VEX CAD CHALLENGE

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This season, our VRC team implemented a flywheel design that utilizes a ratchet which reduces strain on the motors while the flywheel is spinning down. Not only are the motors saved stress, but the free-spinning wheel conserves its momentum for a longer duration while spinning down, making it easier if we want to start the wheel shortly after stopping it. However, we decided that if we wanted to implement a ratchet in a future design, a more modular and simplistic part would be beneficial.

In short, this part is basically a shaft extender that rotates in only one direction. This could be ideal for future designs incorporating winches, flywheels, and other simple machines. Either end of the ratchet features a mount in which the end of a VEX shaft will be inserted, and located inside the drum of the ratchet housing is a classic wheel mechanism that allows the ratchet to spin in only one direction.

To make this part, I used Autodesk Inventor to create solid models for multiple iterations of this design and the documentation thereof. The final iteration consists of a solid model assembly, three different part files and respective drawing files, an exploded view presentation file with animation, and respective drawing file for the exploded view complete with balloons and Bill of Materials. This part was also prototyped using 3D printing by exporting the Inventor solid models to STL files which were then sent to a 3D printer for fabrication. The most difficult aspect of this design was how the ratchet housing was to be proportioned in respect to the wheel, so that the teeth wheel would have just enough clearance to lift the step lever but not be able to do so in reverse. This issue was resolved by deciding a final diameter for the wheel (.5 inches)

and using a digital caliper to make an estimation of the appropriate tooth size in respect to functionality of the ratchet and 3D printability. Once the main body of the wheel was complete, the housing and cap for the ratchet could be modeled in context by adding the wheel to an assembly and choosing the “Create” option. The wheel itself was then made transparent and I was able to project its geometry to a new sketch that would be used to create the body of the ratchet housing.

This project, like many others, have taught me a handful of valuable lessons. Not only have I become more versed in the inner workings of Autodesk Inventor, but in the logistics of design that go into the creation of a part such as this. These are the kinds of lessons that will be of most benefit to me in the engineering field, and it is this kind of knowledge that will affect the quality of my future work. Just as this was not my first time using Autodesk Inventor, it certainly will not be my last. I love using the software and the sense of purpose that comes with creating an object in the digital world with the intent of eventually holding it in my hands. Not only is it an enjoyable experience for me, but being able to navigate the user interface of Inventor also comes in handy during many different situations, for instance the beginning of a new VEX season. Before any physical work is done, I like to model a design concept assembly in Inventor using the STEP files provided by VEX, so that even though we know the design will almost definitely change after that, we still have a general idea of how and where parts will fit together, so that we’re not just banging pieces of metal around and hoping it sticks. Although my main career focus is in computer programming, this kind of thinking could still help me in a future work environment, where planning ahead and having a good idea of what you and your co-workers need to do before you need to do it. Also, knowing how to use Inventor or tools like it

will definitely help to keep future career options open, and as I am a person who is interested in all things computers and engineering, that is definitely a plus.