Mushroom Hook

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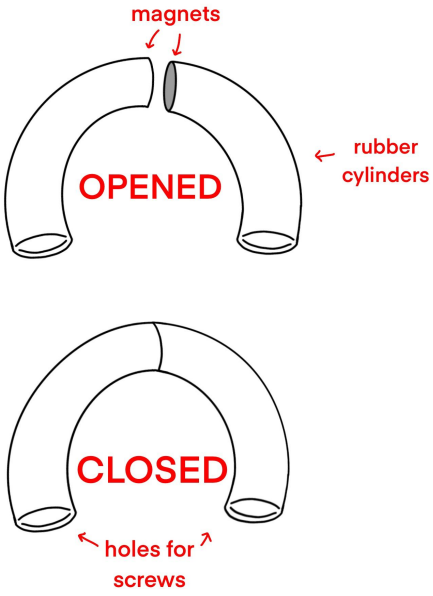
Introduction:

Hello, we are members of team 97101G from American High School and this is our team's third year in vex.

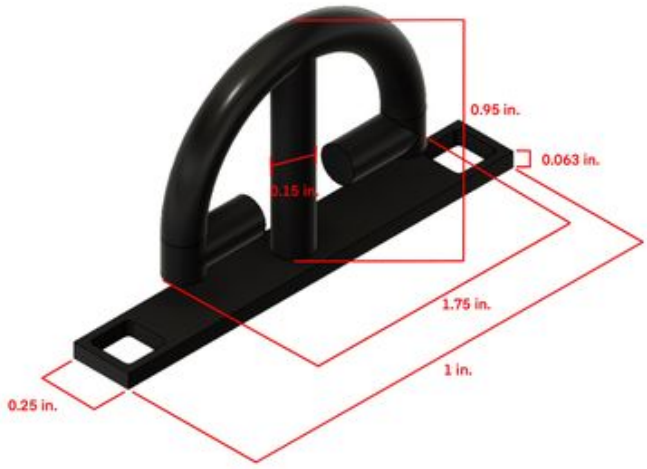
Design Process:

Our design process for this challenge began with a specific function in mind for a part rather than a conceptual design. At first, we focused mainly on creating a piece that hooked rubber bands to c-channels in such a way that reduced the abrasion of rubber bands over time. As our brainstorming progressed, we additionally decided to think of ways to make the process of inserting and removing rubber bands more efficient. After finalizing the desired functions for our part, we began designing and sketching the part.

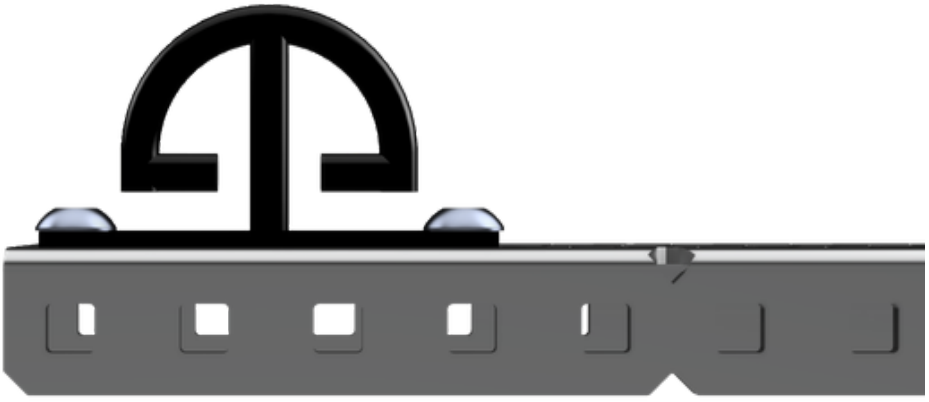


This initial design consisted of two holes within the cylindrical base to secure the part with screws. The magnets at the other end of the cylinders connect the two halves of the semicircles and provide an opening for the rubber bands to be inserted without having to unscrew the part. Because the semicircles are made out of rubber, the design is flexible enough to open without breaking. Unfortunately, one design flaw was that if excessive force was applied on the hook by the rubber bands, the magnets could easily snap open, releasing the rubber bands themselves.

