MAKE IT REAL
CAD CHALLENGE

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MAKE IT REAL CAD ENGINEERING CHALLENGE

INTRODUCTION

When the 2015-2016 Nothing but Net game was revealed, the team instantly began working on countless prototypes. In our sessions during the summer, we built many different shooters such as catapults, double flywheels, and single flywheels. Then we thought, how could we improve our prototypes? How can we create a flywheel that provides us a higher performance than traditional VRC wheels? How can we make our flywheels more efficient? After some thought, our answers became clear: 3D Printing.

HOW DOES IT WORK?

The function of a flywheel is to rotate at high revolutions per minute in order to push the ball into the air as soon as it touches its surface.

What would this flywheel make it different from traditional flywheels?

- 3D Printed material (PLA) is lighter. To compare, PLA is 1.430 g/cm^3 or 2.775 slug/ft^3, which yields a total weight of 0.261 lbs., while the standard 5 in traction wheel weighs 0.352 lbs.
- Most of the flywheel's mass is closer to the rotational axis, meaning that it takes less effort for the motors to rotate the flywheel.
- The diameter is slightly larger with the purpose of increasing tangential velocity.
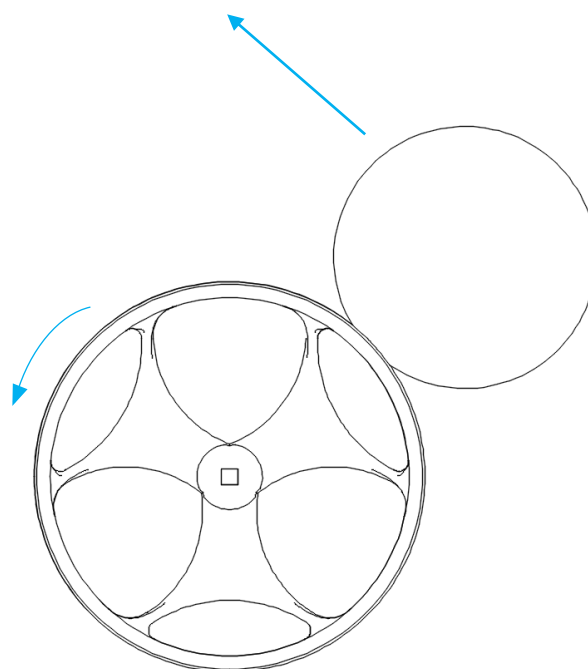
HOW IS IT ASSEMBLED?

The flywheel contains a square hole that easily fits the metal square insert on both sides. A long shaft is introduced into the square hole and then is equipped with two shaft collars to make the assembly behave like rigid body.

