Deliverable J

simpleTools

GNG2101 Section B01

Team B01 B

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Abstract

Our client suffers from Parkinson's Disease, which causes simple daily tasks such as writing, eating, and using hand tools to be difficult. Solutions for writing and eating exist, but are usually quite expensive due to their use of precision electronics or them being custom made. Our client asked for an affordable universal solution to his problem. Our task was to develop a screwdriver that could be used by our client even with his hand tremors.

What started out as a low fidelity prototype made with household items ended with a high functioning prototype that has solved the main issue that our client was having. The Second prototype used to communicate our concept in greater depth was 3D printed. The final prototype also had the handle 3D printed but had the other components ordered online or machined using a mill.

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1. Introduction

Our client suffers from Parkinson's Disease, and requires a low cost and lightweight tool that can help him to complete tasks such as using a screwdriver or utensil by compensating for or neutralizing his hand tremors.

In Canada alone there are 100,000 reported cases of Parkinsons, with an additional 6,600 cases each year. Bringing figures from the U.S. as well, the number of reported cases jumps to 1,000,000. The creation of a successful tool will help to alleviate the issues of patients with Parkinsons with a lower price point than other methods available.

In terms of our final prototype, the price point of the tool comes out to be roughly $40-50, which is significantly lower than the other benchmarks used, whose prices were upward of $150. In addition, the tool itself is as simple to use as a normal screwdriver, with the only difference being the mechanical changes made for ease of use for affected clients.

2. Manual

Important Features & Function:

The prototype is designed to assist clients suffering from Parkinson's Disease who wish to utilize tools by mitigating their tremors while operating them. This is accomplished with the following features:

- Isolated Shell to reduce the effect of tremors
- Interchangeable and magnetic tooltips
- Dampeners to improve durability of tool and further mitigate tremors
- Key attached to inner rod, which allows the toolhead to engage properly

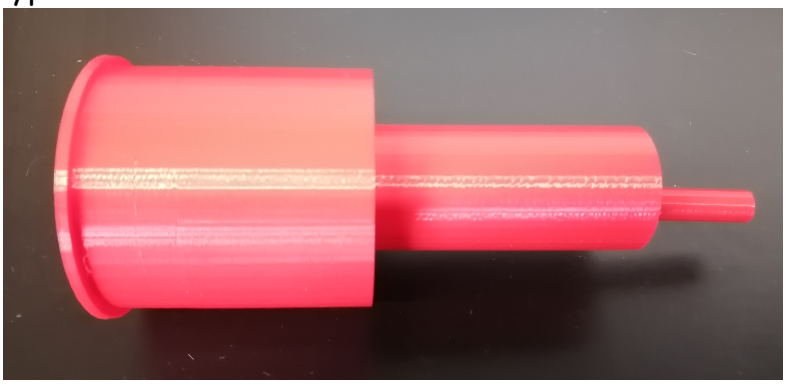
Capabilities:

Metric	Units	Ideal Values	Prototype
Width of Grip	cm (diameter)	=4	5
Cost ($)	CAD	<100	16.01
Total Mass	g	<500	120
Preparation time	s	0	0
Modularity	list	all	all
Leeway in Movement	cm	<0.5	<1
Softness of Handle	subj.	5	1
Subtle Design	subj.	5	3
Compatibility	binary	yes	yes

Production:

The first prototype was created just by using elastic bands, a paper cup and a broken dish washing sponge. While very low fidelity, it was enough to show to our customer to communicate our idea, which he approved of. We then consulted our TA for advice on how to dampen the vibrations in our screwdriver and he helped us develop other ideas we incorporated such as the key.

The second prototype was modeled using solidworks and incorporated the shell and shaft being two seperate pieces. It also included the key at the base end of the shaft that engages shaft with the torsion motion of the shell. After doing some testing with this prototype, we decided to include a previous idea we had into our next design which was balancing the tool in the middle to dampen the vibrations. This was found to be much more effective with foam rather than just the foam on its own. The client also provided feedback on this model expressing that he still liked the direction the project was going in. He did however request that the handle be made a bit slimmer. This feedback was incorporated in the final prototype.



The final prototype was of much higher fidelity and required the most complex production of the three. The shell of the screwdriver, along with the cap, were created using the Solidworks program and then 3D printed. The tool shaft was ordered on Amazon and then shortened by cutting it using the bandsaw until the desired length was achieved. This required a bit of trial and error in order to find the centre of mass with the key and tool bit. The steel key was cut to the required dimensions using the mill machine and then a hole was drilled using the drill press. To attach the key to the tool shaft, the end of the tool shaft was roughed up using coarse sandpaper and then connected to the key through the hole in the key. A metallic glue was used to bind the shaft and the key together to ensure they would not separate. Finally, cotton and foam tape were placed on the inside of the shell to act as the dampening system.

Operations:

Step 1: Insert tool bit into the magnetic bit holder
Step 2: Attempt to steady hand to line the end of the tool up with the screw
Step 3: If the user has one steady hand, they may grab the extender for additional stability
Step 4: Once the bit engages with the screw, the user may release the extender
Step 5: Tighten or loosen exactly the same as a regular screwdriver

Troubleshooting

How do I change bits?
To change the bit, pull up the orange collar to release if there is one already inside, then exchange for a different one.

How do I replace the drill bit extender?
Unfortunately, the screwdriver depends heavily on being balanced, and cannot be replaced with a regular drill bit extender as they do not come with a counterweight to allow the tool to stay balanced.

My bit does not fit, what do I do?
The tool is designed to fit a standard sized bit. As a result, any specialty tool bits that do not follow standard dimensions may not fit. We suggest using a different tool bit.

Safety Precautions

Choking hazard. Contains small parts. Not intended for children under 3 years. Adult supervision recommended when used by children.

3. Conclusion

In retrospect, various improvements could be made during production. With the construction of the tool, allocating more time to generate more prototypes to generate a better product, as well as having a more stable and certain way to determine the center of mass of the centre rod would have both been greatly beneficial to an improved final product.

For future endeavors, the next course of action would be to proceed to further test the tool with other clients, as each one would have a varying degree of tremors in varying locations. In addition, a patent would also be something worth considering should this project turn out to be larger in scale.

References

Link to project through MakerRepo: Click here