MAKE IT REAL CAD ENGINEERING CHALLENGE

FINAL REPORT

TEAM 70820X

INTRODUCTION

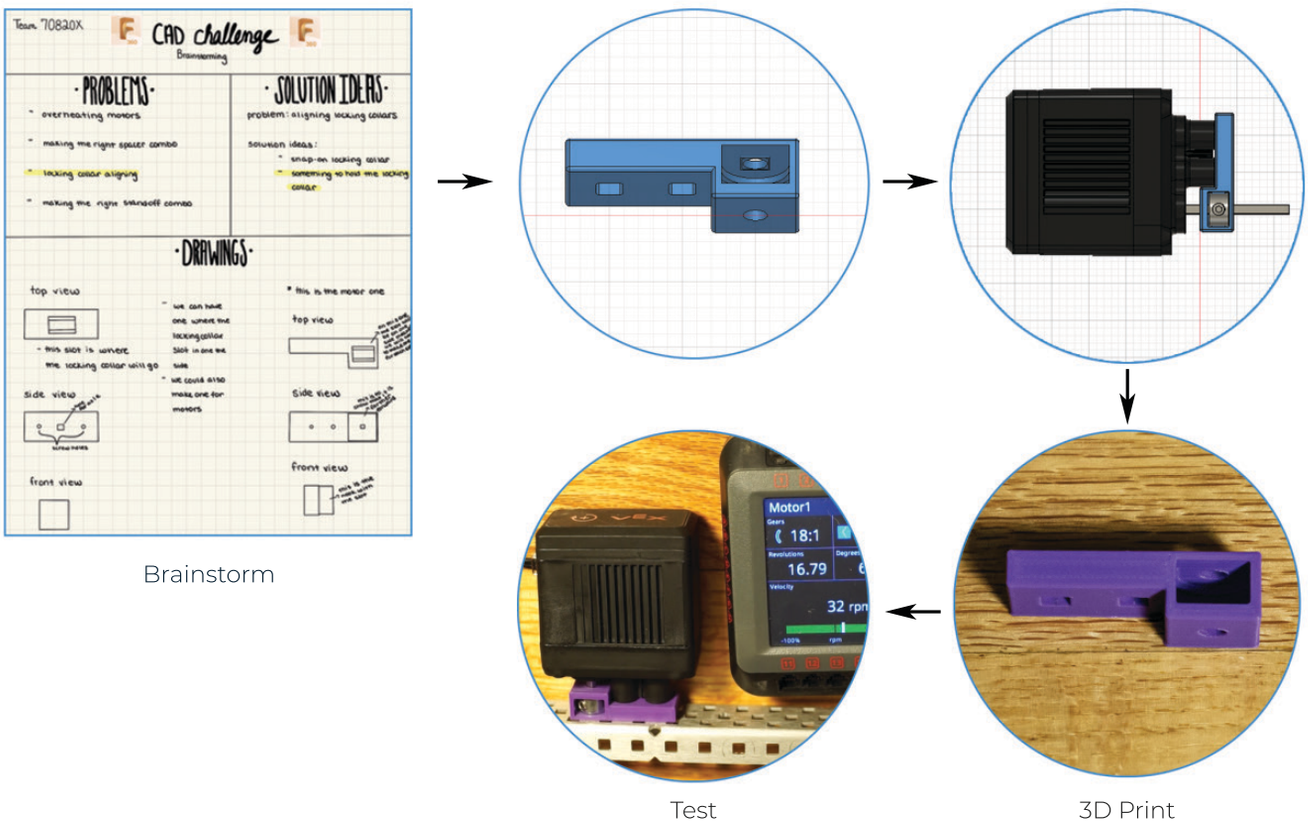
Imagine it was a match in your regional competition that would make or break your chance to get to World's. You put your robot on the field only to find that one of the wheels is not turning. Your alliance calls a timeout, and your team scrambles to fix it. Then, you realize that the locking collar fell off and the axle is out of the motor. But every time you slip on the locking collar, it twists and falls off. You finally get it on with seconds to spare, but you don't have time to tighten the set screw. You run to your match in a panic! Our team faced this situation last season. In the heat of competition, countless times we could not get the locking collar on the axle fast enough, inspiring us to find a creative solution.

We call our part the "Aligner" because it makes the builder's job easier by keeping the locking collar aligned so that the axle can slip through. This is how it works. The aligner has a slot where you put the locking collar in. When screwing it in, the locking collar stays in place so that you can insert the axle. There are four different configurations of aligners, two of which are made for axles with no motor and two are designed to clamp onto the motor.

Locking collars ensure that the axle cannot move; without them, the axle can slip out, making the wheels and spacers vulnerable to falling off. These parts, therefore, are absolutely critical, but can be difficult to put on under time pressure. This can make the difference between winning or losing a match and can cause a team great stress!

