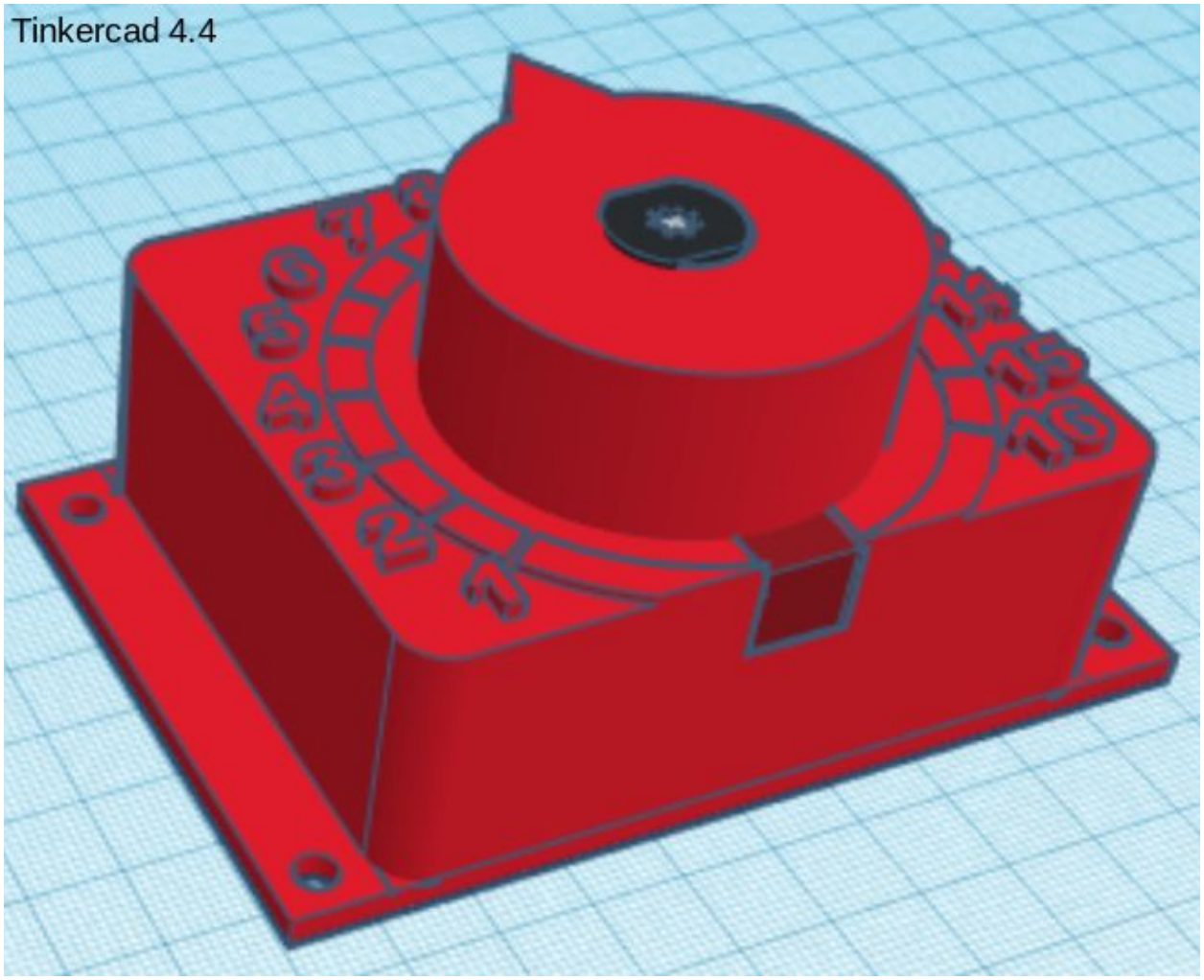
Autonomous Selection Knob

2775J - Jackson Area Robotics

2019 Make it Real CAD Engineering Challenge

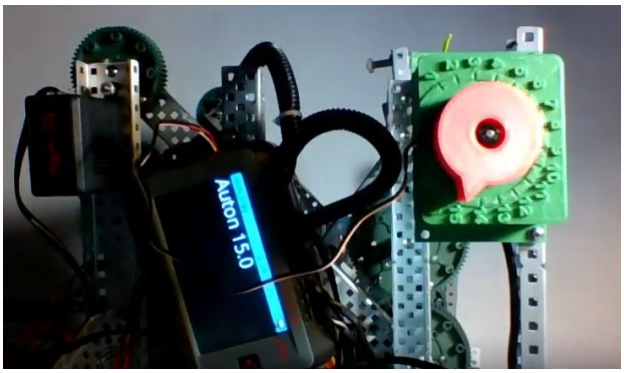


Problem:

Many Vex teams face the challenge of switching between autonomous functions for different matches. Some common solutions include downloading a new program from the computer for each match, selecting a different program with the V5 controller, and choosing the program with an LCD. However, teams often do not have enough time to return to pits to download, the V5 controller has only 8 program slots, and LCDs are not compatible with V5. For the past few tournaments, I've been using the program slots on the V5 controller, but I now have more than 8 functions to choose from, and need a new solution. With this in mind, I designed a simple and effective solution to the problem of selecting autonomous functions.