Exploded View
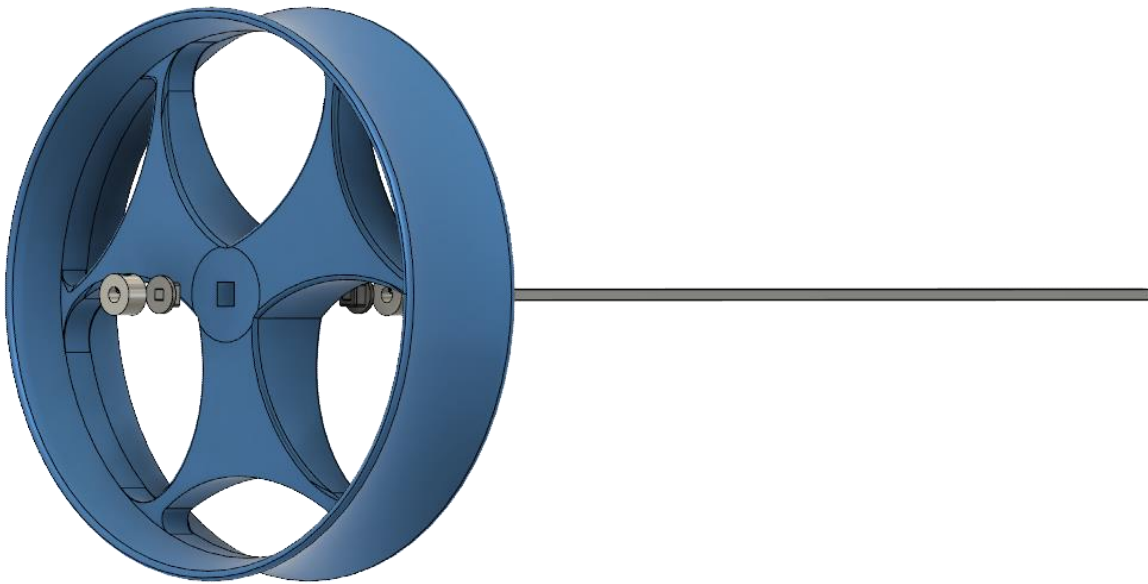
Assembled View
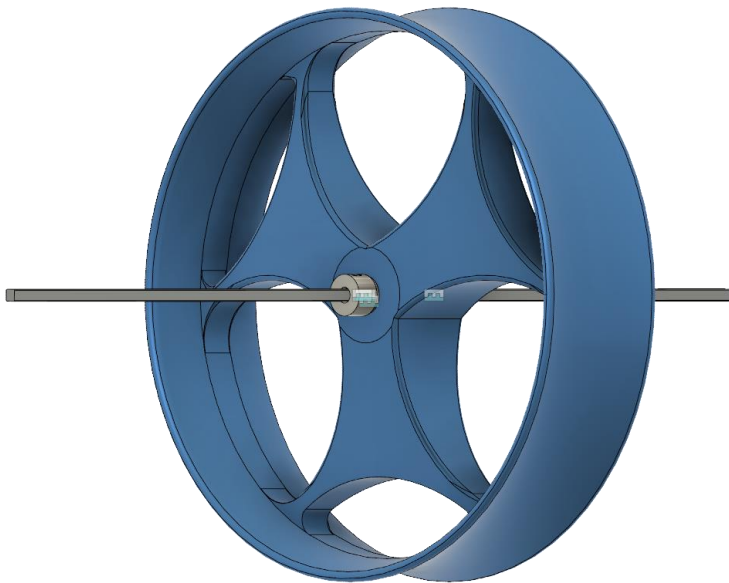
The whole assembly was equipped on the transmission mount that consisted of different gears that allowed the