GNG2101

Design Project User and Product Manual

Power Grabber Handle

Submitted by:

Power Puff Handlers - Z13

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List of Acronyms and Glossary

Table 1: Acronym

Acronym	Definition
N	Newton, a unit to measure force.
cm	Centimeter, a unit of distance

Table 2: Terms

Term	Acronym	Definition
Linear Actuator	N/A	Similar to a piston. This device creates linear (straight) motion.
Battery	N/A	Electrical component used to provide power to the system.
Switch	N/A	Electrical component used to turn electrical circuits on/off.

2 Introduction

This User and Product Manual (UPM) provides the information necessary for people with low dexterity to effectively use the Power Grabber Handle and for prototype documentation. The context for the development of this product was initiated by our client who was looking for an attachment for preexisting grabbers. This addition would allow users with low dexterity to grab and hold everyday objects. Some core assumptions that we have made are that it must be easy to use, light and reliable.

The objective of this user manual is to guide users on the usage and maintenance of the power grabber handle. The following document is organized in terms of the steps a user must take before, during and after the use of the product. First, we will provide an overview of the product, then we will describe the setup and usage of the product. Next, we will provide a troubleshooting guide if ever something goes wrong, followed by an explanation of the inner workings of the device.

Please note that the user manual is not a guide on how to build your own power grabber handle. Any unauthorized reproduction of the following product will result in prosecution against the offender.

3 Overview

This device is designed for someone with low grip strength, so our objective is to generate a small-sized, powered device that can be equipped on the handles of commercial grippers.

The design philosophy is to fulfill the needs of users by helping them grip objects and hold them for a period of time. Moreover, the mechanism of the handle should be simple to make sure users can activate and set it up easily. Finally, the handle must be able to provide suitable force to the gripper such that it will securely hold items, but not damage them in the process of grasping and releasing.

Since there is no similar product currently available in the market, our product might be the only one in this aspect.

The device consists of a linear actuator, a switch, and a battery pack. The linear actuator and battery will be encased and attached in front of the trigger on an existing grabber tool. The switch will be movable, so that the customer can choose where to attach it. When the switch is pressed in one direction, the linear actuator will push the trigger back, closing the clamp of the gripper. When the switch is placed in the middle neutral position, the linear actuator will pause, and the gripper will hold the object in its grasp. When the switch is moved to the opposite direction, the linear actuator will retract, and the gripper will open, releasing the object.

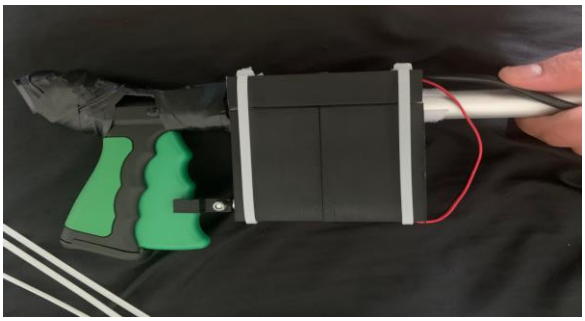

Figure 1: Final Prototype

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3.1 Conventions

When an action is required by the user manual on the part of the reader, it is indicated by a line of text beginning with the word “Action: “

3.2 Cautions & Warnings

Before using the product, the user should ensure that the device is properly secured on the grabber tool. All straps should be tightened adequately so that there is no slippage of the device. The user should cease operation of the device if they notice any improperly connected wiring, or if the casing for the components is damaged. While operating the device, the user should keep all body parts out of the direct path of the linear actuator which will be pushing the trigger of the grabber.

4 Getting started

A general description of the setup for the device would be as follows. Install and zip-tie the mount onto an existing gripper (see figure 2) and ensure that the linear actuator is able to press down on the trigger (see figure 3).

