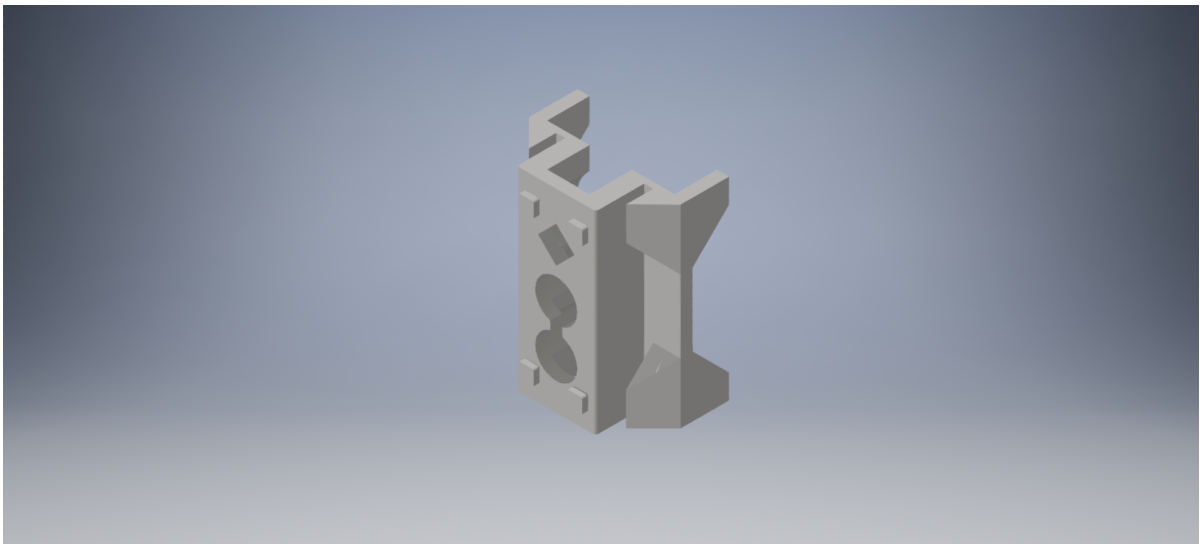
Make It Real Challenge Submission: V5 Motor Mount



Team BLRS

January 15, 2019

1 Introduction

The introduction of the new V5 System has required a shift in building techniques to best utilize the powerful V5 Motors. Two primary challenges came with the new motors - building around their larger size compared to the old 393 Motors, and building strong assemblies to handle to increase in power output.

Our team quickly noticed that using V5 Motors to drive gear ratios for increased torque would put the motor at risk of damaging its own legs or at risk of damaging the surrounding c-channel. Additionally, the normal issue of motor screws loosening over time was exacerbated by these more violent movements. We set out to design a component that would provide additional bracing for the motor and its mounting point, with the end goal to improve the robot's reliability over hours of practice and match play.

2 Component Design

One primary constraint with this component was the size of the mount. The increase in motor power with V5 Motors came with a corresponding increase in motor size. Assemblies that fit just fine with 393 Motors no longer were feasible with V5 Motors, especially with the 15" size limit in VEX U. Any solution that we produced for the mounting blocks would have to only go around the motor's legs, not between the motor and the c-channel, otherwise the motors increased distance from the c-channel would make integration with a robot assembly even more difficult. Additionally, including some sort of an integrated bearing block would be essential for high torque systems where there is not room for a bearing block on the motor's side of the gearbox.

The finished part design is compatible with mounting on 2 wide, 3 wide, and 5 wide c-channels or plates, but designed primarily for mounting on the center holes of a 2-wide c-channel (as seen in the below photos).

Figure 1: A mock assembly of the Motor Mount

Figure 2: A mock assembly of the Motor Mount

If desired, a green High Strength insert can be placed first in the printed part's square hole to serve as a bearing. The motor is placed in the printed parts so that its legs fit through the pair of connected holes and the body of the motor contacts the base of the part. The assembly is then placed with the c-channel flanges fitting snugly in the outer slots of the printed part, and the motor is fastened with bolts in the same manner as if the printed part was not there.

3 Modeling Process

The component was modeled using Autodesk Inventor Professional 2019, the same software that the team has used to model robots and 3D printed components for a number of years. Modeling this component used a number of different CAD design commands and built on our past experience with modeling components for the VEX system. The mounting posts on the component are a good example of this, they have been a staple of the printed parts that our team produces after they were originally designed through a series of test prints. For those mounting posts we took inspiration from the VEX Pillow Block model, but we fine tuned the dimensions for use with our 3D printer by printing a series of test models with different post sizes and fillet radii to find a good fit. It was a simple process to update the model accordingly due to proper dimensioning in the sketches for the model.