flywheel to rotate at high revolutions per minute. A shovel picked up the elements around the field and with a mechanism (not shown in the images) allowed the ball to be transferred into the flywheel. Once the ball was in contact with the flywheel, it rolled through a tunnel until it was later launched at a 45-degree angle.
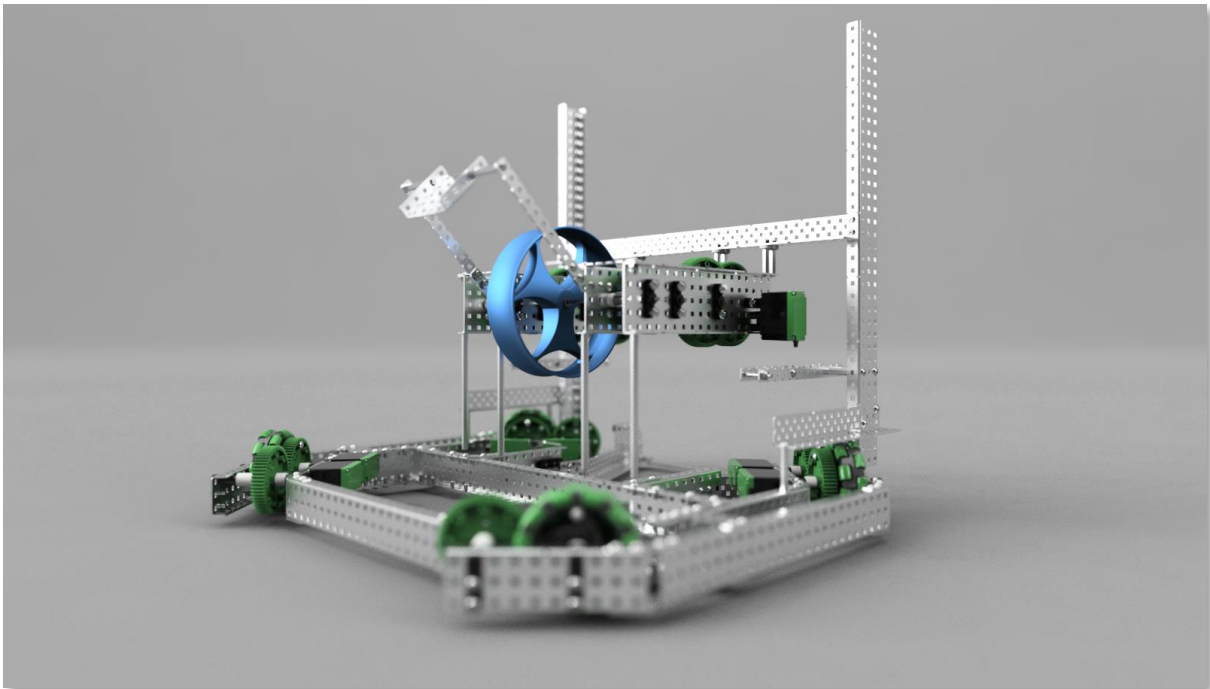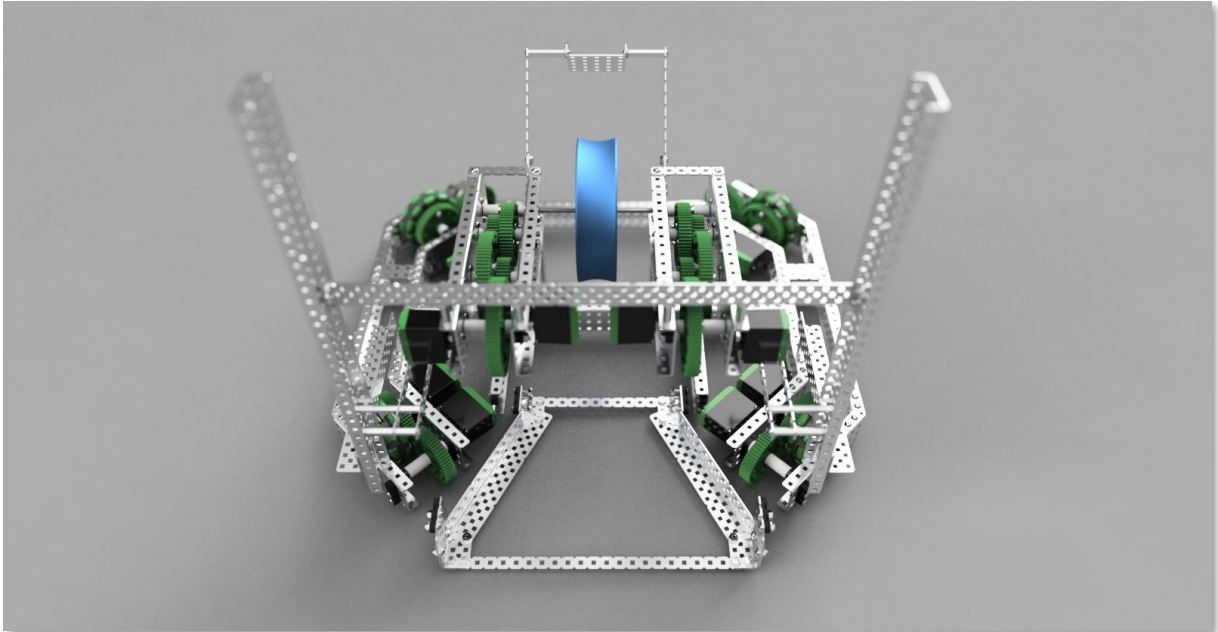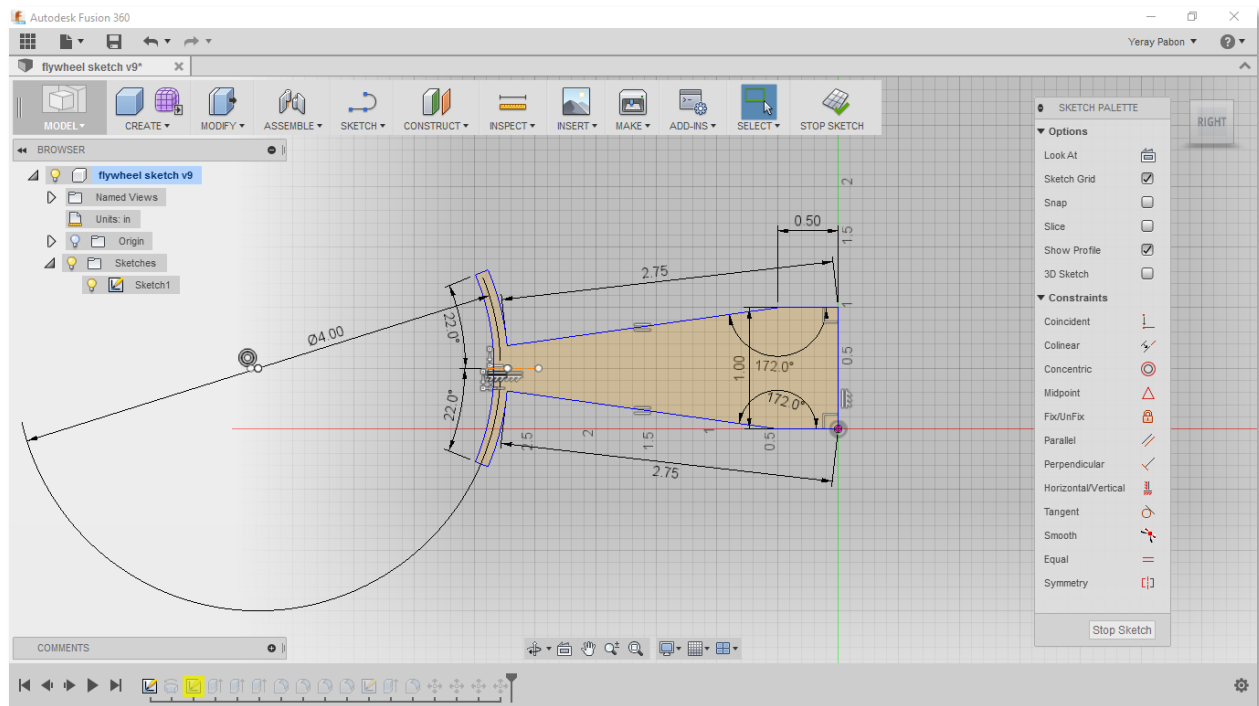

