



The Cover Hinge

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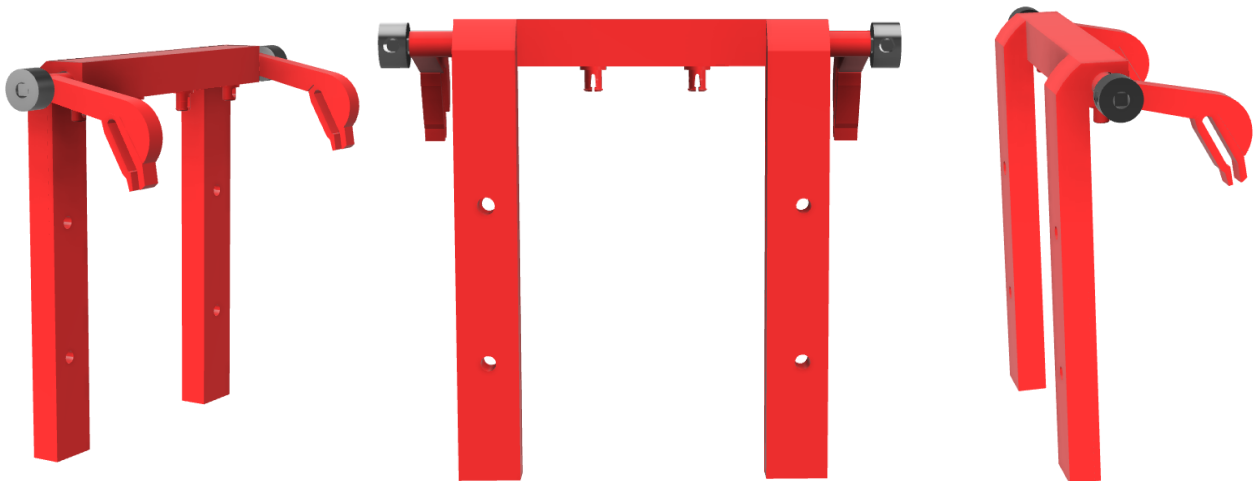
Chapter 1 : Introduction

Brain covers are a vital accessory for keeping the brain safe and in good condition, but there are many situations where you would need to remove it from the robot. For example, testing a singular motor, or switching from VEXnet to Bluetooth.

Every time you remove the cover from your robot, you risk losing it. In the past year, I've seen so many brains that have no cover or shield (including our own). We found that it was a huge risk after our screen was scratched.

That is why we came up with The Cover Hinge. The Cover Hinge is designed to make sure the cover never completely leaves the robot while still allowing access to the brain screen. It's a lightweight and simple hinge design that was modeled in Autodesk® **Fusion 360™**.

The Cover Hinge rendered in Autodesk® Fusion 360™



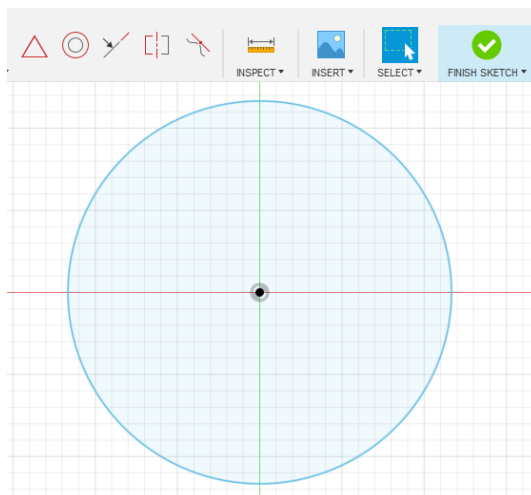
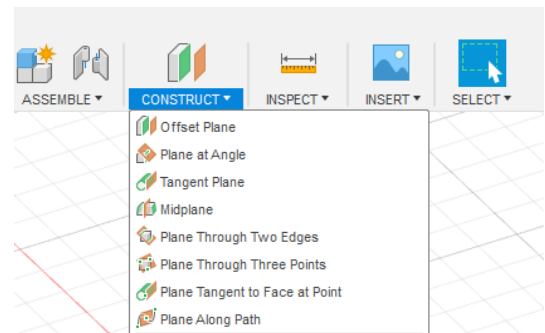
Chapter 2 : The Basics of CAD

What is CAD?

