# DEWBOT XVII

FRC 1640 - Aragya Goyal

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## Contents



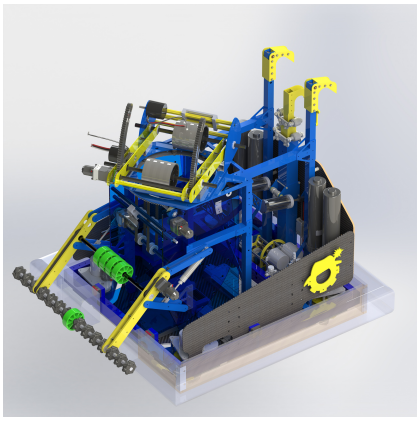

Figure 1: DEWBOT XVII CAD Render

# 1 Introduction

This technical document outlines the build season for the 2022 game Rapid React. The Robot for this year is named DEWBOT XVII. The main highlights of this robot include the iconic swerve, the climber, as well as the turret. Some other interesting aspects of the robot include the Carbon Fiber panels as well as the Vision Tracking using the limelight on the shooter.

# 2 The Chassis

## 2.1 The Swerve

The swerve is one of the most iconic aspects of the team. The team has been developing swerve modules since the summer of 2009 and implementing it into our robot in the 2010 season. The swerve module has come a long way since then including developments with Continuous Variable Transmission (CVT) and also including a Lamprey Hall-Effect encoder to make calibration much easier during competitions. The swerve is a great way to see the engineering method in action with continuous developments throughout the years to make it a reliable, robust, and compact solution to a drive-train.

We decided to use swerve this year because there were no major obstacles on the field and the team decided that the main things to focus on with the drive-train was the speed and agility for the robot to move around the field. This is why the team finally decided to use the swerve module as the drive-train since it offered everything that the team wanted especially with ease of design and use especially with the inclusion of the Lamprey Encoder.

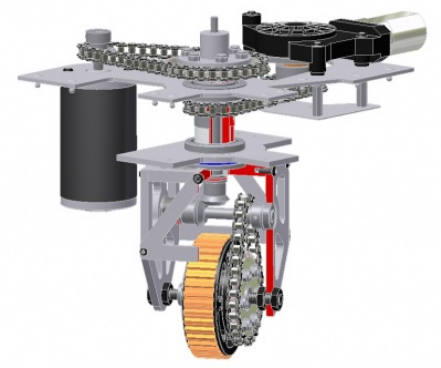

Figure 2: Swerve Module from 2010

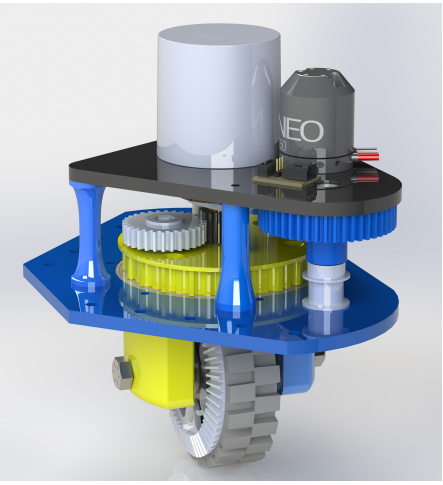

Figure 3: Swerve Module from 2022

# 3 Cargo Control

Being able to pick up and shoot cargo is a major aspect of the game and it is important to maximize cycles per game by making sure that the intake, indexer, and shooter all work in harmony.

## 3.1 Intake

There were multiple conditions for the intake. These included being able to compactly fit the intake into the frame perimeter, making sure that the cargo went into the indexer reliably and to be able to make it as fast as possible as well. This is what led us to use pneumatic pistons as the method of deployment for the intake. For the wheels, it was considered to make an intake which was able to pick up cargo which was bouncing, however it was not included in the final design because we focused on other aspects of the intake and making sure that the robot could pick up the cargo from the floor consistently.