Please note that this robot is a preliminary design made during the summer. It has been largely modified but the flywheel and the concept is still the heart of our design.
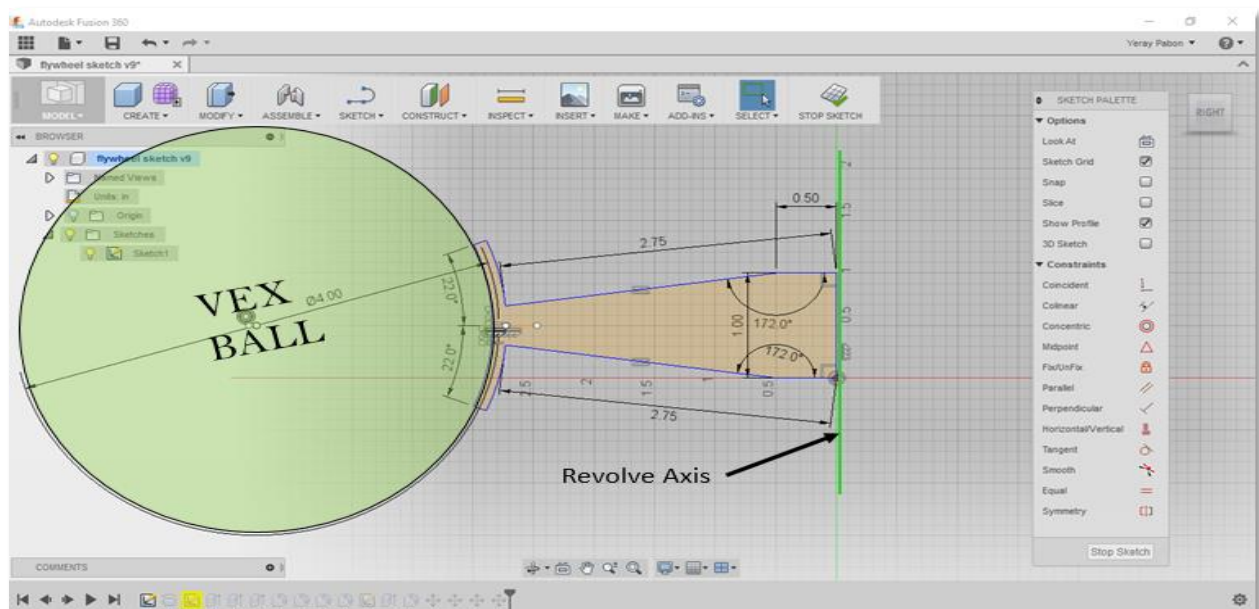
Fusion 360 was used to create the flywheel part.