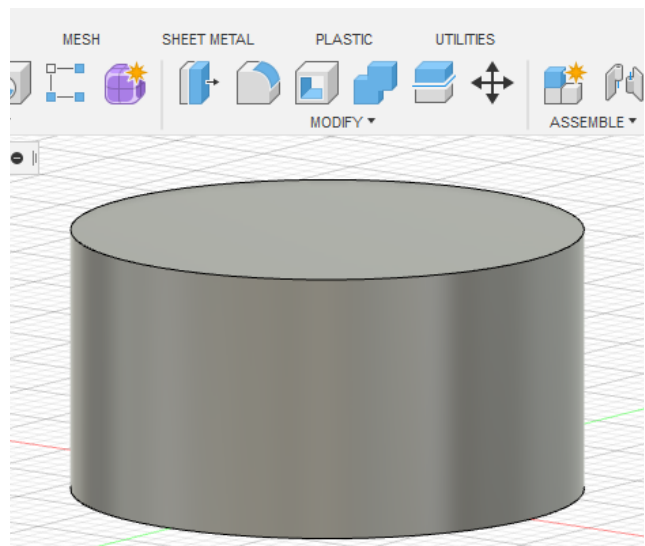
CAD stands for Computer Aided Design; it is a tool that is commonly used to create 2D drawings and 3D Models. Engineers use CAD to design and create products, as well as test them in simulations before creating them in real life.

Tools used during modeling with CAD

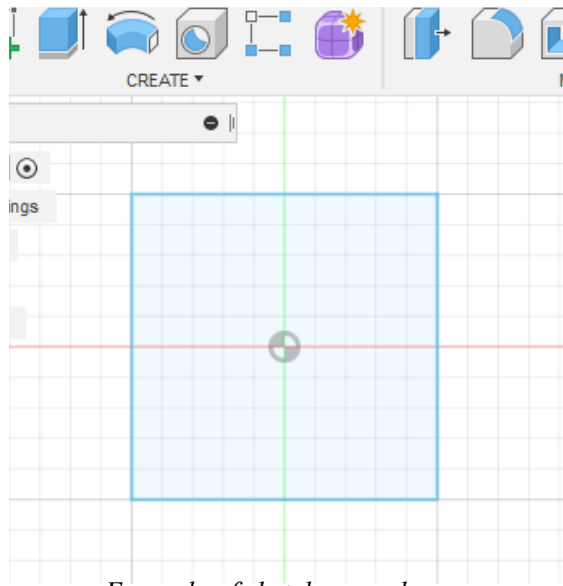
One of the tools that is essential to being able to model with CAD is the construct tool. This allows you to create a plane where you can create a 2D sketch that can become a 3D model. I also used the hole tool a lot.



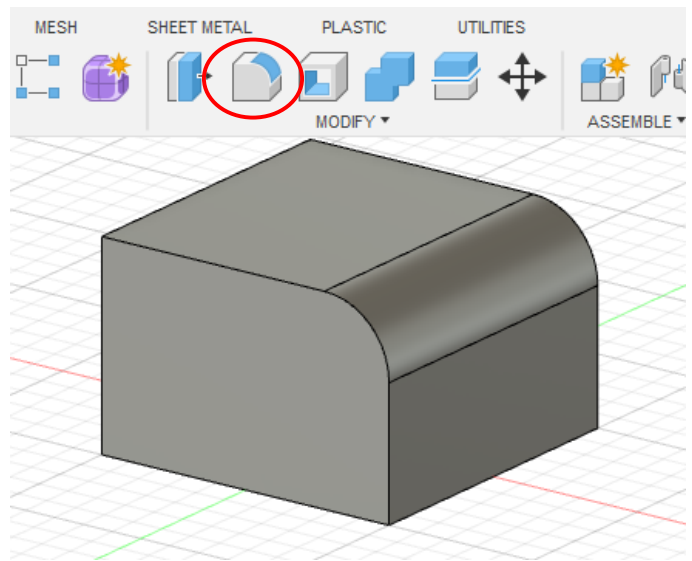
Example of a sketch created on a plane



Sketch after being extruded to create a 3D Model



Example of sketch on a plane



Sketch after being extruded and filleted.