Solution:

My solution is an Autonomous Selection Knob, which utilizes a potentiometer to measure the angle of the knob. There are two main parts to the system: the dial box and the knob. A potentiometer fits snugly in an indentation near the center of the dial box, and a standard 2-inch shaft goes up through the potentiometer and sits flush with the top of the knob and the bottom of the dial box. Two rubber shaft collars secure the shaft in place. The assembly is attached to the robot with four screw holes in the corners of the dial box. The potentiometer wire runs out of the dial box and can be plugged into the brain/cortex. Before matches, one simply has to turn the knob to the correct autonomous number, and the robot will run the selected autonomous. The knob's pointer and dial face's indentations allow the pointer to click snugly into place. However, this solution is only legal for VexU teams, as the Autonomous Selection Knob is 3d printed. The part can be used legally by MS and HS teams if it is just turned to the correct number before matches, plugged in, and unplugged before the match starts. The brain remembers the value of the potentiometer and saves that autonomous as the correct one.

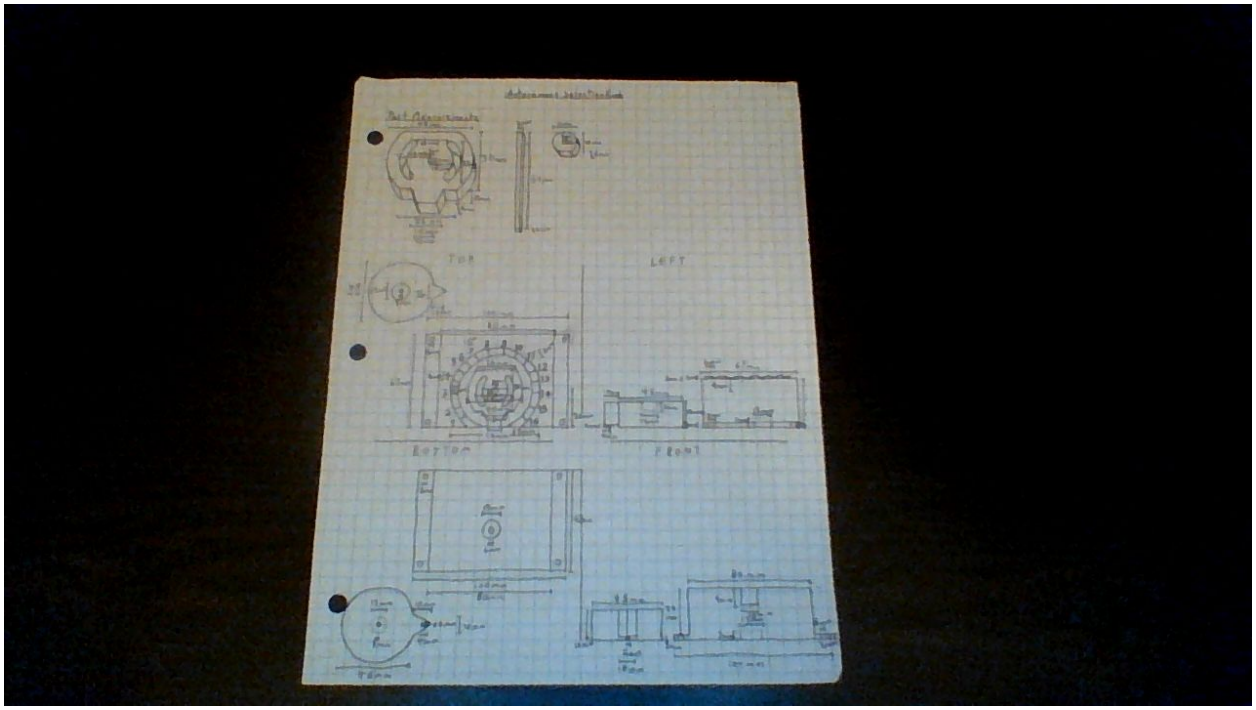


Design Work:

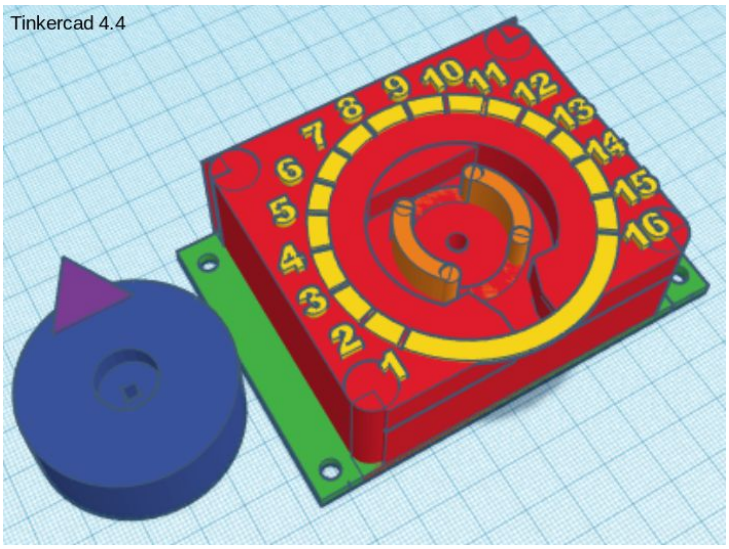
This is my first time designing in CAD, so I chose the simplest option: Tinkercad - Version 4.4. I also liked Tinkercad for its many great features, including online editing.

