CAD Engineering Challenge Submission

AUBIE1 - Auburn, AL

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Overview Design Video

The Problem

Tracking robot position on field is usually tricky in VRC and VEX-U. The motor encoders can be unreliable due to bumps and collisions during a match, and having precise position data is crucial to the success of any VEX team. To provide a more consistent robot position the part our team designed utilized the VEX V5 Optical Shaft Encoder and clever suspension to provide a reliable signal no matter the field conditions or what may happen mid-match.

How it Works

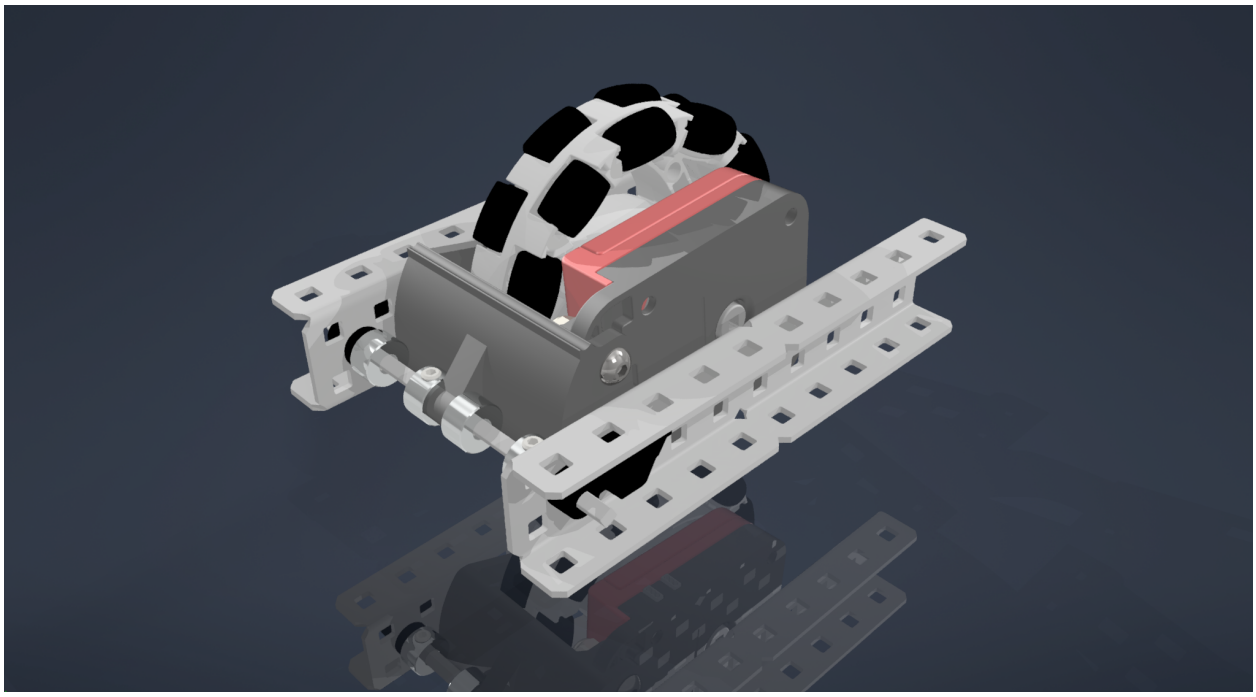

Figure 1: Full Subassembly with the omni wheel, shaft encoder, and custom part

As seen in the full subassembly in Figure 1, the part (called the “Tracking Wheel Rotator”) links together the optical shaft encoder, a 3.25in omni wheel, and two pieces of C channel (providing rotational support). The part can freely rotate about the shaft located in the left of Figure 1, and the wheel and encoder are linked together, so the encoder provides signal

data from just this wheel alone, which would be unpowered and placed in a convenient position for your drivetrain.

Figure 2: Front Isometric view of the Tracking Wheel Rotator

The part itself is complex enough to solve the problem, but simple enough to interpret and use. The left part of Figure 2 shows the slot where the optical shaft encoder is mounted using standard 8-32 nuts and bolts, and once the encoder is mounted, the opposing hole on the right side of Figure 2 would line up concentrically with the optical shaft encoder. This allows for a shaft and spacers to be inserted between the two parts, and for the omni wheel to spin freely while providing signal.