To complete this online challenge, I used version **2.0.12888** of Autodesk®

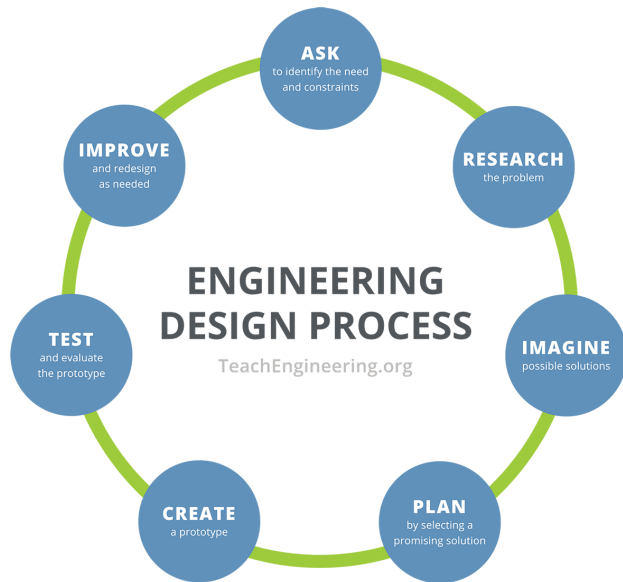
Fusion 360™ on the Student Plan.

Chapter 3 : The Process

The Body

The first thing I needed to do after figuring out my issue was **research**.

Research is a vital step in the **EDP (Engineering Design Process)**. I looked up



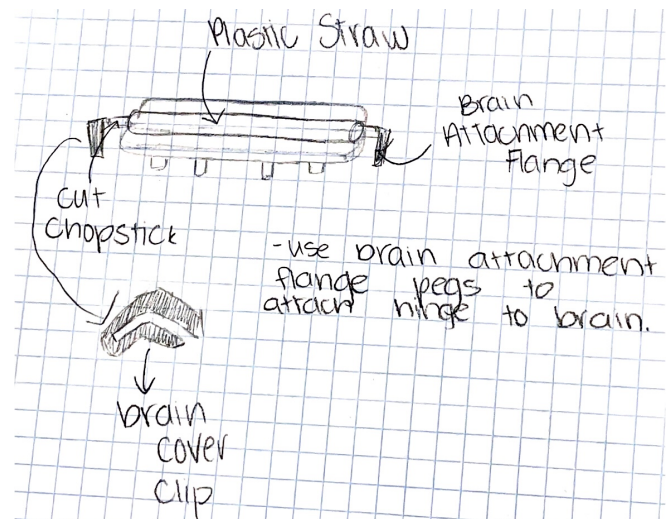
pictures of hinges and slides to see how people solved similar problems.

After doing my research, I decided to move onto the next step of the **EDP** which is **brainstorming**. There were a few **solutions** to the brain cover issue:

we could create some sort of linear

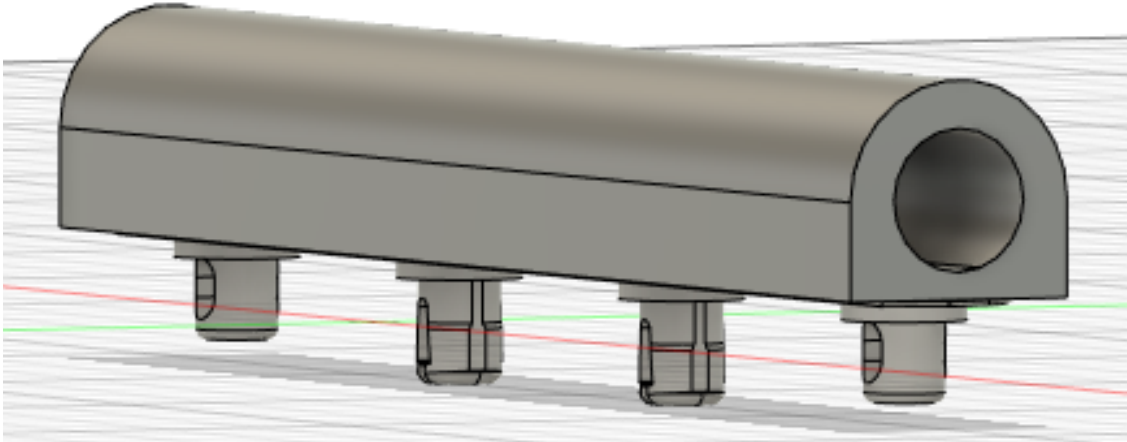
slide that would attach to the cover and the brain, we could make a hinge, or we could fixate it to the brain using some sort of adhesive.