DESIGN PROCESS

After sketching out what we thought the part should look like we used Fusion 360 to create the part in CAD. We attach it to existing VEX parts (c-channels, axles, motors) to make sure that it will work when printed. Even so, we often miss something and will go through a few iterations before we get it right.



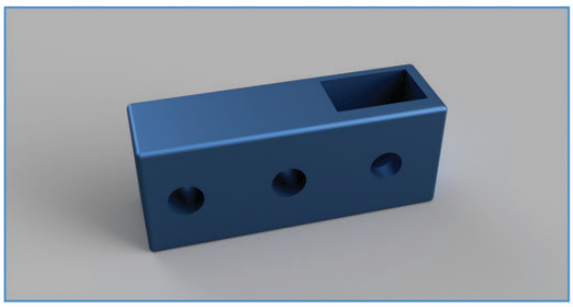
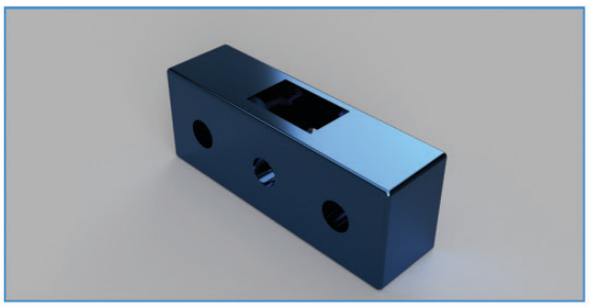
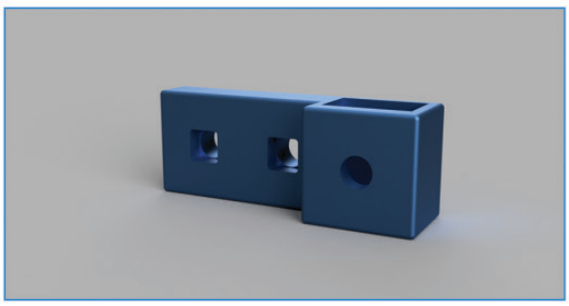
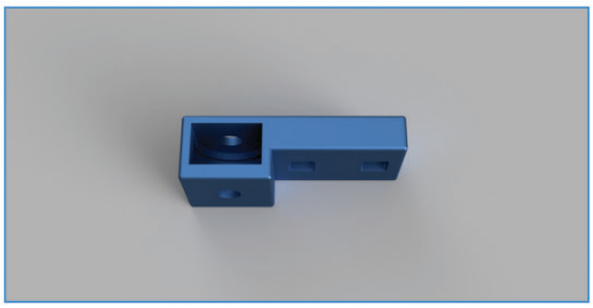
Brainstorm

PART DETAILS

Advantages of the Aligner

1. Reduces the time to attach locking collars
2. Frees your hands so one can push the axle and the other can line it up with the motor
3. Allows easy access to set screws to tighten the locking collar

There are four versions of the Aligner that function in different positions:

The first two configurations are meant to be put on sides without motors. These have a slot in the middle or the side for the locking collar to go through. They also have two screw holes that attach to the metal. To use the Aligner, simply put a locking collar in the slot, screw it in, put the axle through, and tighten. In the slot there is a ridge for the set screw to go along easily.

The next two configurations go on the motor. These have an L shape so the two screws can fit onto the motor. The holes on the Aligner are perfectly shaped so that the ridges on the motor can go in. The screw holes have different shapes on each side, giving the builder the choice of which side the axle should go through depending on their needs. The box with the slot for the locking collar is the same as the ones of the other version. To use, pop the locking collar into the slot, screw in the motor, put the axle through, and tighten.