Figure 2: Installing mounts onto gripper

Figure 3: Ensuring the actuator pushes the trigger

4.1 Configuration Considerations

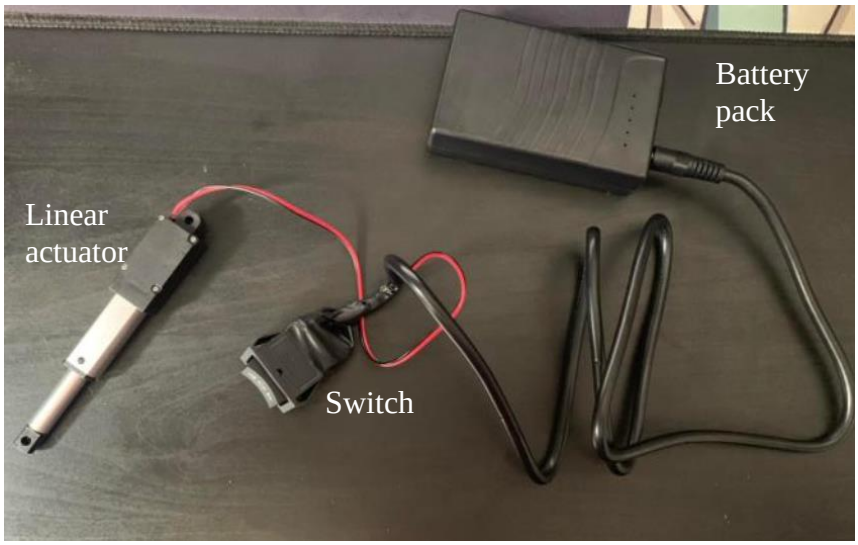

Figure 4: Switch, Linear Actuator, and Battery

The system consists of three main components: the linear actuator, the switch, and the battery. There is also a case for these three components and attachments included. The linear

actuator and battery will be set up within their cases prior to distribution to customers. The three main components are also pre-connected.

4.2 User Access Considerations

This product is suitable for patients with congenital/acquired hand muscle loss or injury who do not have enough strength to activate traditional grippers. The product cannot lift items that are heavier than its maximum capacity. The linear actuator is rated for 90 N, so it has a very large capacity. Furthermore, the attachable device cannot function when the battery runs out of charge, however the provided battery is rechargeable.

4.3 Accessing/setting-up the System

To set up the system, users must first set up the powered device onto the grabber tool. The battery and linear actuator should be placed in front of the trigger (as seen in Figure 5), and that they are properly strapped in. Once users tighten the straps properly and ensure the battery is charged, they can begin using the product. The device should be set up in such a way that the linear actuator can fully press and release the trigger. The straps must be tightened fully to avoid slippage of the system.

