NYIT Bears in VEX U (Team NYIT2)
IEEE Student Branch at New York Institute of Technology
New York, United States
REC Foundation Online Challenges

Make It Real CAD: Pneumatic Tank Holder

Our university has a rich history of competing in VEX-U tournaments and doing relatively well. From season to season, one can see the improvements and innovation for all our designs coupled with more advanced programs. We have only been able to achieve such success because we are constantly faced with high level challenges at the VEX competitions we attend, and we are able to overcome them.

In the previous game, Nothing But Net, we continued to show our prowess by placing 14th in the world in regular competition, 1st in robot skills, coupled with the Amaze Award. We aim for a well-rounded robot that performs well in all aspects of the game. If our robot is not well-rounded, we lose critical opportunities to gain points, so we create robots that are able to tackle most of the design challenges.

Every team begins the year on a level playing field because they are all given the season's game at the same time. The same raw materials are also made available to every team. In VEX-U, we have a significant advantage because we can use 3D-printed parts. Competition robots are allowed to use of any 3D-printed part as long as the part fits within the volume of 3"x6"x6". This allows us to make anything that we need. If we can think of it, we can build it. This is the main difference between teams: the choice to print and the quality of the designs. 3D-printing really helps let the robot come together as one coherent mechanism to score in the StarStruck game. 3D-printing also allows for out of the box designs that cannot be done with only screws and precut metal.

This game has brought its own unique challenges compared to last game. One key difference between previous VEX U games and this year's is that we only have one robot on the field during a match or skills challenge, compared to the two of last year. Another hurdle this year is hanging – a lighter robot would be able to hang more easily than a heavier one, and the location of the hanging mechanism is extremely important. The final major hurdle of this game is that it is low scoring. Each game object is 2 or 4 points each in the far zone and there are only a few dozen pieces with a total max possible score of less than one hundred. This means that each game element is very important, while last year there were so many objects with a maximum score above 600. There is also no backup robot in game. This year, a single game object or a single second can make all the difference in who wins each round, and heaven forbid something unfortunate happens to robot.

For our designs this year, pneumatics are a critical component of the robot design. With every pneumatic system, we have to use a VEX approved pneumatic tank. The most common issue we have as a team is that these are large tanks do not have a reliable way to mount them securely to the robot. We initially used a big c-channel and surround the tank with standoffs. Then we tried tying the tank down with rubber bands and nylon string. We found that the best solution was using large zip ties to secure the tank to the robot, but zip ties are prone to breaking. Our solution was to design a part on Autodesk Inventor. This part is sturdy and reusable, so we have a secure way of mounting the tank, and we do not waste zip ties unnecessarily every time we need to move the pneumatic tank. This part also serves as additional structural support for the chassis gearbox.

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

1. Measuring the size of the pneumatic tank to make the rounded enclosure and measuring the spacing on the robot where the tank will be mounted.
2. The process of the design using Inventor:
    i. The design process (discoveries for the pneumatic tank)
        a. Needs to have more structural support
        b. More stability for tank
        c. Reduce wasted zip-ties.
        d. Various ideals were visualized graphically before the final selection
    ii. The engineering process
        a. Measured space for a 6-hole by 6-hole that is the width of the chassis gear box; this reference was used as the main dimension.
        b. One Inventor file part was created to support the pneumatic tank
        c. Measurements, in inches, were taken for: the 6-hole gap, circumference of the tank, and the distance between holes on the metal
        d. Using a series of 2D sketches made completely from geometric shapes, the basic outline of the part was created
        e. Extrusions, 3D representations of the 2D sketches, were used with slight alterations
        f. 3D parts were then added to the assembly file to ensure the correct measurements for the pneumatic tank as well as to assess future potential modifications
    iii. The manufacturing and distribution process was not attempted for this particular part, but the steps would be to:
        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

While working on the pneumatic tank holder, from the initial standoff method to the 3D parts, we learned that sturdy and secure mounting brackets are critical for every piece of the system. For us, this custom mount allows us to place the tank virtually anywhere on the robot. This design also includes custom holes to secure the pneumatic tubing. As we know, wiring and cable management is essential for debugging and identifying any problems. Besides providing a functional use this design is also very aesthetically pleasing. With the super thin thickness that mimics the thickness of a 0.125” spacer, it can be placed without worry of it interfering with any other component of the robot.