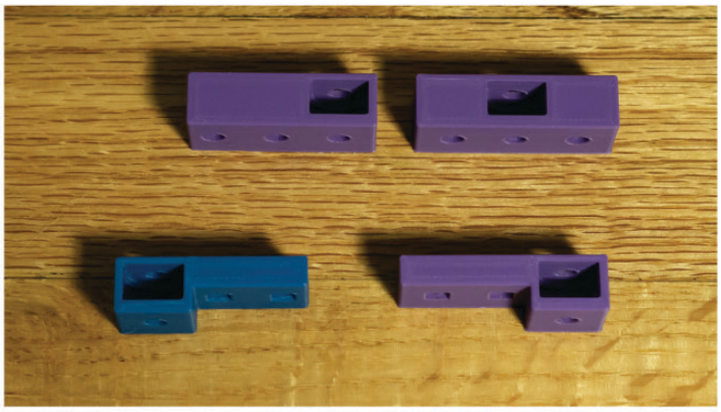
TOOLS

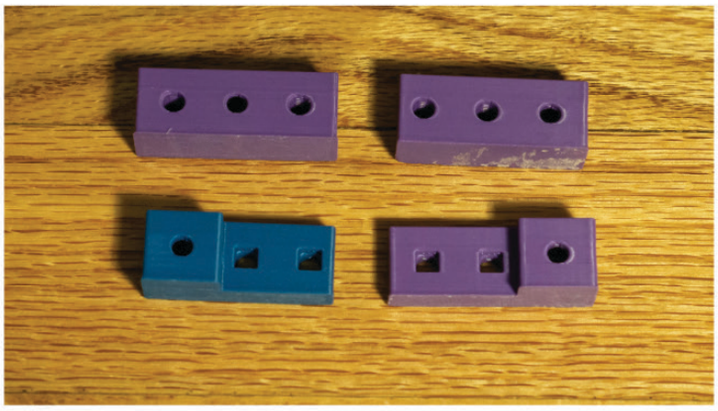
To make the Aligner, we used Autodesk Fusion 360 (v2.0.9313). First, we made a box by creating a sketch and extruding it. Then, we created sketches and cut them to create the holes and the slot. To make the ridge inside the slot, we used a locking collar and found where its set screw was so we could make sure it was in the right spot. In the one for the motor, we used a piece of metal to cut half of the screw hole to the size of one of the holes in the metal so that the clamps could attach into our part.

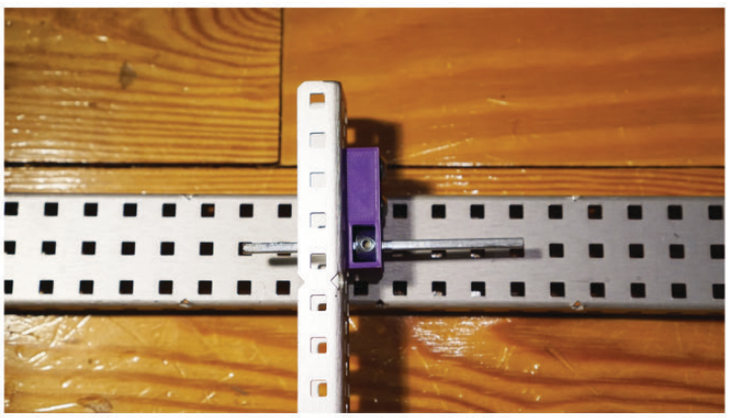
Once we made all of our parts we exported them to an stl file. Then we put them in Ultimaker Cura v4.7 and put the bottom of the parts to the base plate. Last, we printed our part on an Ender Pro 3D Printer.

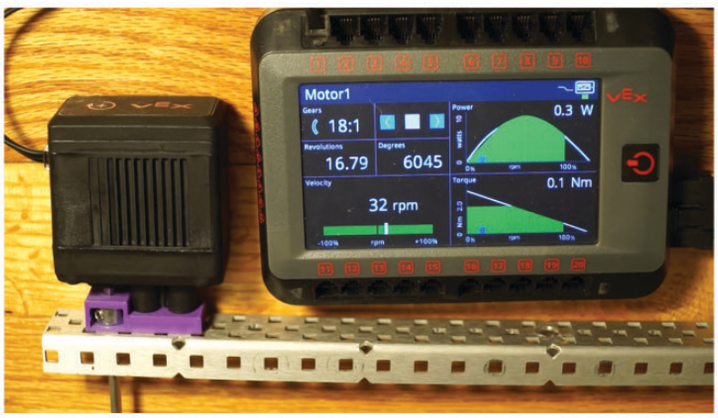
CAD is not only an effective tool for robotics, it also has many important applications that can be important for our future careers. One of our team members hopes to become a doctor someday. In medicine CAD is used to model parts of the body, make models of artificial limbs, and create implants. CAD helps researchers come up with medical solutions. If doctors are doing a tissue or organ implant, they can see how this new body part will function. Now, doctors can use CAD to map out the progression of diseases like COVID-19, so that they can see how it will impact the body.

FINISHED PRODUCT









CONCLUSION

This CAD challenge taught us that the first solution you devise is not always the best one. One of the first lessons you learn in robotics is that you don't get it right on the first try. We are constantly redesigning parts for our robot, making it more effective with each iteration. This is just as true for CAD. It took many tries to get this part right, and each time, we improved the design until we found the best possible solution.

Our VEX robotics team uses CAD to model our ideas before building with metal. This allows us to brainstorm and see if ideas will work before we commit time to cutting and bolting pieces together. We use the parts list feature in CAD to document the building process, which helps us remember exactly how to build it. It is like creating our own lego instruction manual. We also learned how to animate the parts, so we can see how they will work mechanically.

The Aligner is a must-have tool for a world-class robotics team. It can make putting locking collars on a piece of cake. Don't you want one for your robot?