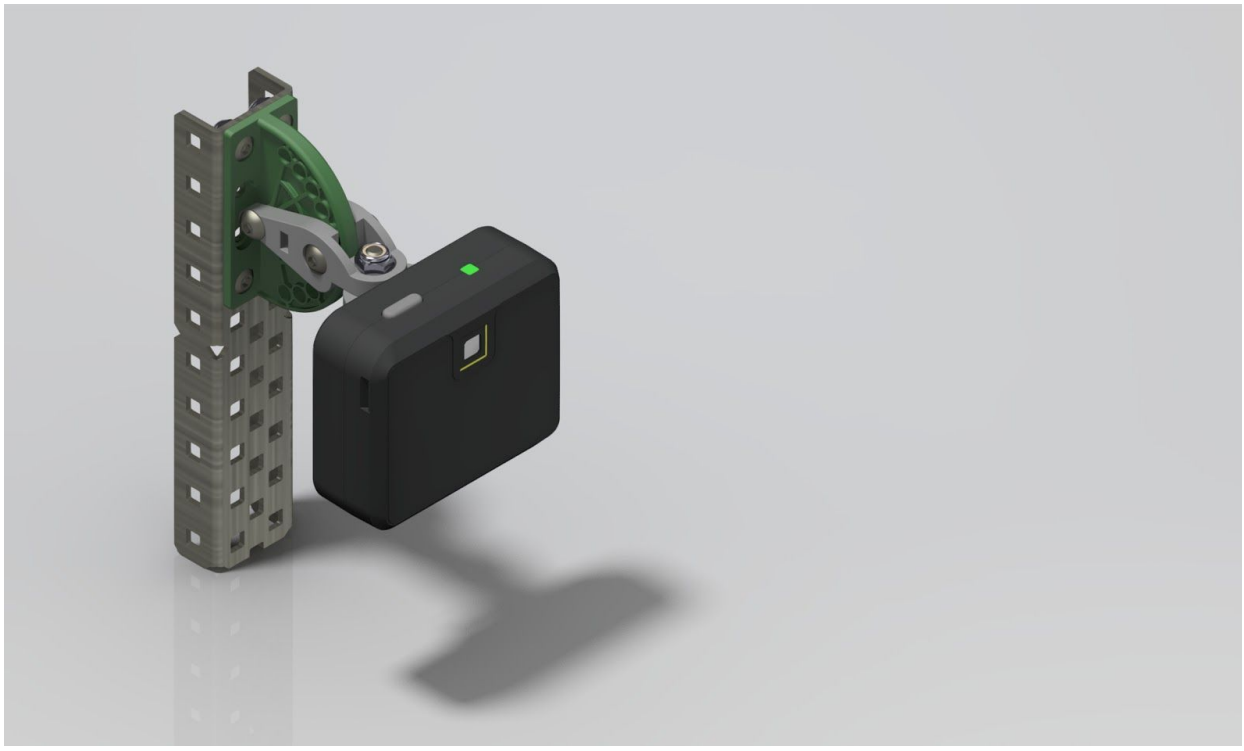

AUTODESK MAKE IT REAL CHALLENGE

Precision Mount for V5 Vision Sensor

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2018-2019 VRC Turning Point

INTRODUCTION

The 2018-2019 VRC Turning Point challenge marked the introduction of the V5 suite of products, heralding a new age of competitive robotics. The V5 Vision Sensor is one component in particular that thousands of VRC teams have eagerly awaited for.

In this year's game alone, there are many potential uses for a Vision Sensor:

- Aligning robot's launching system to Flags for long-distance shots
- Tracking rolling Balls and automatically intaking them
- Detecting opponent Flag state for strategic Autonomous routines