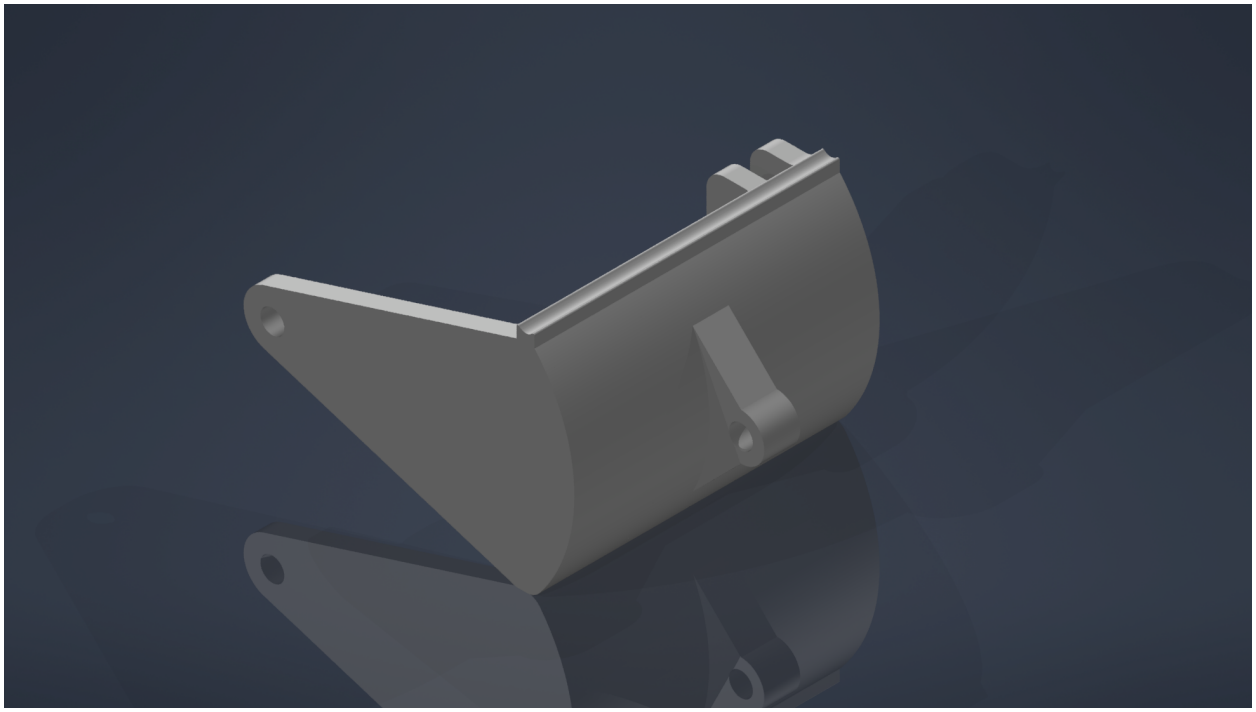

Figure 3: Rear isometric view of Tracking Wheel Rotator

The rear view of the part as shown in Figure 3 displays the two components that make the part work well no matter the field conditions (for example, the bumper on the field in 2022-23's game "Spin Up") or what may happen between robots (collisions) in the middle of a match. The first of these is the hole out the rear of the part that is designed to freely rotate on a V5 shaft. A fixed or free spinning shaft may be inserted between two structural components, and the entire part can slide on that shaft around this hole and freely rotate.

To keep the wheel on the ground at all times, there is a groove as shown at the top of the part in Figures 2 and 3. This groove is narrow, but works well with a rubber band, which would be wrapped around the entire upper part of the subassembly springing it downwards and acting like a car suspension. This is visually demonstrated further in the provided YouTube video at the beginning of this report.

The part was modeled in Autodesk Inventor 2022 and provided below in Figure 4 is the feature history tree for the part. This part utilized simple features such as cuts and extrusions as well as chamfers and filets to clean the part and improve performance. A midplane was also utilized to decrease total feature number when centering a feature on the part.

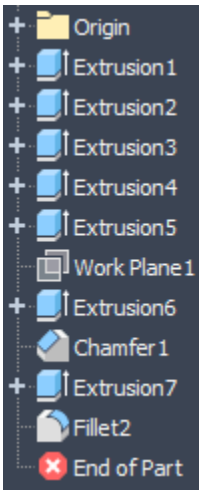

Figure 4: Tracking Wheel Rotator feature history tree

Why it Works

The part is simple and straightforward to use and is fully compatible with existing VEX structure and encoders. This works well because a team may decide to implement tracking on their robot and may assemble and add this component at a moment's notice, demonstrating maximum flexibility.

The suspended wheel maintains contact with the ground providing a constant signal update, no matter if the robot may be bumped or traveling over field terrain or end-game mechanisms. This part provides without a doubt some of the most accurate tracking possible in the VEX Robotics Competition.

What We Learned

This challenge was a fantastic way to communicate between programming and mechanical minded people, where the programming team provided what they wanted out of sensors and tracking and our mechanical group would update and modify the design accordingly. These tracking wheels will provide excellent signal for autonomous at competitions this year and future revisions of the part may allow for better actuation, smaller size, or more simplicity to produce this part easily on our own and for other VEX teams to use the part on their drives.

Youtube Video describing and demonstrating CAD Model: *https://youtu.be/2CSyi9TFC88*

CAD Model provided in ZIP submission