## 3.2 Indexer

The Indexer is an important aspect of the robot since it acts as a gateway between the intake and the shooter. Since the max carrying capacity of the robot allowed by the rules was 2, it was a fairly simple design which works elegantly to store the cargo and feed them to the shooter when the motor runs. It is also a major structural part of the robot since it holds the shooter with the turret on top. This means that the indexer is carrying a lot of weight and is prone to shifting especially during high acceleration/deceleration. This is why a lot of focus was put on ensuring that the Indexer is structurally sound and is not capable of easily breaking by attaching it to the main chassis as well as the carbon-fibre e-panel. There is also an interesting aspect of the Indexer where there are two motors on the indexer to be able to control the feed of the ball to the shooter. This gives us the option to outtake balls when accidentally/purposefully picking up the other alliance's cargo. Either way, the indexer gives us flexibility in the drive strategy that can be made on the fly and also integrates with the whole cargo system to allow for reliable movement of the cargo through the robot.

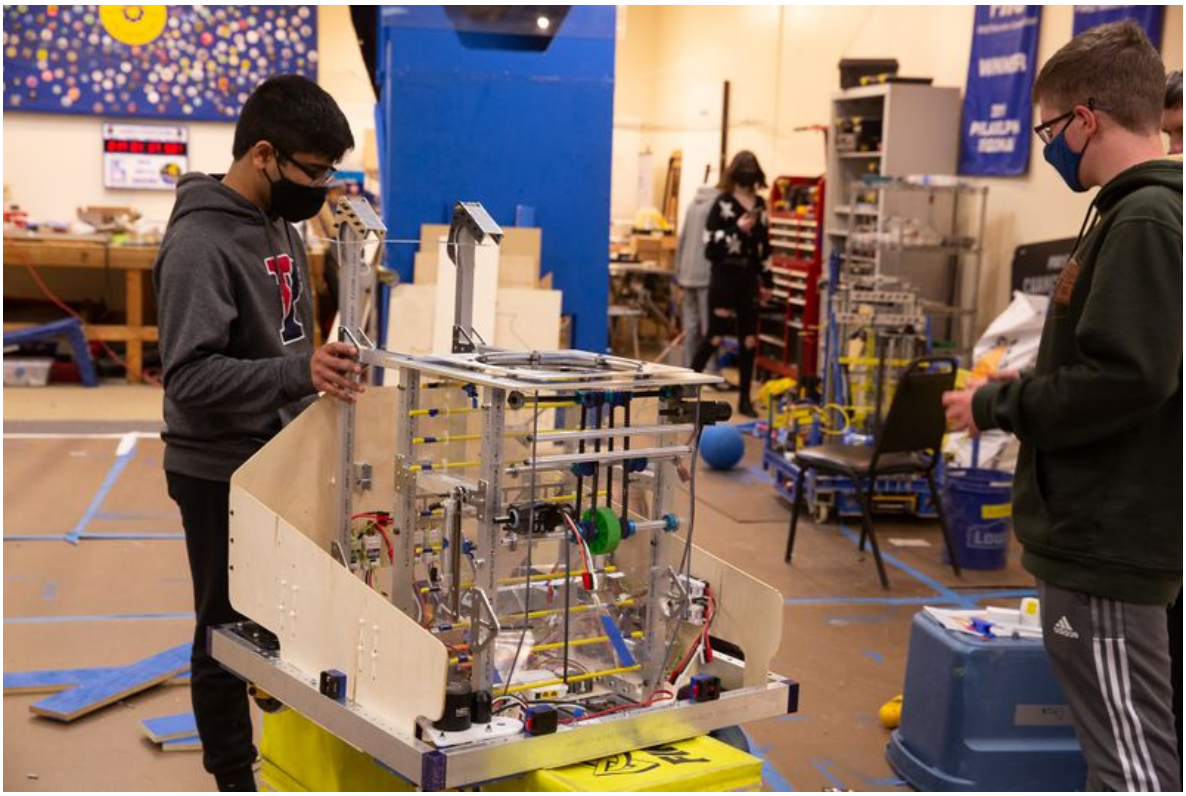

Figure 4: Indexer on Deux

### 3.3 Shooter and Turret

While naysayers may say that having a swerve drive and a turret is overkill, the majority of us here at 1640 beg to differ. The way that this game is set-up, it is crucial to have flexibility. By having flexibility, you open up many more opportunities to score points even when stuck in a tricky situation. Since there is a central goal with open space all around, it makes sense to have swerve to be able to move quickly around this central goal to pick up cargo and by having a turret, the driver is not required to line up the shooter every time they want to score some points. This reduces cycle times and allows for faster game play on our behalf. The shooter itself is also very different from what we did for last year. One of the design requirements for the shooter was to be able to control the spin on the ball when it is shot. Through the process of prototyping, we were able to learn a lot about how the ball reacts to just one set of wheels and two sets of wheels. We prototyped several control variables, including compression, wheel diameter, and the RPM of the motors. Using the information from prototyping, we decided to go with two sets of wheels which would be controlled by two independent motors and also a gear system that allows us to adjust the angle of the shooter during the match to give us the most flexibility on the field. The shooter is made to maximize speed, accuracy, and the flexibility so that the robot can perform at its best and make sure nothing is left on the field.

