CRANK IT UP: ROBOTICS CRANK

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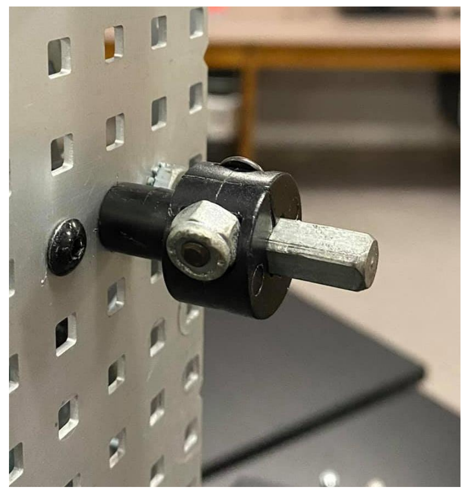
THE PROBLEM

When I have to work on my robot and raise or lower the lift, it is sometimes difficult for me to grab the axle to turn it. Most of the time, I cannot use the remote control or motor, especially if I am redesigning parts of my robot. One of my coaches always says, “For every problem, there is a solution.”

So the question we needed an answer to was: How can we easily raise and lower a robot lift when we are designing the robot?

THE SOLUTION

My solution: a detachable crank

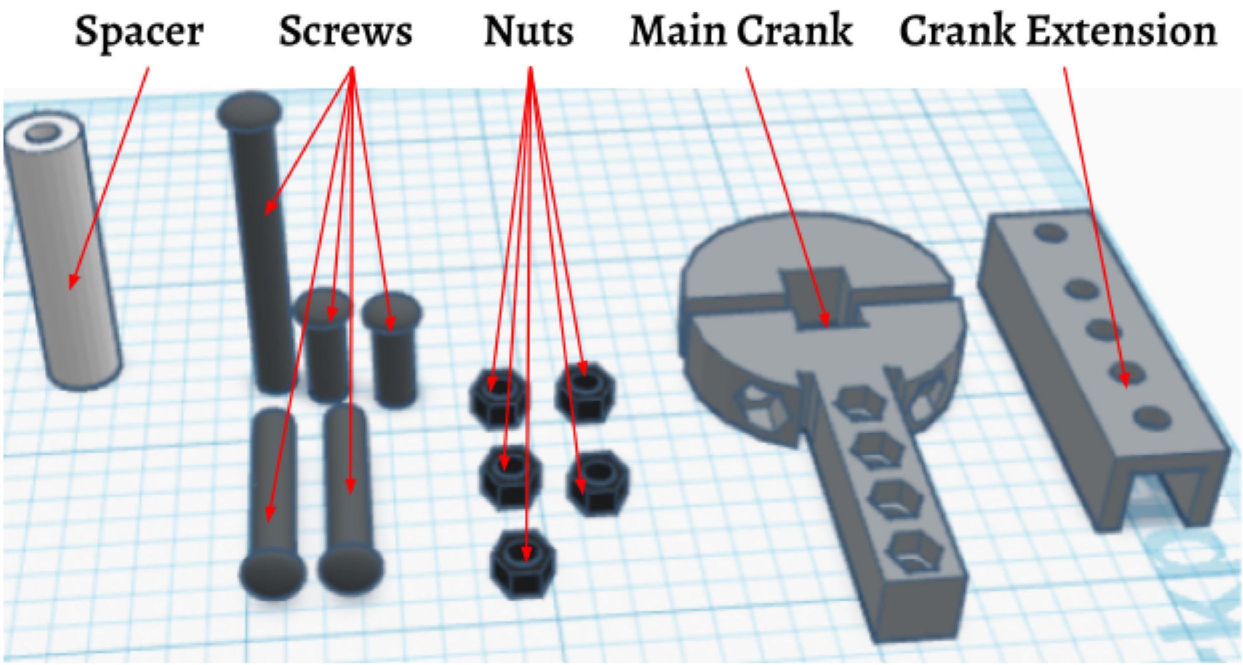


The design process went through many modification attempts. My first solution was to use a pair of pliers, but that did not work well. My coach would have a hard time raising or lowering the lift and would ask me to do it for them. I also found the pliers hard to grip the axle, so it would sometimes take too much time. I also noticed the pliers were scratching the axle.