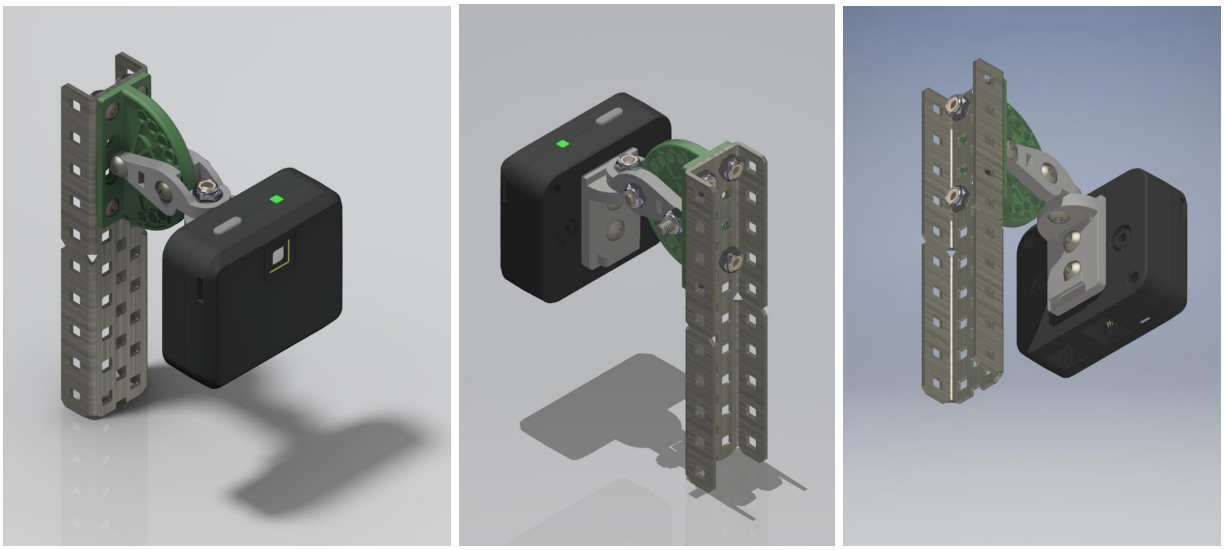
Each of these applications relies on a **single, fundamental assumption** - that the Vision Sensor itself maintains a precise mounting on the robot.

Frequently, the Vision Sensor must be angled up or down in order to be have the target objects appear in the camera's field of view. Since the sensor itself only has two unwieldy mounting holes, teams often rely on flexible structural components to achieve desired angles.

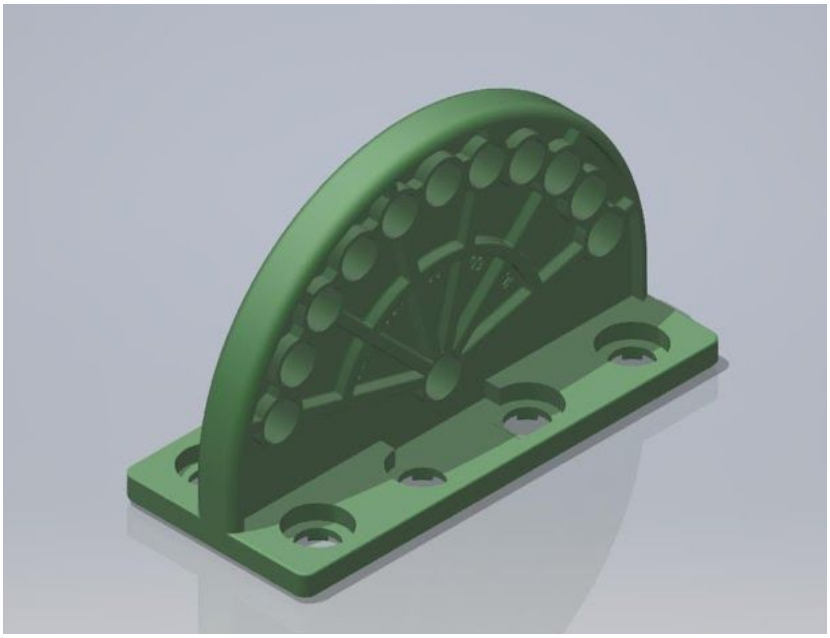
However, by the very nature of flexible construction, these mounting systems are **just one impact away** from permanent misalignment.