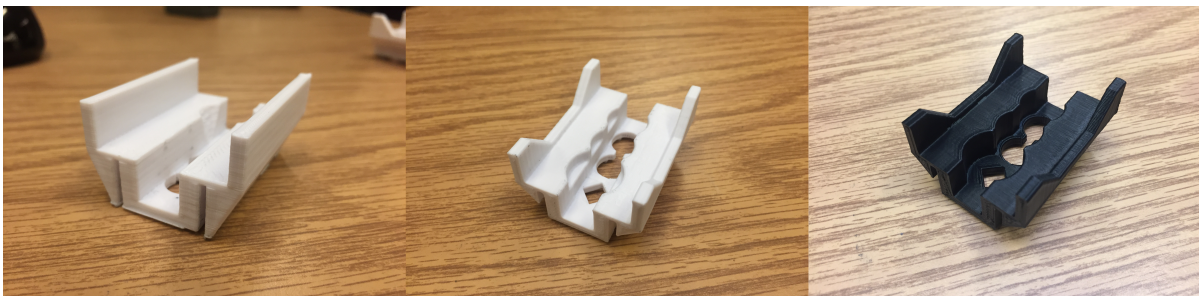


Figure 3: A series of test printing iterations, with the final version on the right

In most regards, we found that physical testing with a printed piece was the best way to ensure proper tolerances and piece strength. Creating an assembly in Inventor allowed us to find the ideal size for components such as the mounting pegs and the slots, and then

physical testing allowed us to tweak this value based on the resolution of our 3D printer. The motor mounts have been present on Team BLRS' robots for a number of months now, and have protected the motors' legs and surrounding c-channels through hours of driving practice and defensive play from other robots.

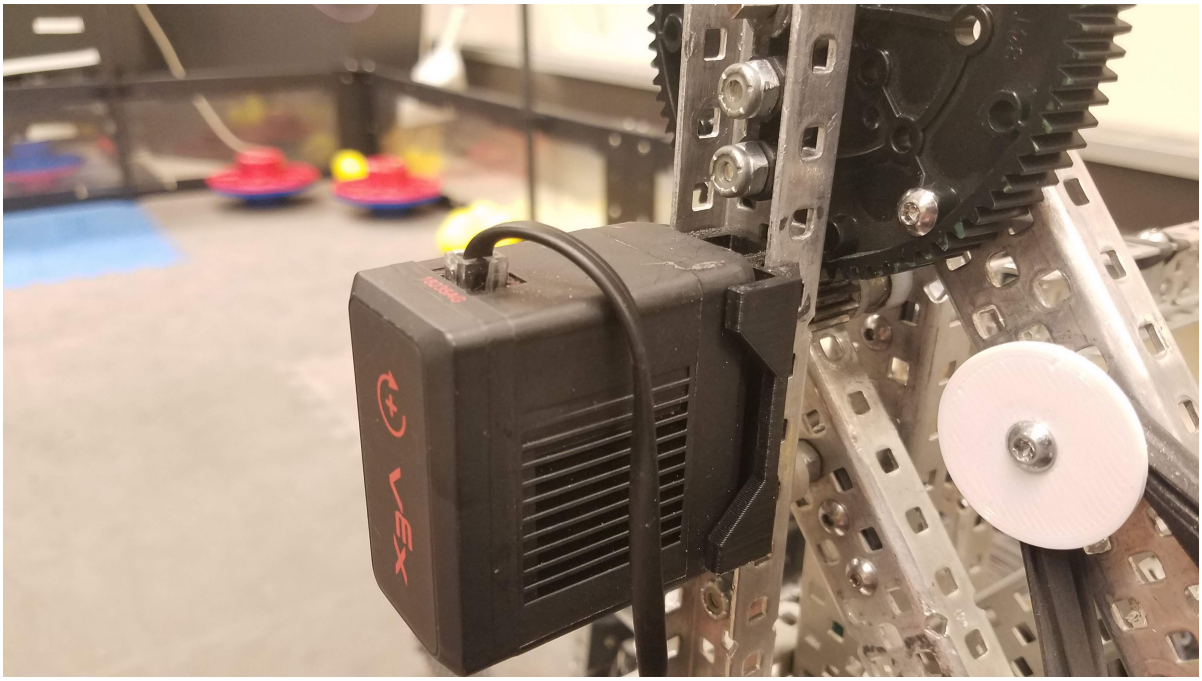


Figure 4: The Motor Mount in action on one of Team BLRS' robots

4 Conclusion

The V5 Motor Mount has been a very important part of Team BLRS' robots this season and will continue to be useful for many seasons to come. The component itself has improved the robots' reliability notably and, even more importantly, the skills learned along the way have improved the design process for the involved members of the team.

Autodesk Inventor Professional 2019 has proved to be a very important piece of software for our team's design process - the robots are modeled in Inventor first before being built and the 18 unique printed pieces on the two robots were modeled in Inventor as well. Many of the students on Team BLRS are studying either engineering or technology where CAD is

an important part of the curriculum. CAD is an important part of both Team BLRS' design process and its members' studies and future careers.