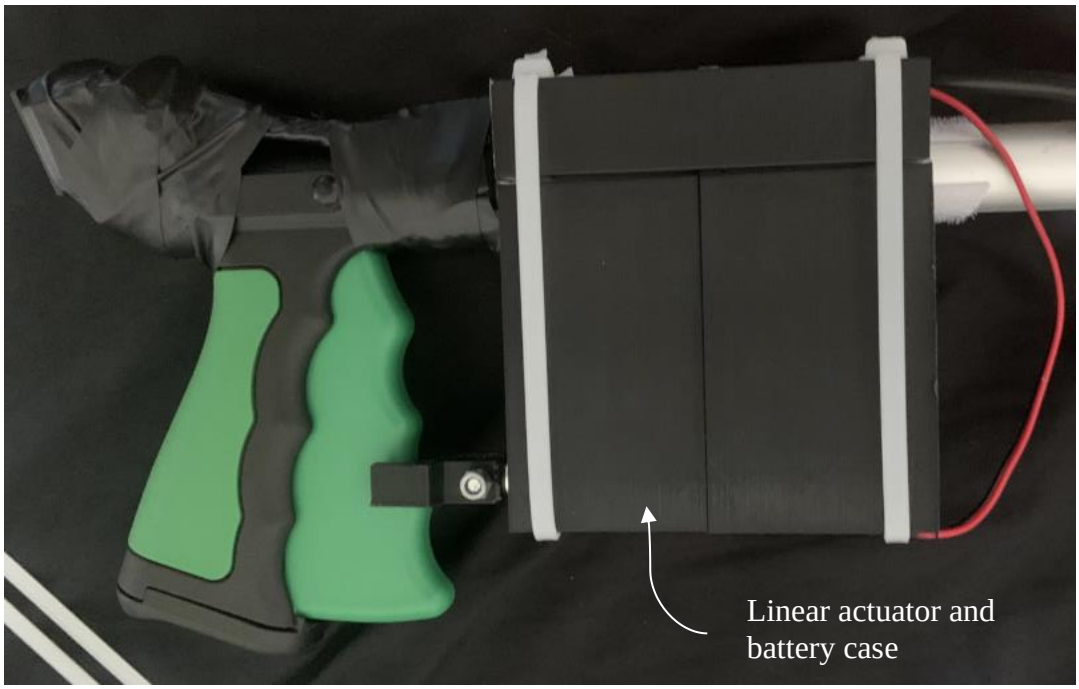

Figure 5: Assembled powered grabber, with linear actuator in front of the trigger

4.4 System Organization & Navigation

Main components of the product such as battery, linear actuator have been combined into the operating box. The user only needs to clamp the small hole on the operation box on the gripper rod and make sure that the linear actuator is aligned with the trigger of the gripper to finish the setup. After that, the user only needs to press the button on the handle to control the grab. Press to the right and grasp the item, and press to the left to release the item

4.5 Exiting the System

If the user wants to use the gripper frequently, the handle does not need to be removed from the gripper after completing a grasping task. Just make sure the battery is still charged, then the product can be used anytime. If the user no longer needs the gripper handle or needs to charge

the handle, please remove the operating box in the order of assembly and place it in a shaded place away from direct sunlight.

5 Using the System

The following sub-sections provide detailed, step-by-step instructions on how to use the various functions or features of the Power Grabber Handle. Once the device is properly secured onto the grabber, it can now be used. It has a switch which can be put into 3 positions: Open, Hold, Close.

Action: To use the grabber, ensure that the grabber prongs are in the open position by pressing down on the left most part of switch (see figure 6).

Action: Next to grab an object, press down on the right most part of the switch to begin closing the prongs (see figure 7)

Action: Once the prongs are holding the desired object, put the switch into the middle (holding) position (see figure 8).

Figure 6: Switch in left most position

Figure 7: Switch in right most position

Figure 8: Switch in neutral holding position

5.1 <Given Function/Feature>

Since we have studied the shape and mechanism of grip switches on the market, our products can be applied to almost all kinds of commercial grippers. Moreover, the user can control the grasping force by himself through the switch of the handle.

Possible problems:

User pressed the switch, but the handle did not work: Check the battery to make sure it is not out of power, and the linear controller has been set up against the trigger. Also ensure that all wiring remains intact.

User cannot lift the item via the handle: Make sure the item is lighter than its maximum capacity and press the switch to make sure the gripper is tight so that to generate enough friction to catch the objective.

6 Troubleshooting & Support

The following section contains information on steps that can be taken in the unlikely event that the device is not working properly.

6.1 Error Messages or Behaviors

Possible error behaviors could be the following:

- User pressed the switch, but the handle did not work
- User cannot lift the item via the handle

If any of these problems are occurring with your power grabber handle, consult the following section.

6.2 Special Considerations

Possible problems:

User pressed the switch, but the handle did not work: Check the battery to make sure it is not out of power, and the linear controller has been set up against the trigger. Also ensure that all wiring remains intact.

User cannot lift the item via the handle: Make sure the item is lighter than its maximum capacity and press the switch to make sure the gripper is tight so that to generate enough friction to catch the objective.

6.3 Maintenance

- Check the 3D printed module to make sure there are no cracks on it.
- The temperature of the battery is normal and will not get hot during use.
- Make sure that the battery and Linear actuator are properly connected without damage or poor contact.
- The shape of the pusher is updated in real time to accommodate a wider variety of grippers.