On my second try, I replaced the existing high-strength axle with a slightly longer one. I added a 6-tooth sprocket to see if that would help me turn the crank. It did not work well either. So I used the sprocket as a spacer and added a high-strength locking collar to turn the axle. It worked better than pliers, but was still a little difficult. Finally, my coach was still having problems turning the high-strength locking collar, so they asked me if I could find a better solution.

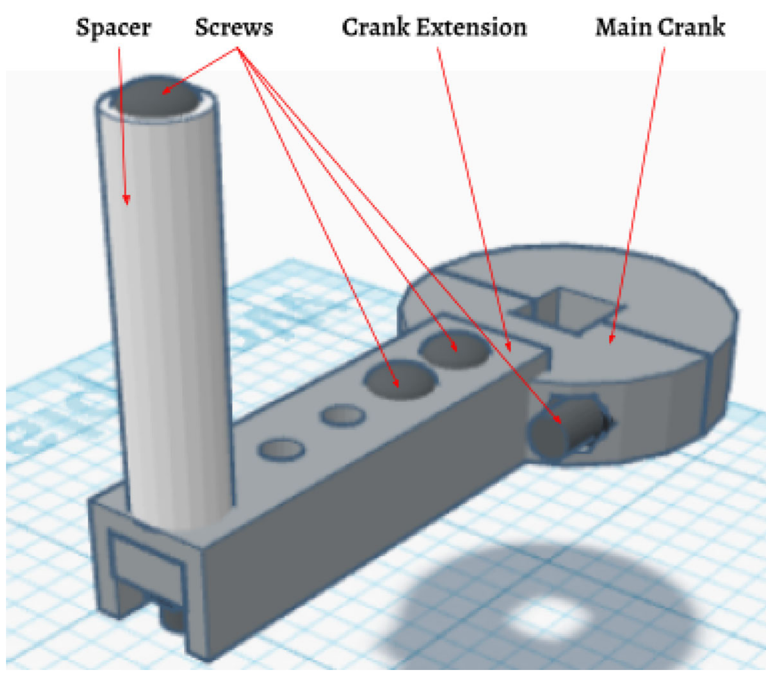
With the sprocket, turning the axle hurt our hands because there was not enough room to grip the sprocket easily. With the locking collar, our hands would slip because the surface was too smooth. So what supply did we have handy that was not too rough and not too smooth? A high-strength gear.

First, I replaced the high-strength axle with a longer one and added spacers. I tried different-sized gears until I found one that was not too big where it got in the way of the air canisters, and not too small where I had trouble gripping it. This was a better solution than the other ones I tried, but it would still hurt my hands sometimes when I would need to constantly raise and



lower my lift. It would also take longer than I thought.

That's when I came up with my final solution. My part is a crank that fits on a high-strength axle. You can also put a metal pinion inside the square hole to turn it to low strength. The main crank can be taken apart to fit inside a robot. The main purpose of the crank is to go on the outside of a robot, and attach on a high-strength axle that sticks out. The crank extension is used to connect the spacer. The spacer is used as a handle to spin the crank. The crank allows the axle it is on to rotate easily. I currently use a 36-tooth gear connected to a 3-by-1 C-channel.