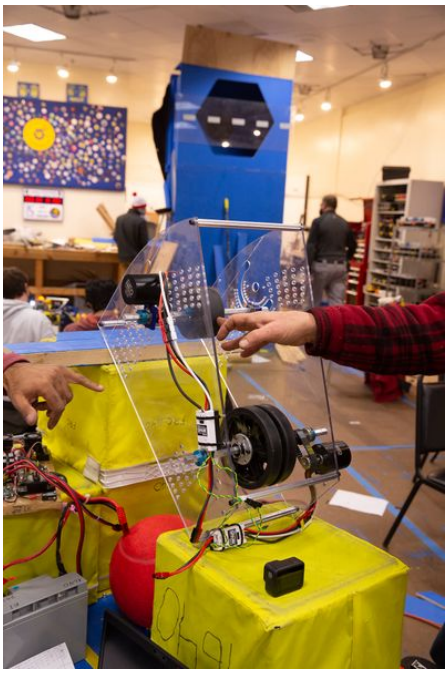

Figure 5: Shooter Prototype

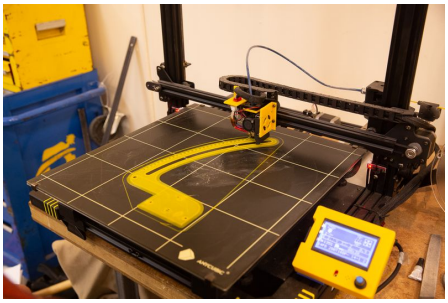

Figure 6: Rack and Pinion System 3D Printing

# 4 Going Higher

The Endgame is a crucial part of the game Rapid React. It can make and break games. It is very important to have a climb mechanism to be finish the game on a high note.

## 4.1 Climber

The climber has two distinct types of hooks. Two are static hooks and the one in the middle is a motor controlled hook. The one in the middle can move up and down by a gearbox and then also back and forth at an angle using pneumatic cylinders. These pneumatic cylinders are attached to the back carbon-fibre panels. These panels are super strong and can withstand a lot of forces. This is why they were an integral part of our robot last year and also why we have decided to use them again. Also they look really cool and fit our aesthetic. The basic idea of the climber is to extend the middle arm to the middle rung and climb up until the static hooks grab on. Then the pneumatic cylinders activate and tile the movable arm back which is then extruded once again. The robot now starts pulling on this arm and viciously swings back and forth as the arm retracts and the static hooks grab on once again. This whole process is repeated once more to reach the traversal rung.

Figure 7: 3D Printed Model for Proof of Concept

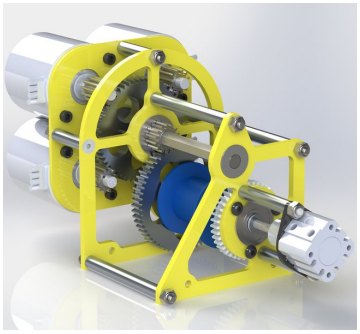

Figure 8: The Gearbox for the Climber

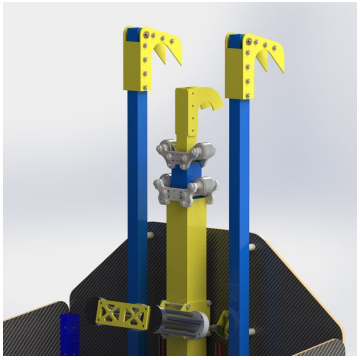

Figure 9: Climber Hooks

Figure 10: Testing Climb using Deux

# 5 Conclusion

All in all, the robot has gone through multiple hours of work and a lot of effort has been put in by the team to create a robust robot which will hopefully perform well at competition. The chassis gives us the speed and maneuverability that we need to outrun other robots, the cargo subsystem work together to let us control the cargo and score as many points as we can, and finally to give the finishing blow, the climber will let us rise to new heights and bring us to victory (Hopefully).