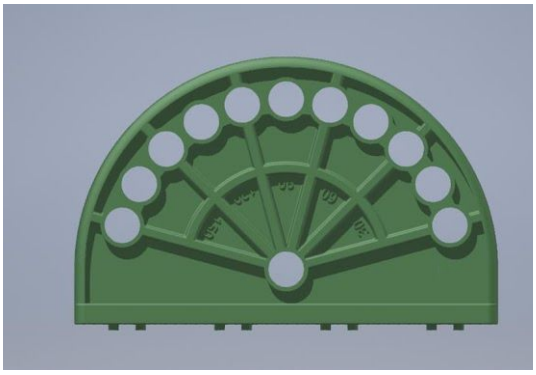
An error of just a few degrees can be the difference between near-miss and game-winning full-field shot. In order to truly unlock the full potential of the Vision Sensor, VRC teams need a robust, exact, and repeatable mounting system.

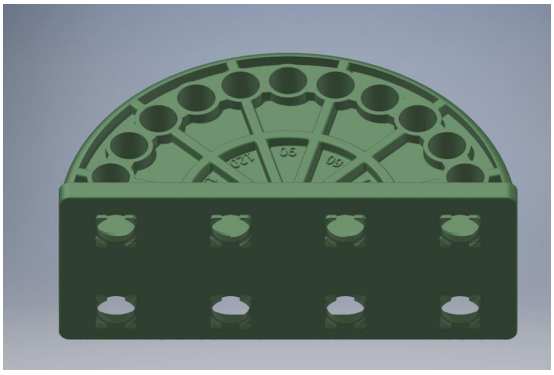
USAGE OF THE NEW PART



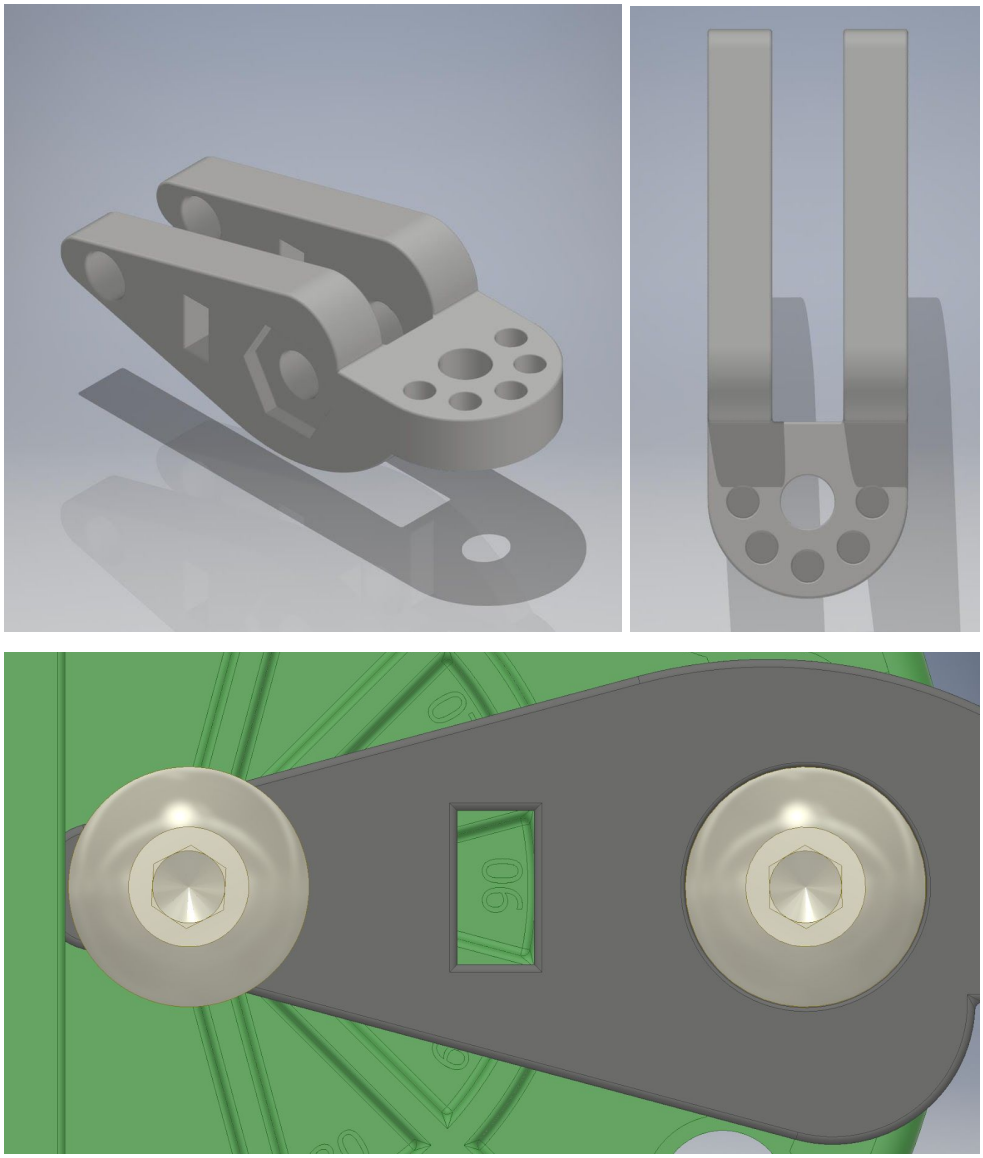
The newly-designed Precision Mount provides teams with two-axis **alignment and locking** capability for the Vision Sensor.