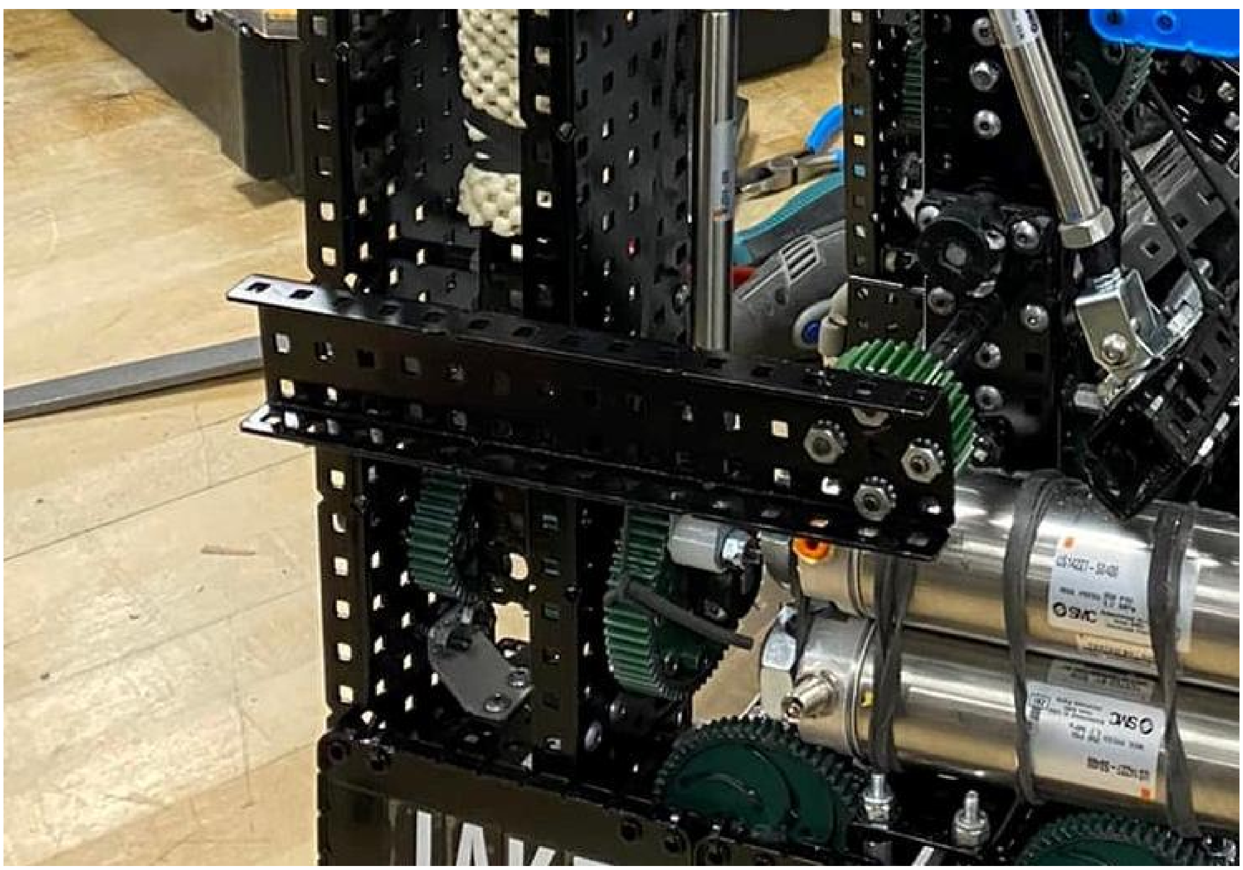


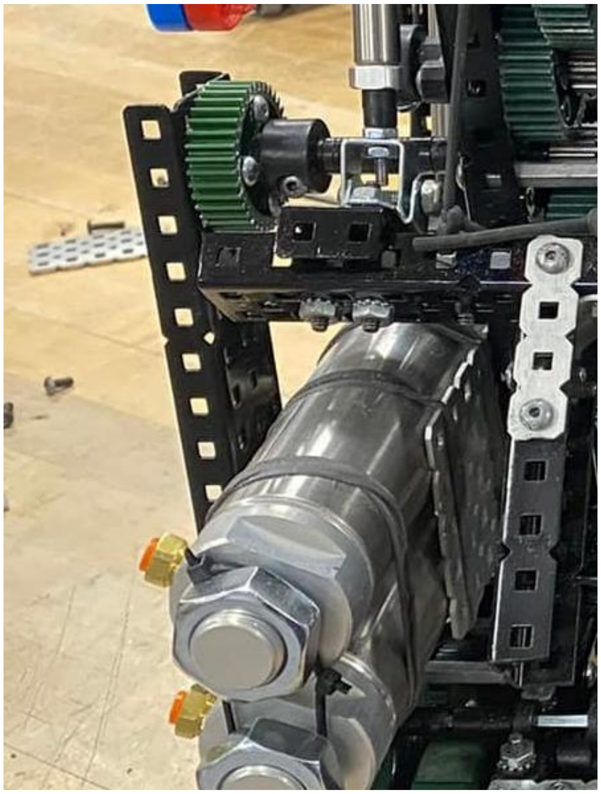
I used Tinkercad to create the model. My school Chromebook does not have any other 3D software on it yet. I used the 3D basic shapes to make the design. First, I made the main crank by shrinking a cylinder and adding a square hole in the middle. I then made a rectangular prism for the extension by adjusting a cube. Next, I made the extension by making a slightly larger rectangular prism. I copied and pasted the main crank's rectangular prism, and made the copy a "hole" piece and cut out a section for the crank extension.

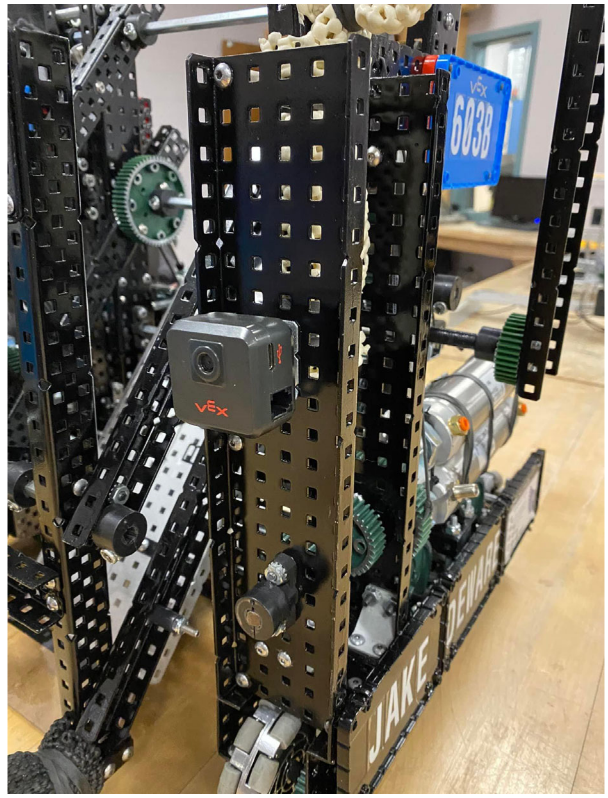
Once that was done, I took a copy of the extension and made that another "hole" piece. I used that to cut out a small section of the main crank. That allows the crank extension to fit easily on the main crank. I then made the screws with cylinders and half spheres. I made copies of a screw, and made it another "hole" piece. I used that to make all the screw holes. I also used it to make a hole through the spacer piece that I made with a white cylinder.

Next, I made the nuts by shrinking a hexagon and using the screw "hole" piece. I also made a spot for a nut on the extension. Lastly, I made a copy of the main crank and used a square hole to cut both of them. That allows for two separate pieces. The extension can come out more to make it longer, and the nuts are at the end of all of the screws.

This is what the final product looks like:







CONCLUSION

I learned a few things with this project. I learned more about Autodesk Tinkercad software and how easy it is to use. I learned more about the engineering process and how to use that to design a solution for the problem I had.

My teammate decided to focus on other sports and dropped out of robotics for this season. Because of that, and since I am a freshman in high school, I have had a huge learning curve this year in robotics. This includes learning about torque, gear ratios, the engineering design process, pneumatics, sensors, and more about programming. In the future, all my knowledge from these online challenges will help me in the future with other challenges, robot builds, and helping other students.