Step 1

A sketch was made with the intention to do the "revolve" CAD technique on the y-axis. It was designed to fit the ball on the exterior curved surface that allowed us to maintain good traction when the ball was in contact.

Step 2

Then, we placed a sketch on the top to design the area that was trimmed. It was very important that the design maintained symmetry and that the mass was the same on the three supports that looks like a "Y". The angle between each support had to be equal. Otherwise, the center of mass will not be centralized on the rotational axis. Our goal in the design is to maintain as much mass closer to the center as possible while offering stability and stiffness.
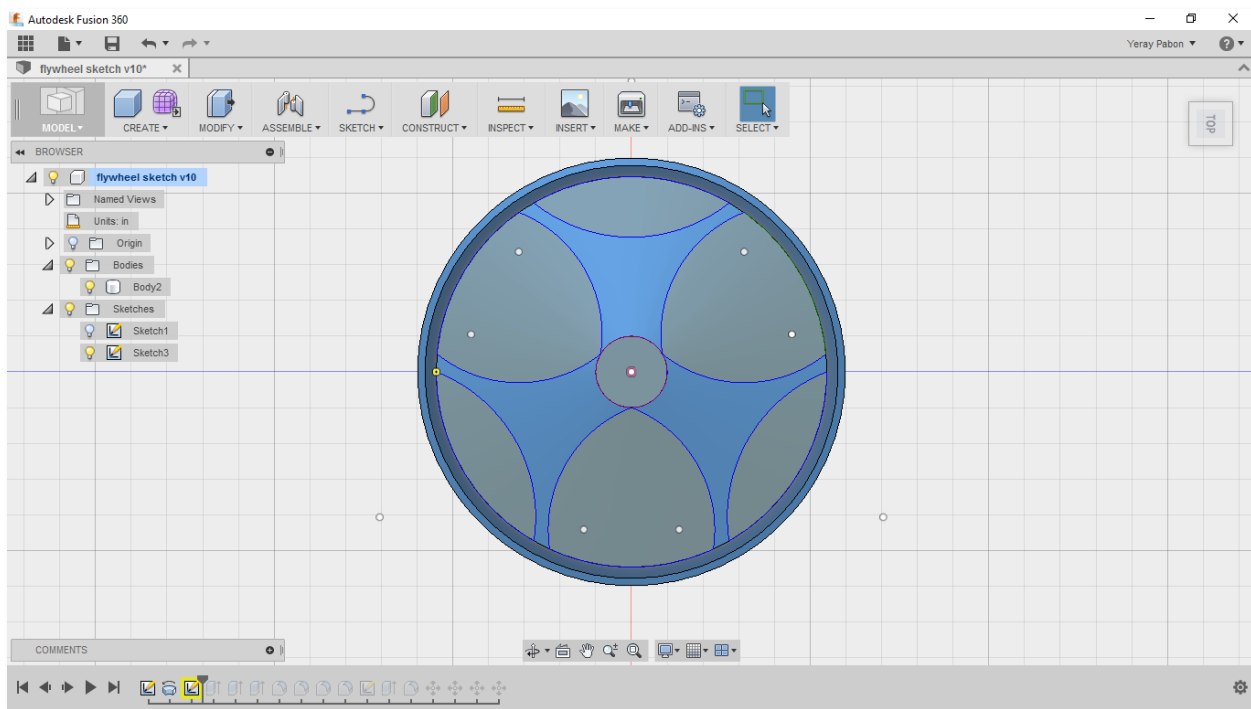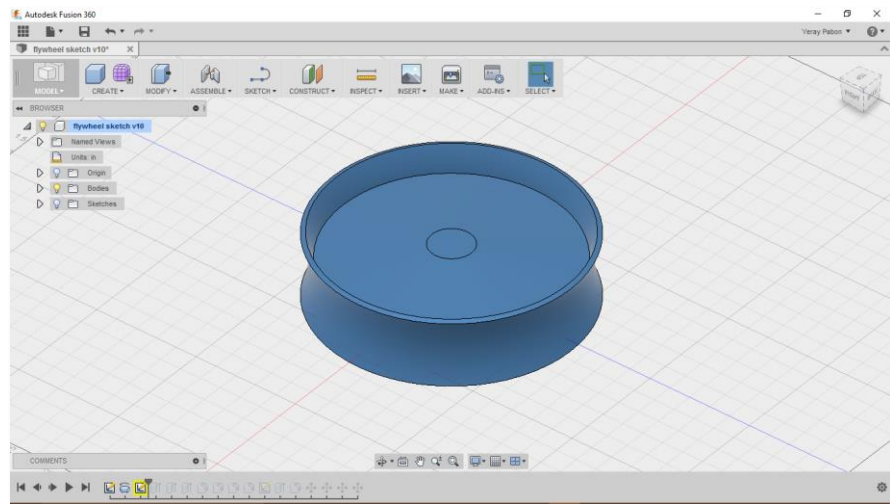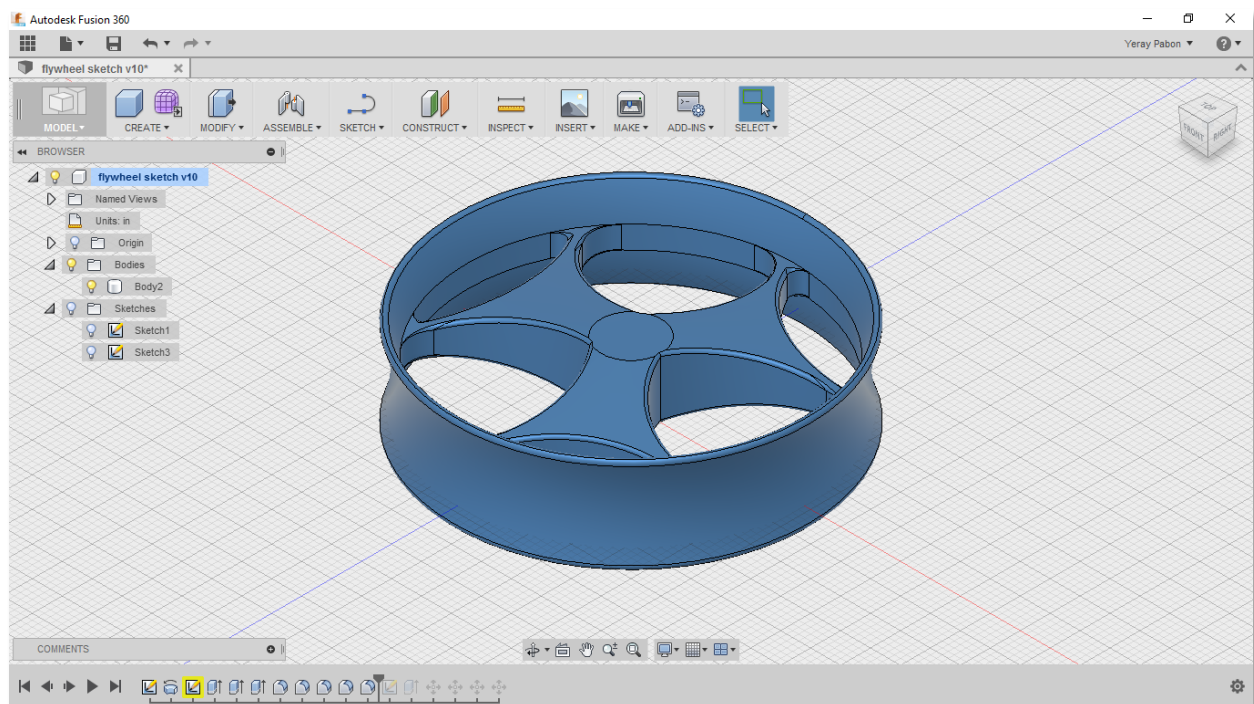