CAD of final design using Fusion 360 with added dimensions:



Side View on a C-channel:

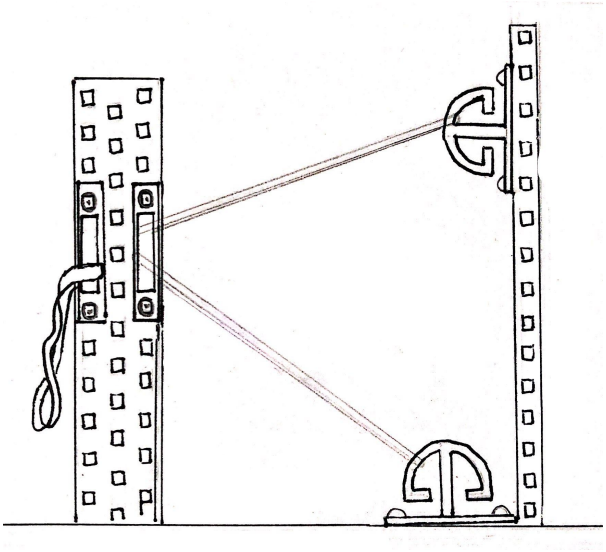


We used Fusion 360 v2.0.11894 to create our part, utilized VEX parts to maintain accurate dimensions for the base, and also used the design features in the application to alter and customize the part.

Our Final Design:

Our final design consists of a nylon cylinder bent to a semicircle and attached perpendicularly to a base made of the same material. To allow for easy application of rubber bands onto the hook, the ends of the hook near the base bend inwards creating a mushroom-like appearance. The "stem" of the mushroom extends from the base upwards and connects to the highest point of the semi-circular hook. The base is designed to be four holes (from a c-channel) long; the two holes on the outer ends are used for security onto a c-channel. Because the base is only 0.25 inches wide, multiple mushroom hooks can fit side by side on a c-channel.

Preliminary sketch of how the design would function:



How This Part Contributes to a Robot's Design:

Our robot design for Tipping Point includes a four-bar lift and a two-bar lift to carry goals around the field and up the balance. Surprisingly, the most time-consuming task we faced was balancing the strength of our motors with the rubber bands pulling in the opposite direction to lift and drop the goal. However, it is known that rubber bands break easily and wear away over time, losing their strength, interfering with our calculations, and reducing our design's efficiency. Although we had a strong rubber band configuration, we needed to add spacers or pulleys to create smoother edges for the rubber bands to pull on. Additionally, the intricate

directions and locations rubber bands had to reach meant we needed various methods of attaching them to prevent chafing or uneven stretching. The mushroom hook can be attached to any flat piece of metal in a way similar to a bearing. Its compact design allows rubber bands to be attached in any direction or from obscure parts of the robot. Since the hook is made of nylon material, it prevents abrasion and preserves the elasticity of the rubber bands, similar to the spacers we used before but simpler and more efficient.

What We Learned:

Creating computer-aided designs is an important step in the design process and could potentially become a required skill to enhance any field of engineering. During this challenge, we learned that while CADing initially seemed rather complicated and intimidating, we were able to learn how to do it through diligent research. It also forced us to have a clear idea of our design before physically building it, strengthening our design process. Additionally, with the spread of the new omicron variant of the Coronavirus, we were forced to limit the in-person designing and prototyping sessions we had as a team. This challenge has taught us that we do not have to let this become an interference to our team's success. Being able to CAD provided us with the luxury of collaborating virtually while still maintaining a concrete idea of our designs. Working online allowed us to improve our communication and time management skills. This challenge became an exceptional reminder that we are ready to tackle our engineering careers, one problem at a time.