Linear Motion Gear Attachment

It took our team a while to come up with an idea for a new part to design. It seemed that all the necessary pieces were already made with VEX. Using the various plates and c channels you could create almost any structure, there were already worm gears, 90º angle gears, and clutches. It seemed that all the things necessary to creating these robots were available. Then we decided to think outside of the parameters we had been making our robots. Just at the beginning of this season, we had just gotten the pneumatics set. Another member of our team and I had been experimenting with them, trying to figure out if they would work. After about a week we gave up, the pneumatics were not fast enough. That is what reminded me about our predicament. I realized that the only powered linear motion that VEX had were the slow resetting pneumatics. After some research online about powered linear motion, we came up with a solution. The piece we would design could convert the rotary motion of the motors into linear motion systems. There were two ways to do this, either with a crankshaft mechanism or a yoke mechanism. We started by designing both. As we went through the iterative process, we ended up ruling out the crankshaft because there were too many moving pieces that might get caught and break the piece. The yoke design was the simple, realistic fix to our problem.

The way that the yoke is designed is that it is placed right near a gear and a pin attached to the gear. Since the yoke has a long slot, when the pin spins on the gear it pushes against the short side of the slot to move the pistons up and down, and it slides up and down the slot. This part can be used to make a faster acting powered linear motion.
For instance, we created a robot that could play the piano and this linear motion piece was perfect to its development. We wanted a robot that could slide up and down the keyboard to hit the different keys in a song. We thought of just attaching a finger mechanism to one of the wheels, but we realized that it would never spin all the way around before we needed to press the finger again. Additionally, we needed a faster-moving piston. The end product of the piano finger machine is in the designs below. The robot can slide up and down the piano on the two rails and can spin the gear with the linear motion gear attachment, pushing the keys down. This application, however, is specific but we believe that there are many other applications that could benefit from a modular piece like this.

We used Fusion 360 for our design, a decision we made because Inventor did not work on our Apple computers. However, after a while, we found that Fusion 360 had some unique functions that suited our intended design well. Last year was our team's first time using Fusion 360. We started with simple methods for making our piece, but gradually found ourselves able to use more advanced techniques as we became more proficient at using the program. This year we were able to take advantage of more of the different functions that Fusion 360 has. We were also able to take advantage of the joint system that Fusion has and especially the animation. Fusion 360 was excellent in that it was easy to use as beginners with only one year of experience, while at the same time offering plenty of room to improve and try more advanced models. Last year the best we could do for animation was a turntable and an explosion. This year I was able to emulate the motion that the robot will take and also show how the linear motion gear attachment would work.

From this project, we learned mostly about simplicity and optimization. Our first idea for the piece had too many moving parts that could get jammed, while this piece was much simpler and served the same purpose just as well if not better. Another thing that we learned was about some of the most complex functions that Fusion 360 could do. Because of this, we plan to use

Fusion 360 in the future so that we can build on the skills we already have and go even more in depth.

Fusion 360 is especially handy due to the cloud sharing especially on a competitive robotics team. We can work together seamlessly on designing our robot. Also, the many different design functions of Fusion can provide us with joints, motion links, and the object manipulation needed to develop a competitive robot. The many rendering and animation functions that Fusion has, helped us to create appealing pictures and videos to show at our table at the competitions.

Personally, I plan to go into mechanical engineering which has many uses of 3D design programs such as Fusion 360. The advantage to learning about Fusion 360 now, as a high school student, is that these same Autodesk 3D design applications are used in university and professional work. I plan to take my skills in Fusion 360 to my career path.