After designing the sketch, we proceeded to extrude it, trimming the areas that are shadowed on the image.

Step 3
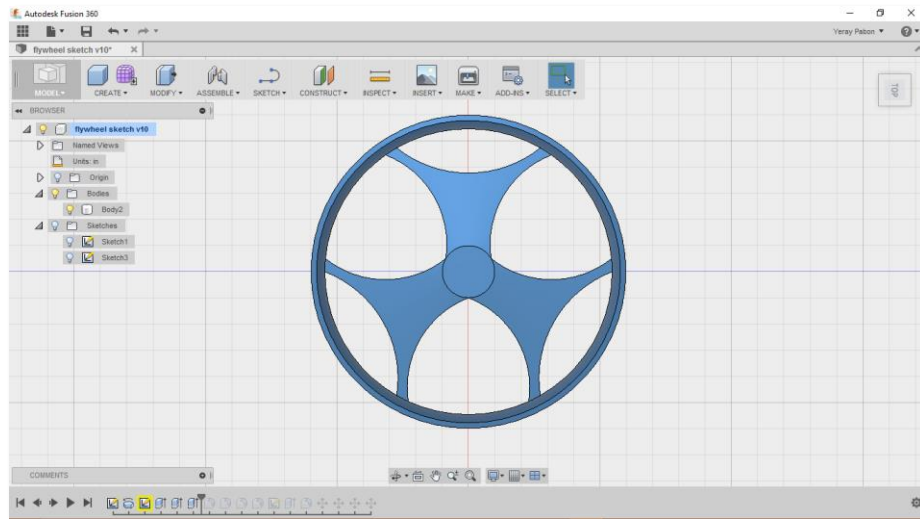
After extrusion, we can see on the left image that the shadowed areas were eliminated.

The "Round Fillet" was used on almost every edge. Besides making it look nicely, the "Round Fillet" was also used to add more stability and stiffness and eliminate high stress concentration on the ends of each support.