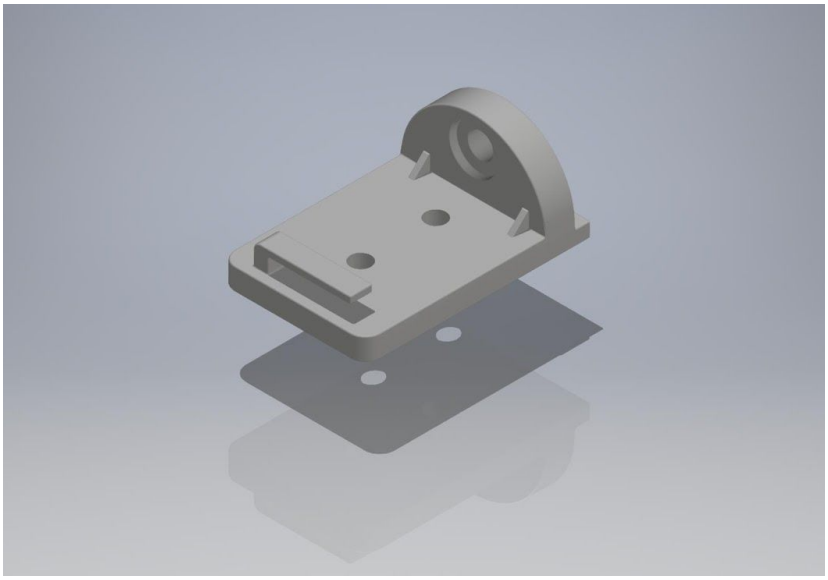


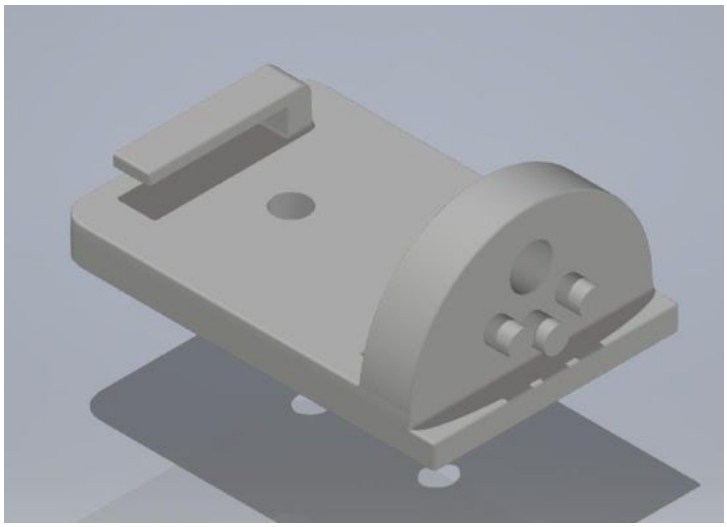


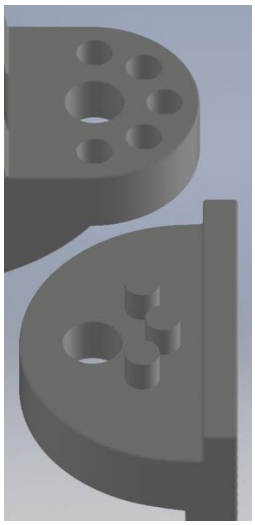
The primary axis “base” piece provides 8 mounting holes to allow teams to easily attach the component almost anywhere on their robots. Each of these mounting holes also features inserts, similar to those in VEX Bearing Flats, for proper alignment to the square holes. The base piece offers 11 slots to secure the Vision Sensor at an angle of 15°-165°, in 15° increments.



The secondary axis “middle” piece easily affixes onto the base piece with 2 screws and nylock nuts. During building, the team can easily remove the radial screw to test various angle configurations, and then tighten the screws once a perfect setting is found. Labels embossed on the base piece make it possible to record a specific setting. If an extreme circumstance leads to part breakage, it is easy to recreate the same precise alignment on a different Precision Mount system.







The final camera attachment “plate” piece screws into the back of the Vision Sensor. The plate has 3 small extrusions that can be aligned with the 5 divots on the middle piece to aim ‘left’, ‘right’, and ‘center’ on the secondary axis. The plate also includes a wire management clip to secure the Vision Sensor wire.

USAGE OF AUTODESK INVENTOR

Version of Software Used: Autodesk Inventor Professional 2018

In order to design the Precision Mount system, I utilized many basic and several advanced features of Autodesk Inventor Professional 2018. The typical commands, such as Create Sketch, Extrude, Fillet, and Driven Constraints were used throughout the design to create relevant structural geometry and to impart a clean look-and-feel on the parts. In terms of the more advanced features, I used the Emboss tool to incorporate the degree marker labels on the base piece; Circular and Rectangular patterns to duplicate hole distributions; and Part References to ensure that the three pieces fit together perfectly.