I began by brainstorming a part that would solve a common issue, and came up with the Autonomous Selection Knob. Then I drew a few rough sketches, just to line out my concept. After that, I used calipers to measure the dimensions of a potentiometer, a shaft, the rubber shaft

collar, and the distances between holes. Using these measurements, I drew a few cleaner final sketches of my part. When I went to Tinkercad, it was much, much easier to design the part since I had already sketched it.



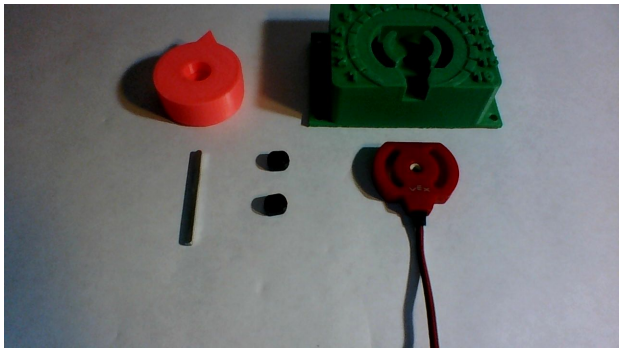
In Tinkercad, I began with a box for the dial knob, using 4 box holes and 4 cylinders to round the edges (Red). I then placed a cylindrical hole through just below the center for the shaft to run through. To form the potentiometer shape, I used a cylinder hole for the main opening, a box for the top edge, 3 box holes for the bottom trapezoid and wires to fit in, a tube for the 2 line-like holes in the potentiometer, 4 box holes to cut off the ends of the tube, and 4 cylinders to round off the edges of the tube (Orange). On the underside, I added a cylinder hole for the rubber shaft collar to fit inside. To make the dial face, I used a tube, 16 box holes spaced 16.667 degrees apart, and digits to form numbers 1-16 around the face (Yellow). To finish up the dial box, I placed a box and four cylinder holes which formed the base flange to attach to the robot (Green). In order to make the knob, I began with a cylinder, and placed a box hole through the center for the shaft to fit snugly through. I then used a cylinder hole

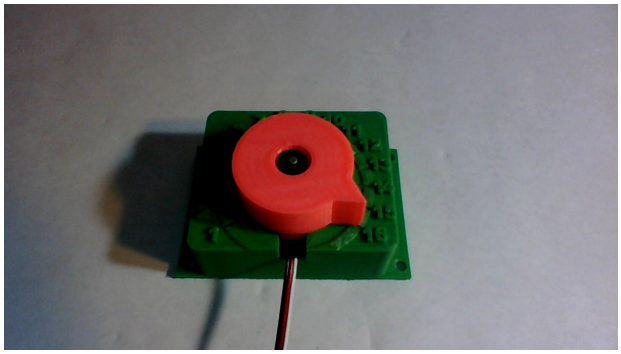


to make space for the rubber shaft collar (Blue). To finish off the knob, I used a trianglular prism and a wedge for the pointer (Purple). I then positioned my objects for printing and saved them. Because I already had my measurements and design planned out, as well as the simplicity and user-friendliness of Tinkercad, designing the Autonomous Selection Knob took only about 5 hours to do, over the course of 3 days.

Making It Real:

The first time I printed my final print, the 3D printer stopped a little bit before the end. However, the knob was still intact, so I used it and reprinted only the dial box, which worked well. The assembly can be easily completed in less than 20 seconds, and mounted to the robot with the four screw holes in the corners. The part can be used legally by teams outside of VexU by just plugging the potentiometer in for a fraction of a second before matches. The system is very easy to use and I plan on using it at my next competition. Overall, I'm very satisfied with the way the part turned out and look forward to using it.





Conclusion:

Overall, this project taught me a lot. I learned the importance of pre-sketching ideas before designing in CAD software. That way, positioning shapes and adjusting their measurements is a much faster process. Of course, I also learned to use the Tinkercad software through their helpful lessons.

In the future, I plan on using CAD software to see how certain design changes might affect my robot. It would be very helpful to make adjustments in Inventor rather than on my robot. For example, I wanted to try to change the drive on my robot. I took apart the drive and reconfigured it, only to realize it wouldn't fit in the space provided, and I'd have to put it all back the way it was. Had I used CAD software, I could have seen that the change wouldn't work, and come up with an alternative.

In my career, I plan to become an architect or engineer. Both jobs use CAD software to design buildings or mechanics, and in these professions CAD is much more of a priority than it is in Vex. I think that learning to use CAD software now will help me greatly in either of these career paths.