6.4 Support

If additional support is needed, contact the development team with the following email: Support@powerpuffhandlers.ca

7 Product Documentation

7.1 Power grabber device

7.1.1 BOM (Bill of Materials)

Table 3: Bill of material

Product	Price
Linear Actuator	$38.55
12 V Battery	$48
Velcro Straps	$10
Switch	$9.99
Wires	$13.99
3D printed mount	$0
Total	**$120.53**

7.1.2 Equipment list

- CAD software (Solidworks)
- 3D printer

7.1.3 Instructions

To build this device, you must first purchase all the necessary parts outlined in the bill of materials. Next you must create the 3D mount using a CAD software of your choice. Ensure that all

the components work together before beginning the assembly process. Attach the battery to the switch and to the linear actuator using electrical wires and ensure that you can extend and retract the actuator (see figure 9). Once everything is operational, begin assembly by mounting the 3D printing mount onto the selected gripper. Next attach the linear actuator using zip-ties ensuring that it can push the trigger when in the extended position. Finally attach the battery and switch using zip-ties and ensure they are securely mounted. (see figure 10)

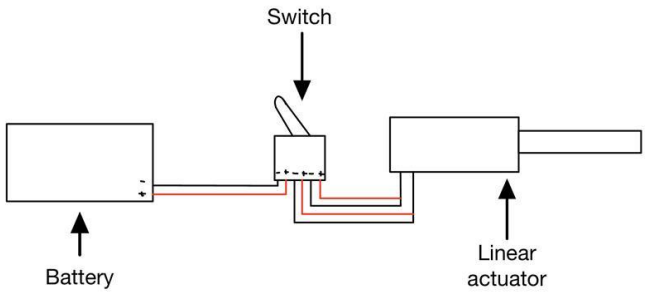

Figure 9: Wiring diagram for the electrical components

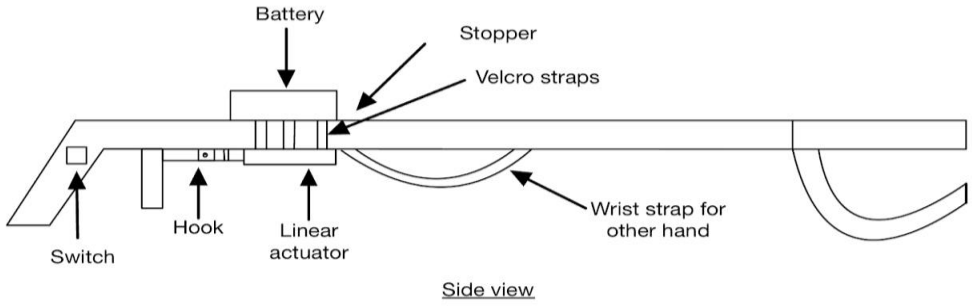

Figure 10: Sketch of final product

7.2 Testing & Validation

We equipped the handle to a gripper that currently available on market and try to use it to catch items that common in the daily life, for example, water bottles, key ring etc. Each time we grab an item, we wiggle the gripper to make sure it is firm enough to hold for a while without damaging the item. Finally, all items of varied sizes passed the test

8 Conclusions and Recommendations for Future Work

In conclusion, the biggest lesson we have learned is the importance of defining the problem correctly. We misinterpreted the client's statements and started off with an incorrect idea of what they were looking for. Thus, we wasted precious time trying to fix what we had started so that it could better match with the client’s vision. In addition, we also learned the value of good time management, since we never were behind schedule, and never had to rush to complete the weekly deliverables. If we had more time to work on this project, we would refine the 3D mount, since 3D printing is not always accurate with smaller intricate parts. In addition, we would also proceed with additional testing on different grippers.

9 Bibliography

APPENDICES

10 APPENDIX I: Design Files

The relationship of this document to other relevant documents is that they are all weekly deliverables, which we have created to help keep us organized and on track with our ultimate goal, which is to create a power grabber handle.

MakerRepo link to our project:

https://makerepo.com/jmaoulaoui/1212.power-grabber-handle-teamz13

Table 4: Reference documents

Document Name	Document Location and/or URL	Issuance Date
Project Deliverable B (1).pdf257 KB	Click the document name to access its contents	07/22/22
Project Deliverable D - Detailed Design, Prototype 1, BOM, Peer Feedback and Team Dynamics.pdf626 KB	^^	07/22/22

Project Deliverable E_ Project Progress Presentation.pdf2098 KB	^^	07/22/22
Project Deliverable F - Prototype 2.pdf	^^	07/22/22
Z13 - Project Deliverable G.1 - Business Model.pdf86 KB	^^	07/22/22
Z13 - Project Deliverable G.2 - Economics Report.pdf245 KB	^^	07/22/22

11 APPENDIX II: Other Appendices