After evaluating the **possible solutions**, I settled on a hinge design. I came up with a design and sketched out a **prototype** that could be built mostly out of easily accessible materials so that I could test without wasting filament for the 3D Printer.



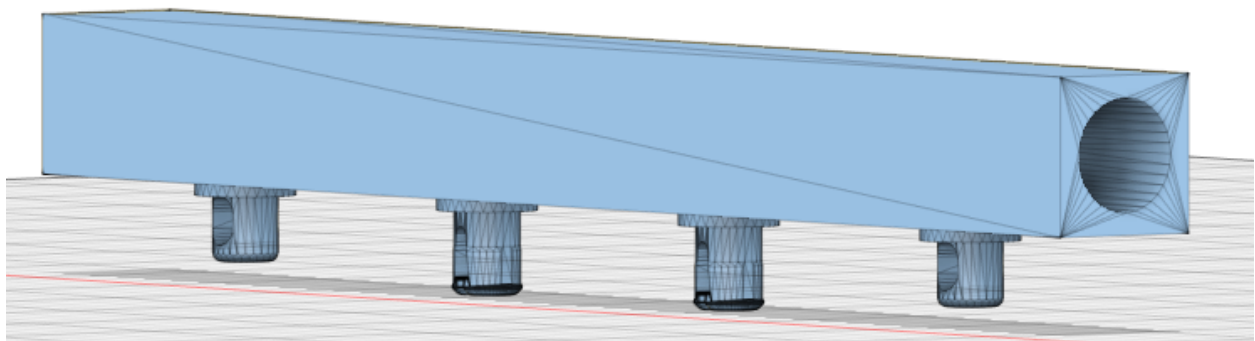
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My idea was to use the brain attachment flange to connect the hinge to the brain. In the very beginning, I had limited knowledge on how to use CAD so my first models didn't come out great and were very messy, and I didn't try actually printing it until my second **iteration.**



Second model made in CAD after learning basics ^^

Once I learned the basics of CAD, I was able to create a model that looked cleaner and was more **effective.**



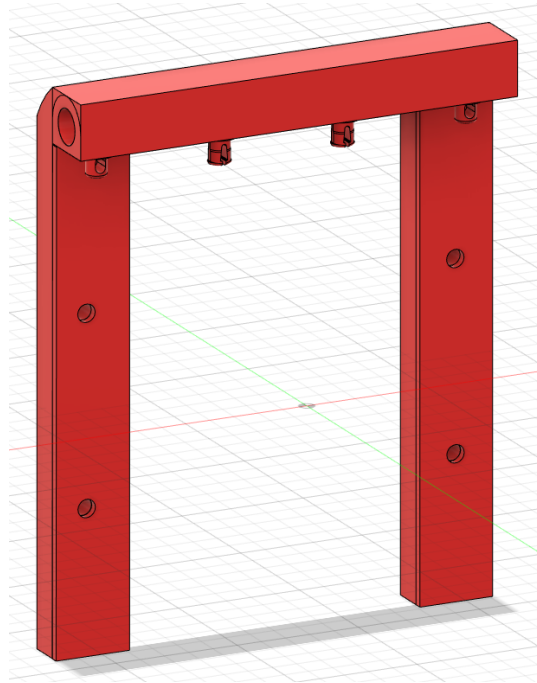
Final model I made in CAD with square shape for cleaner printing^^

After printing this and testing it out, I found that the weight of the cover caused the entire body to fall off of the brain. To fix this, I added arms that

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extend off of the back of the body that can be screwed in or through to attach firmly to the brain.

