NYIT Bears in VEX U (Team NYIT3)
IEEE Student Branch at New York Institute of Technology
New York, United States
REC Foundation Online Challenges

Make It Real CAD: Wheel Locks

The NYIT Bears team from the IEEE Student Branch at the New York Institute of Technology in Old Westbury has competed in VEX Competitions in 2012. Every season, students join and students graduate, but there is a fundamental principle amongst our members: keep the legacy alive. By following our timeline, one can see that each generation of students is performing at a higher level of engineering excellence, and that is something we hope to continue.

In Nothing But Net, our team placed 14th in the world in regular competition, 1st in robot skills, received the Amaze Award. Our goal is to design and build robots that can tackle as many game challenges as possible. For without a good robot, chances of success are very low.

VEX challenges are great because every team has the same opportunity to succeed. Every team begins the year on equal footing because everyone must use VEX approved raw materials and the game is released at the same time. For VEX-U teams, we can use 3D-printed parts within the volume of 3"x6"x6" which improve our odds of success. 3D printing is especially useful this year because of the irregularly shaped game objects.

Important challenges for this year's game are many. We only have one robot, we want to try to hang, and we need to manipulate two very differently shaped scoring objects: a star and a cube. 3D printing will greatly help us in all areas.

For every single robot we design, the most important thing is the chassis and drive train. If the robot cannot move, the robot cannot perform and it becomes a sitting duck on the playing field. Because we try to save as much money as possible, we try to reuse as many parts as humanly possible. One of these parts we try to reuse is the wheels, specifically the 4" wheels, either omnis or regular ones. If we think about it, the wheels bear most of the robots weight during its lifetime, and as a result there is wear and tear on the square axle hole. For us, we noticed that the play in the axle resulting from years of use significantly affected our driving ability and our autonomous programming. To solve this issue, we tried to come up with a solution that would allow us to reuse the wheel, but not have so much play on the axle.

Our solution was the wheel lock. It is kind of like a sandwich – one slice of the wheel lock goes on one side of the wheel and its mate goes on the other side. A drive shaft bar lock is mounted on either side – because it is metal and the axle is also metal, there is little to no possibility of the axle eroding a hole in the shaft bar lock. Two screws combine the entire assembly.

The steps we used to make the parts are as follows:

1. Get a 4” wheel, take measurements of the spokes, and design a piece to fit
2. Using Inventor:
    i. Design
        a. Issue: wheels have too much play
        b. Reason: the hole for the axle is eroded
        c. What can we do?
        d. Solution: Make something that can hold a drive shaft bar lock in place
    ii. The engineering process
        a. Measured the distance and size of the spokes
        b. Measured the thickness of the wheel and divided by 2 for the depth
        c. One Inventor file part was created for one side of the wheel
        d. Using the same measurements, another Inventor file part was created for the other side of the wheel
        e. We made these parts by using 2D sketches and extrusions (3D representations of the 2D sketches) of these sketches
        f. The 3D parts were placed into an assembly file to assess for future potential modifications
    iii. The manufacturing and distribution process for this part:
        a. Convert part file to STL files
        b. Convert STL files to printable files compatible with the 3D printer
        c. Printed pieces can be used on the robot

The concept and design of the wheel locks are extremely useful. We had difficulty coming up with an idea for this Make It Real CAD Challenge because there were so many different possible engineering designs we could make, but we wanted to make something that would benefit our robots and our future team mates in the long run. The wheel lock is specifically designed for 4” wheels – we mainly use omnis so this is what we designed them for. The challenge was a lot of fun, but there were many trials and errors because the size of the attachments needed to be exactly right so they were a snug fit. One thing we would modify for these wheel locks is to make it so that it is symmetrical: give both pieces little tabs and put a drive shaft bar lock on both sides.