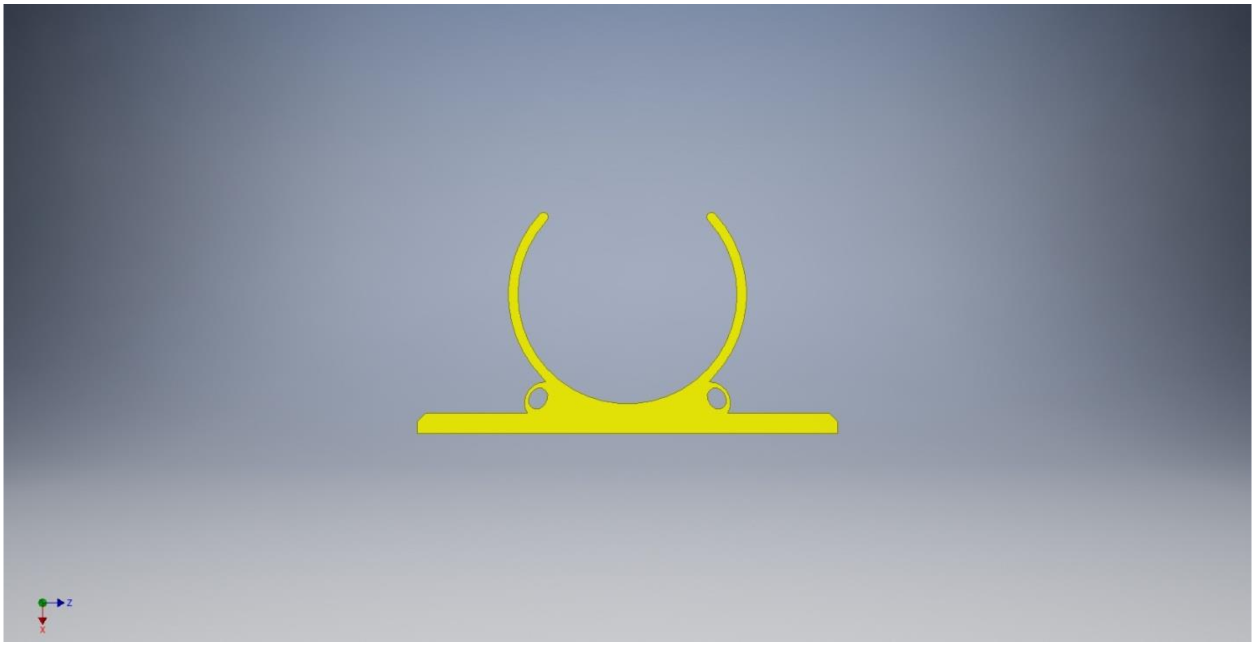

Figure 1: Front View of Pneumatic Tank Holder

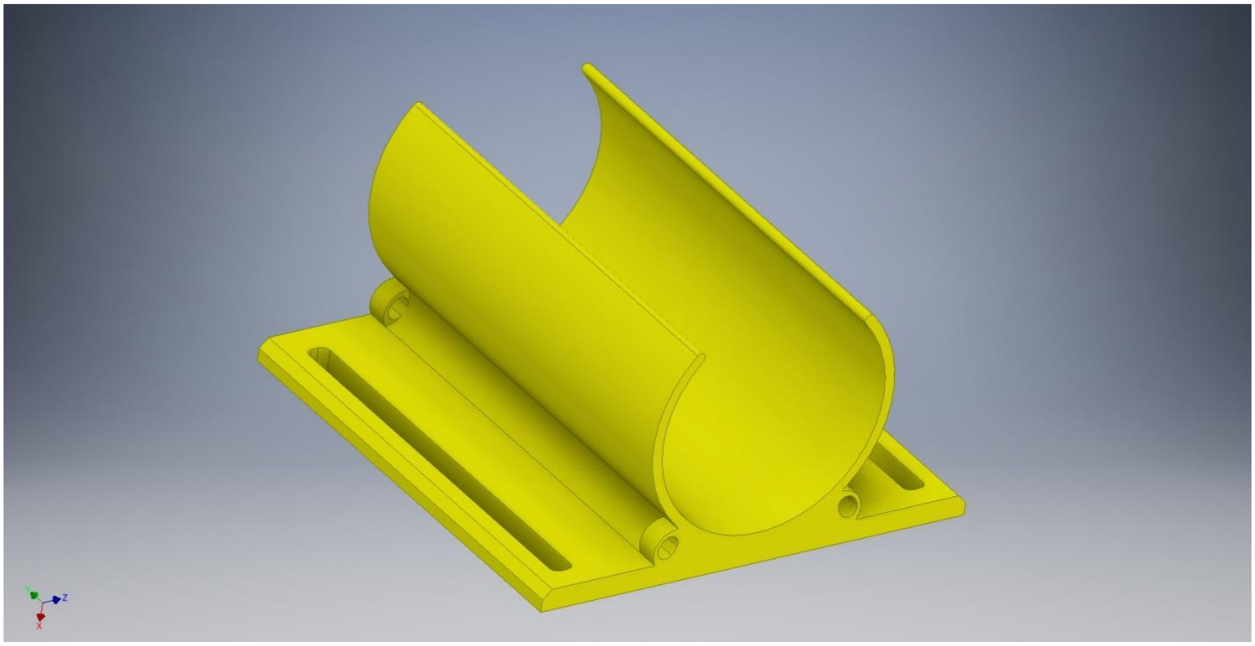

Figure 2: Orthographic View of Pneumatic Tank Holder