Changing the body to be able to directly attach to the brain added a lot of stability that was missing before



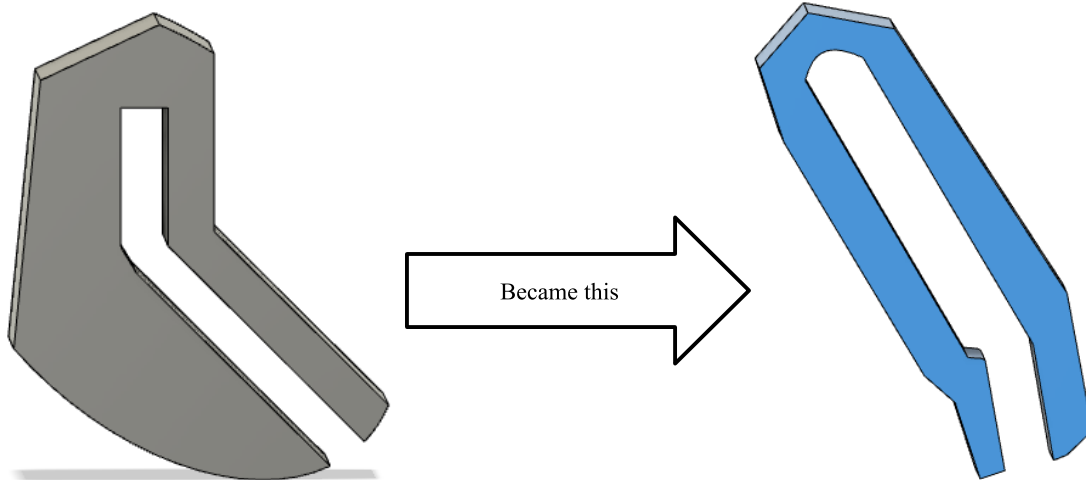
Body with new extensions^^

The Cover Clips

I had designed the body, the next step was the part that would attach to the actual cover. I had thought about taping poles on, however that is illegal and I wanted to do something that was almost entirely designed in CAD or used VEX legal parts. This left a couple options, some of these were; drill holes into the cover, use something like Velcro, or make and design clips. I didn't want a solution that would permanently damage the cover, and like I said before, I only wanted to use VEX legal parts. This left me with the idea for

clips. My first iteration was very chunky and had a lot of extra bulk, so for the second iteration I tried cutting down on the excess volume.

The first design I made, I made the beginning longer than the end which was the opposite of what I was supposed to do. In the second prototype, I also cut down on the excess material.



The first prototype of the brain clip

Second Prototype of the brain clip

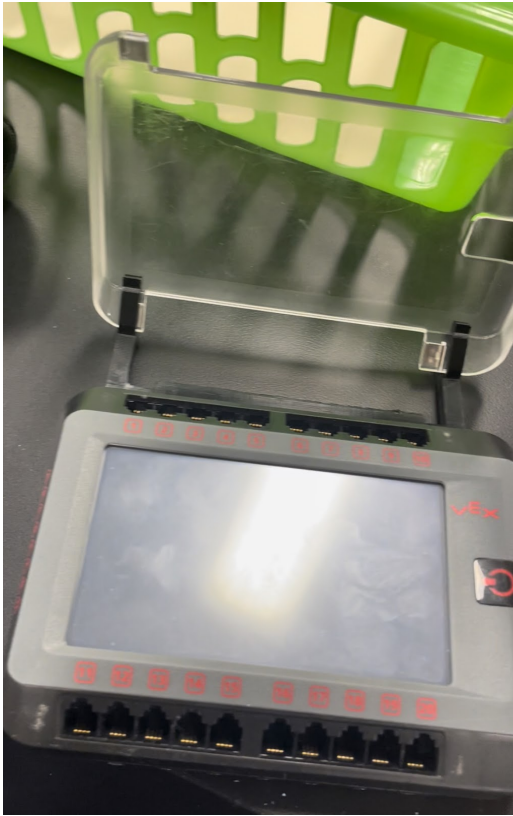


First print of brain clips



Brain clips tested on brain cover

Chapter 4 : How to use the Cover Hinge



The cover hinge can be printed in 3 separate parts; the clip, shaft, and body. After it is printed, insert a 5" shaft through the opening in the center of the shaft and clip and secure on both sides with shaft collars. Snap onto the brain and secure using the screw holes on the body and enjoy!



Chapter 5 : Conclusion

After completing this challenge, I gained a more thorough understanding of Computer Aided Design and learned how to create original structures in CAD softwares. This will help me in the future because CAD is a helpful tool for people in all professions. This challenge encouraged me to learn how to use CAD, which I have already been using outside of robotics to solve real-world problems.



More Screenshots of the Cover Hinge Rendered in CAD





Images of 3D printed Cover Hinge on an actual brain and cover