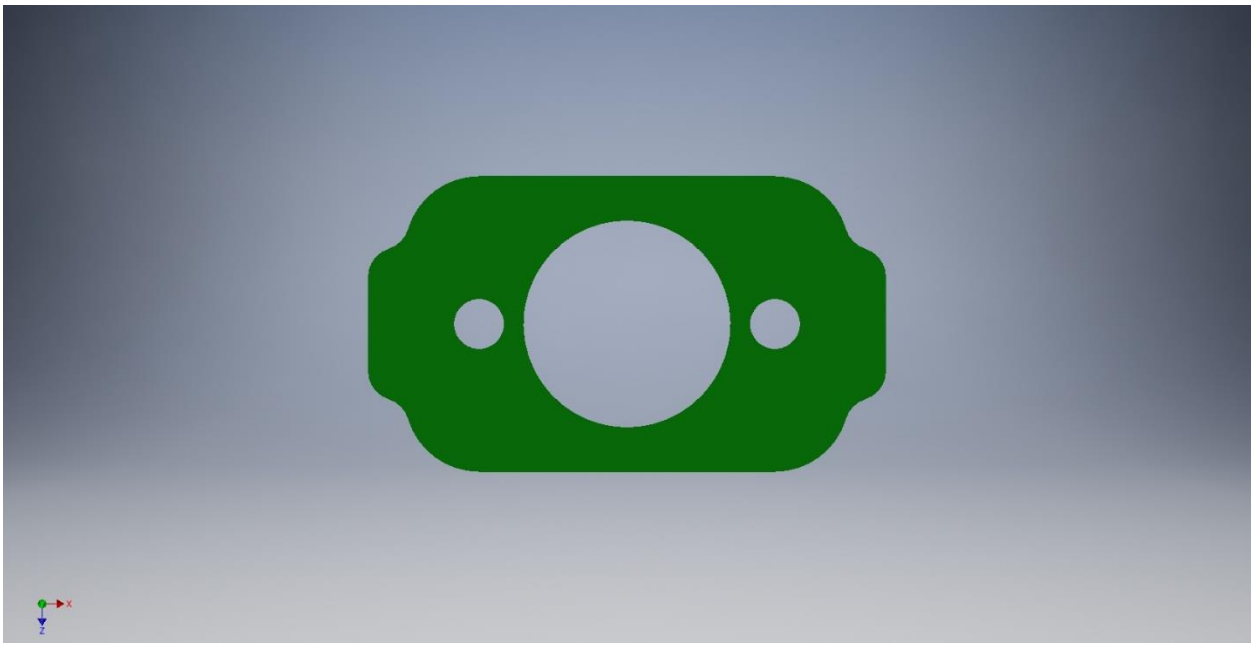

Figure 1: View of Wheel Lock Attachment for the Drive Shaft Bar Lock

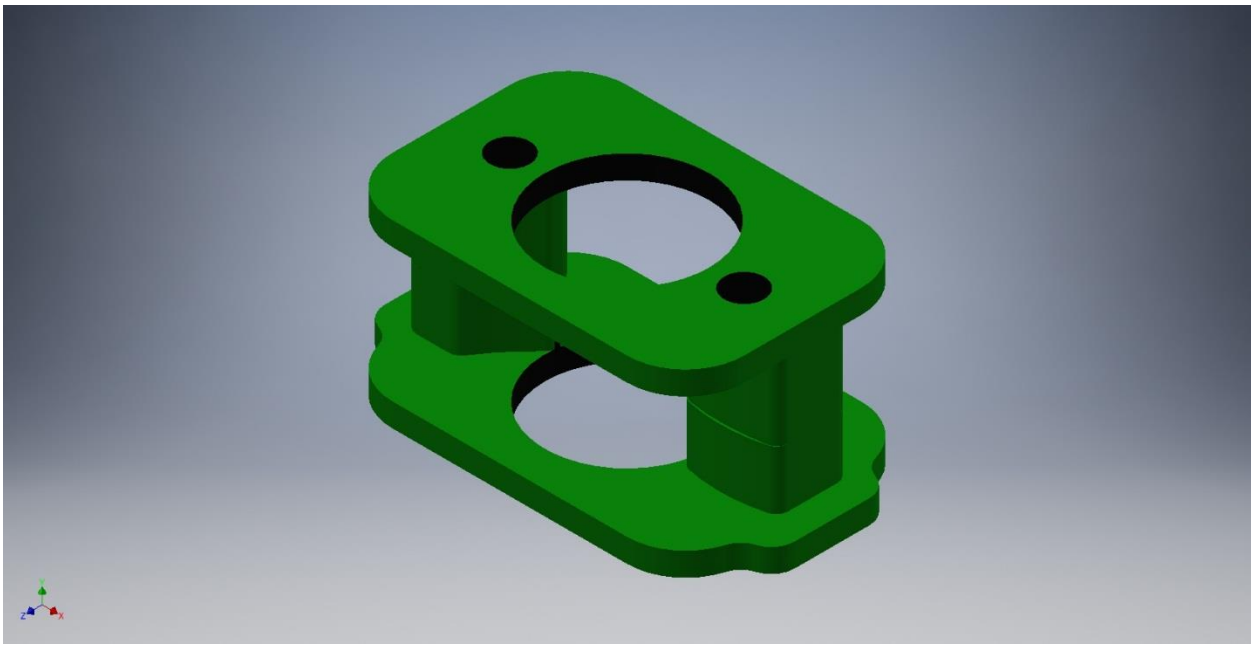

Figure 2: Orthographic View of Wheel Lock Attachment

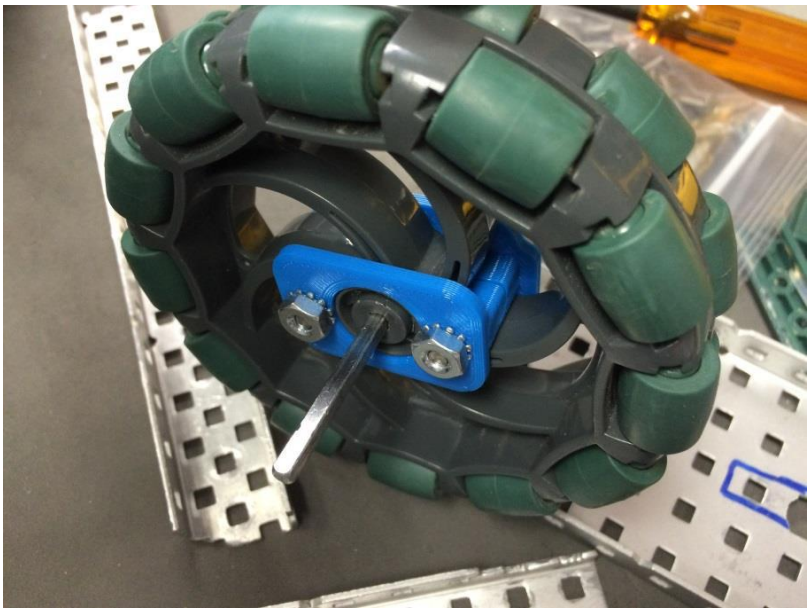

Figure 3: Wheel Lock Attachment on 4” Omni Wheel (Shaft Bar Lock on other side)