For emergency assistance and system support related to the hockey stick holder, users can contact Aws Falah at **awsfalah@gmail.com**, Steven at **ssiew100@uottawa.ca**, Darren Fang at **darrenfang@gmail.com**, or Usman at **usman@gmail.com**. These individuals are responsible for providing troubleshooting and technical support.

5 Product Documentation

BOM (Bill of Materials)

Deleted: <Subsystem 1 of prototype>¶

Material	Parts req'd for	Dimensions (Inches)	Unit cost ($)	Amount	Source	Total cost ($)
Steel rectangular tube	Standoff	1x2x3	3.56/foot	0.25 feet	Metalpros.com	0.89
Steel rectangular bar	Chair mounting clamp	3/8x1/2x3	2.46/foot	0.5 feet	Metalpros.com	1.23
Hot rolled steel flat bar	All other steel parts, excluding hardware, will be cut from this	3x12x1/8	4.28/foot	1	Metalpros.com	4.28
5/16-18 x 1" bolt	Mounting bolts	Nil	0.33	4	McMaster Carr	1.33
5/16-18 x 2" bolt	Knob screw	Nil	0.54	1	McMaster Carr	0.54
Delrin	Knob	2 diameter x1	$35.10/foot	0.08 feet	Metalpros.com	2.93
3 inch steel hinge	Hinge	3	3.43	1	McMaster Carr	3.43
Total with tax						14.63

Equipment list

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The following pieces of equipment are needed to manufacture the product.

1. Laser/waterjet cutter

2. MIG or TIG welder
3. Lathe or 3D printer (for knob)
4. 5/16-18 tap

Instructions

Deleted: List all the equipment that was needed to build this subsystem. This is different then the materials or software listed in the BOM.¶

Refer to Appendix I for the engineering drawings. All parts except parts 2 and 4 can be laser or waterjet cut according to the drawings. Part 2 is simply cut to length from 1”x2” rectangular tube and the hole is drilled and tapped as per the drawing. Part 4 can be cut from 3/8”x1/2” rectangular bar stock and drilled, or laser cut from 3/8” plate. All parts can then be assembled according to the assembly drawings.

Testing & Validation

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The following table outlines the performed tests and the results.

Table 1 Testing

Metric	Units	Marginal Values	Ideal Value	Test Method(s)	Test Result
Time required to attach hockey stick.	Seconds	45-60	<30	Attaching stick several times	<20
Impact sustained without damage to holder.	Joules	50-100	>170	FEA	Minimum 170

Maximum stick deflection	Inches	0.5-0.75	<0.125	FEA and dial indicator test	~0.2
Damage to stick from clamp	Yes/No	No	No	Testing with softwood	No damage
Cost	Dollars	<50	<50	SendCutSend quote, BOM, and estimation	$30-$46

6 Conclusions and Recommendations for Future Work

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Future works that we believe could be implemented would be a solution to the fact that subsystem 1 can only be attached to one type of power chair. Designing a better subsystem that allows for the product to be used on other chairs. Additionally, there could be padding in subsystem 2 to ensure no damage is done to the stick, and a ball and socket joint could be added for those who have mobility in their hands and can move the stick on their own. If we had a few more months to work on this project, those additions would be the 3 most important aspects that should be implemented in the prototype.

The key lessons learned from this project are understanding the importance of manufacturability, making sure to maintain consistent material thickness throughout the prototype, and analyzing the differences between making the parts from scratch and buying pre-made parts. These lessons were very important when designing and prototyping the hockey stick holder. They will also continue to be useful for future products and groups.

In terms of things that were abandoned because of lack of time, the main ideas were already stated above, specifically adding adaptability to other wheelchairs, creating a ball and socket joint, and adding padding in subsystem 2. Some more aspects that could be added if we had more time would be adding a technological mechanism to the clamp that allows the wheelchair user to screw and unscrew it. We would also need to add more cost analysis and optimization to our prototype, ensuring ability for mass production and further testing stamped sheet metal for manufacturability.

APPENDICES

7 APPENDIX I: Design Files

Table 2. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
Drawing	HOCKEY STICK MOUNT	18 Oct 2024
MakerRepo Page	Stick Gripper | MakerRepo	3 Dec 2024
Video	https://youtu.be/itBxGRA4G90?si=SvxsNSQxlvIWs3EZ	3 Dec 2024