We have been working on VEX Robotics for the past three years, and each season, one of the main goals was being able to grasp game objects. Whether you need to stack cubes or launch balls, intake mechanisms have always been a crucial part of VEX robots. From In the Zone, to Tower Takeover, many different intake mechanisms have been used. However, one of the most frequently used structures was ‘Roller Mechanisms’, which are also the main component that form most of this season’s robots. The aim of my design is to improve the stability of the Roller Mechanism, based on the challenges we faced while building our robots.

Roller Mechanisms are formed by attaching two sprockets on a shaft and attaching rubber bands between the sprockets. Using the elasticity of rubber bands, this system easily gets a hold of desired game objects. Even though Rollers are a common choice for intake mechanisms, they also create some common problems that VEX teams must overcome while building their robots. In this design, the Roller was enhanced according to our own robot. One of the main problems we faced was the tension of rubber bands causing the other components to deform. Since we had limited materials, this was an important problem for us. The rubber bands caused both the shaft and the sprockets to bend, and thus, made the system unusable after a point. Even though this problem could normally be solved by attaching a metal between the sprockets, this would prevent the rubber bands from stretching to their full extent, making the intake process more difficult and also taking up a larger space inside the robot. To solve this, we designed a circular channel -which the shaft could easily go through- between the sprockets, and prevented it from moving. In addition to this, we added small branches to both sides of the design. These structures held the sprockets in place, and kept them from bending inwards due to the rubber bands. With the use of these small structures which were placed only at the ends of the Roller, the whole middle part of the Roller was left empty, creating the required space for the rubber bands to stretch. Furthermore, since this season’s game objects are larger with respect to the balls which were used in Turning Point, Rollers needed to be respectively larger as well. However, our team did not have shafts long enough to build the Rollers. Considering that a total of six rollers are used in our robot design, we wanted to find a way of connecting the short shafts that we had to form a reliable structure. Therefore, we added a component in the middle of our design. This small structure has a barrier in the middle, and has high strength shaft inserts attached to its sides to force the two shafts to move as a unit. The empty space in the middle is designed according to the size of set screws, and two screw holes were placed on top of the long channel that the shafts will go through. When everything is attached properly, the design will be able to connect two shafts and prevent deformations of the used materials.

While designing this component, I used the ‘2.0.9313’ version of Fusion 360. I had designed our robot using the same program, thus, it was great to be able to use my experiences to create my own component instead of just attaching others. Additionally, using Fusion 360 also allowed me to visualize how the object should be for it to perfectly fit our robot. Initially, I measured the distance between the sprockets in our previous robot design. Using the obtained value, I created a sketch, drew a circle, and extruded it to the required dimensions. Then, I created a sketch on the side of the cylinder and drew a square which was slightly larger (for it to be easily attached) than the size of the shaft. I extruded this sketch as well, and created a hole through the cylinder. I downloaded the CAD files of VEX sprockets, and attached them to both ends

using a rigid joint. Using the ‘create form’ section, I designed the cylindrical structures which hold the sprockets in place. By editing its form, I was able to give the desired curve. Afterwards, I copied this design, and placed all of them in the correct positions. I turned these bodies into components and attached them to the whole design by merging them. I also downloaded the set screw files and using only the screw part, I created holes on the shaft channel, to attach screws while using it. For the middle section, I created a sketch of all the shapes that would be needed, and extruded the whole thing in the correct dimensions. Using the fillet tool, I altered the shape of this piece. I created holes throughout this structure as well, and placed high strength shaft inserts using rigid joints. Finally I cut the middle of the cylindrical channel, and instead, placed the new structure using a rigid joint. Some final touches were made, and the design was completed.

Throughout the process of designing this component, I got the chance to improve my 3D Design skills, and explore new techniques to create different structures. I will certainly continue to use 3D design softwares in the future because recently I realised the great advantage it gave to me and my team. Especially during the pandemic, designing our robot with Fusion 360, allowed us to save a lot of time, and fix various problems without even building the robot. In addition to how useful the process is, it was also quite fun to be able to design whatever I was imagining at the time. I will most probably continue to use these 3D Design programs outside of robotics competitions as well. I want to be a mechatronics engineer, and I try to always improve my design skills to create new and functional mechanisms.