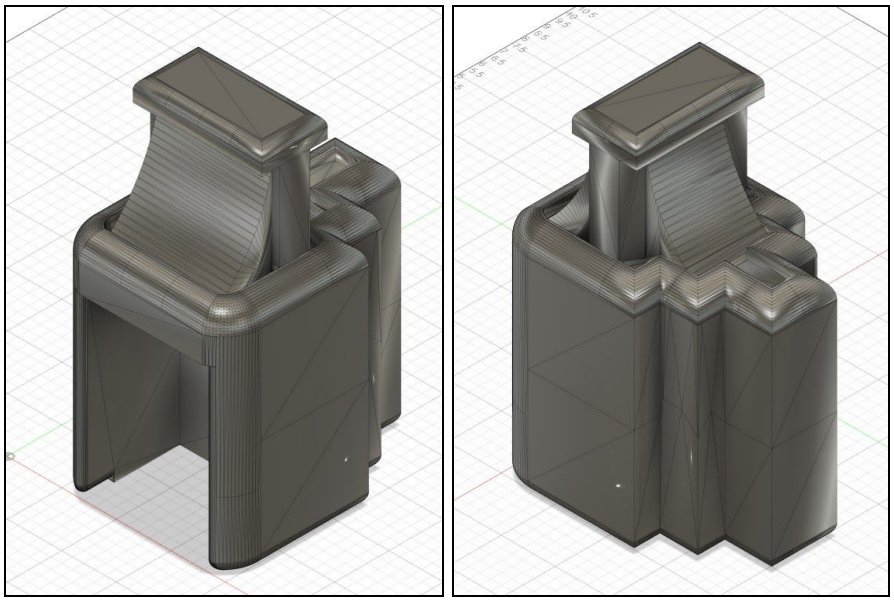
2021 Make It Real CAD Engineering Challenge
V5 Smart Port Inserts

Introduction

On a V5 Robot Brain, there are a total of 21 smart ports to be used by motors, the radio, and other electronics. At one time, our team will likely use at most 10 or 11 of these ports depending on our utilization of sensors, leaving many of the empty ports susceptible to particles such as dust, dirt, and sawdust, which can quickly build up on the ports and are tedious to clean all the time.



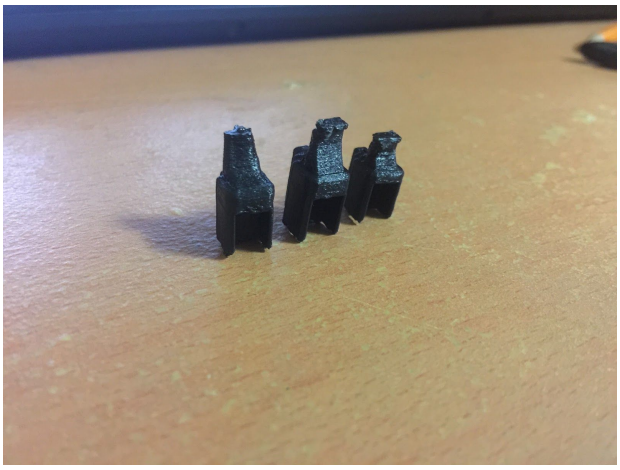
Final Design for Smart Port Inserts

Our solution to this problem is the V5 Smart Port Insert. This insert goes directly into any of the V5 Smart Ports that are not being used and traps out any unwanted particles from entering the ports. This also applies for V5 Smart Ports found elsewhere, such as on motors or controllers. The handles are made small enough that they don't interfere with other robot components but just big enough for fingers to pull them out without difficulty. The inserts are designed so that they can be removed without too much resistance.

Insert Inside V5 Brain

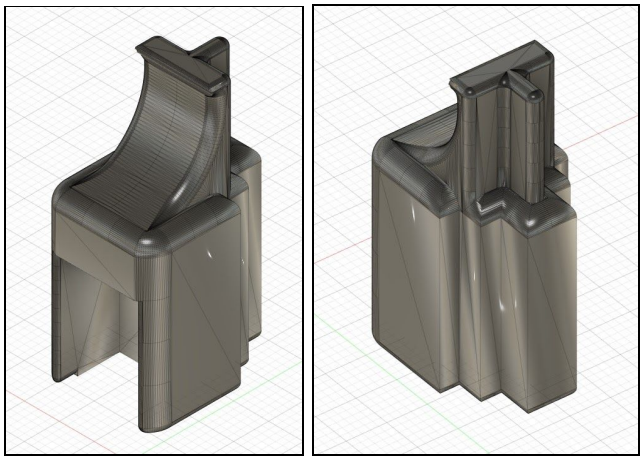
Iterations

Including our current design, we had 3 iterations for the insert.



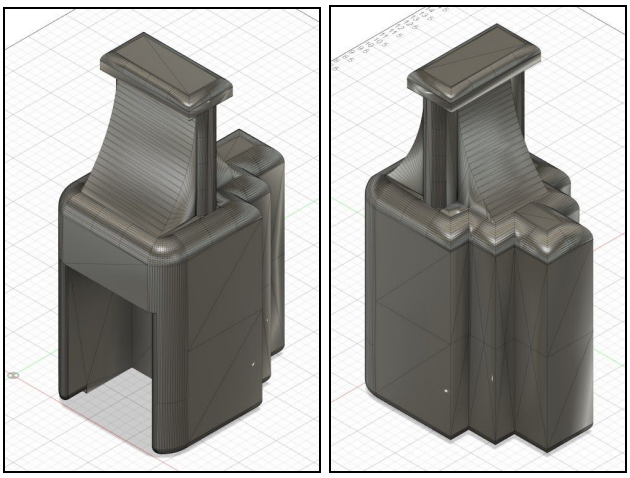
Iteration 1(left), Iteration 2(middle), and Current Model(right)

In our first iteration, we quickly realized that the plug's dimensions made it so that while the insert could fit in the smart ports, they were incredibly difficult to remove without the use of some form of pliers. Another factor in this is that the fragile handle was ineffective in creating enough grip for our fingers to pull it out, mainly because much of it was easily torn off shortly after it was 3D printed.



Iteration 1

In our second iteration of the insert, we created a simpler, but ultimately more effective handle that could bear the pressure of fingers without tearing off immediately. In terms of size, we scaled down the first iteration to roughly 95% of its original size, where the width of the insert better matched port measurements taken from a CAD model of the V5 Brain. In turn, we were able to insert and pull out the insert without too much difficulty, but there was definitely still some resistance. In addition, the handle stuck out a bit too much and would definitely be a nuisance.



Iteration 2

In our final design, we reduced the height of the handle, and scaled the size down to around 94.5% the size of the original design, which fits comfortably in the ports.

3D Printed Final Design

Software

We used Fusion 360 in modelling this part because of its range of tools for modifying different components which are not as streamlined in other applications. We also found it easier to render images using Fusion. As a starting point in making our first iteration, we measured a CAD model found on the Vex website to make accurate measurements of the brain, compared to using perhaps a ruler or caliper, which may not have been as precise when dealing with millimeters.

Conclusion

In conclusion, we have learned a lot from working on this challenge that we may not otherwise have learned outside of online challenges.We have also further developed our abilities in CAD and plan on possibly using Fusion 360 more in our design process. In post-secondary courses and future employment, being able to develop a functioning 3D CAD model from just an idea is an incredibly useful asset to have, as such a task is common in manufacturing and product design. In relation, CAD is also an excellent tool for communication and can be a common visual medium with which students can communicate with their peers, mentors, and others. We enjoyed partaking in this experience again this year and we hope to be back next year.