Step 4

Finally, we made a square hole with the right size for the square inserts to fit by simply doing a sketch and extruding again.

And voila!
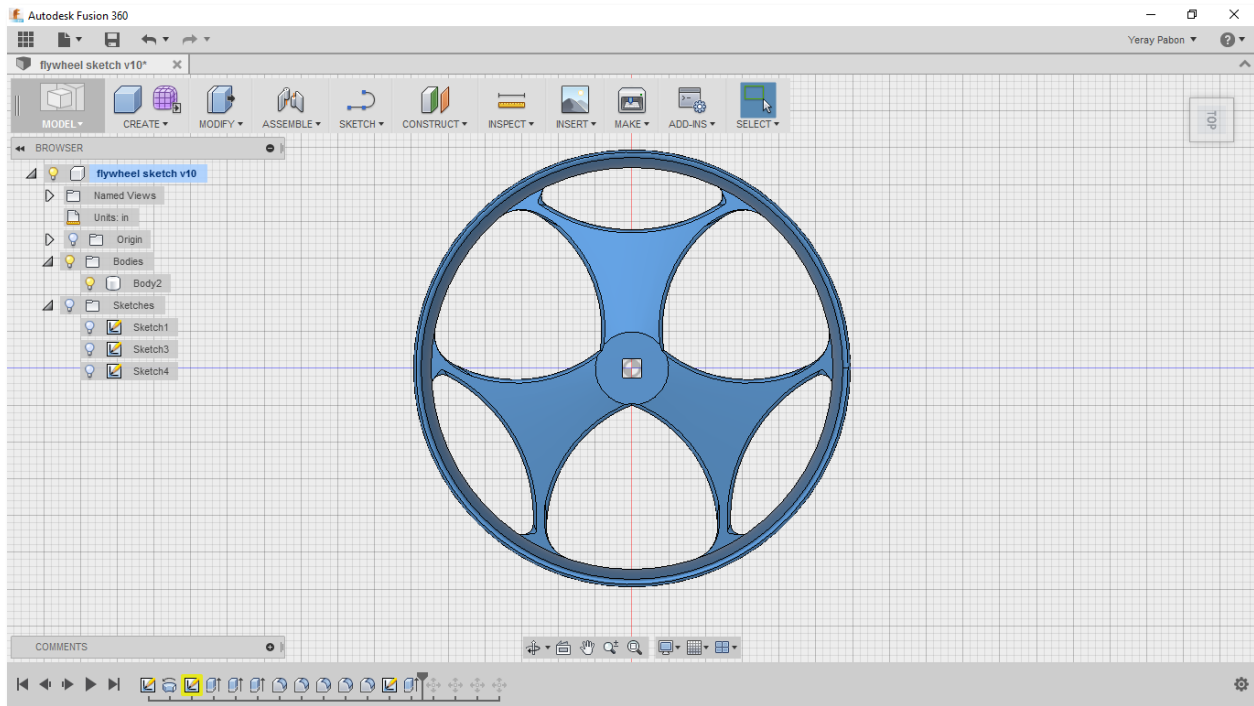
CONCLUSION

Using the latest 3D printing technology, we learned that we could design whatever limits your imagination. From geometric to dynamic theories, we as engineering students can now design a part that can function efficiently and elegantly with low cost.

Before using Fusion 360, Creo PTC was our default CAD software and we have zero regrets converting into Fusion 360 as my default. It offers elegance, simplicity, and a wide range of useful features like rendering, simulations, drawings, etc. Fusion 360 helped us design robots for the team by showing them the assembly in detail that reduced construction time and design issues. It allowed us to design useful parts that are not available in the Vex Robotics store.

Learning a CAD software is essential for every engineering student. Anyone can understand what you are visualizing when designing a part. It is the new era of presenting three-dimensional figures in a monitor without prototyping the part yourself and breaking the bank. Nowadays, to present an idea, this is the most effective way of letting our clients see our combined vision become a reality.