Once my custom parts were complete, I assembled them together along with standard VEX screws, nylocks, and C-Channels, and of course the V5 Vision Sensor itself. In order to make this more presentable, I used Inventor Studio to appropriately render each of the parts and assemblies with a more realistic physical appearance. My final step was to create an exploded-view video demonstrating the straightforward component assembly. This makes it possible for anybody to easily understand how to set up the Precision Mount system and use it for their own robots.

CONCLUSION

Designing the Precision Mount system for this online challenge has been a unique and engaging experience. As an Autodesk Certified Professional who has taken multiple Project Lead the Way (PLTW) engineering classes in high school, I found this online challenge to require a great combination of creativity and skill.

Taking Precision Mount from concept to full CAD model reminded me just how iterative the design process can be. As I presented my concept and solicited feedback from mechanical experts on my team, in my club, and throughout the world, I continuously discovered ways to improve my design and make it truly useful for VRC teams everywhere. The biggest lesson I have taken away from this project is to make sure I always talk to the final users of everything I design, because those people will always have great insights to help spur on my process.

As I continue in VRC, I will definitely continue using Autodesk software. Inventor is an amazing tool for planning out a new robot or mechanism, because it allows our team to rapidly ideate without wasting time in endless construction. With a few simple constraints, we can instantly see if our base fits in size or if our lift reaches the target. Rapid innovation is the key in VRC, and it is only possible through CAD software.

In the professional world, CAD software remains a constant. I am interested in pursuing Mechanical Engineering in college, and I have been fortunate enough to discuss this aspiration with actual mechanical engineers in industry. From my interactions with these mentors, I have learned that Autodesk software is used by many major companies in the sector, and having solid CAD fundamentals is integral for every job candidate. Though I am only designing a small component now, I am confident that this challenge is another step in my journey towards making a large impact.