FRC Elevator

Summary

Organization: *Ten Ton Robotics Academy (First Robotics Competition)*
Role: *Test and prototype potential designs to pick up a game object*
Duration: *Sept. 2024 - Dec. 2024*
Team size: *3*
Tools: *CAD (Onshape, Fusion 360), 3D printer, Wood Tools*
Skills: *Rapid prototyping, documenting progress*
Outcome: *Settled on elevator/intake design*

Problem

The game objective was to score game objects called “Algae” into a reef-like structure in the middle of the field. To score higher points, lifting the Algae balls to a higher point in the reef was necessary.
Challenges:

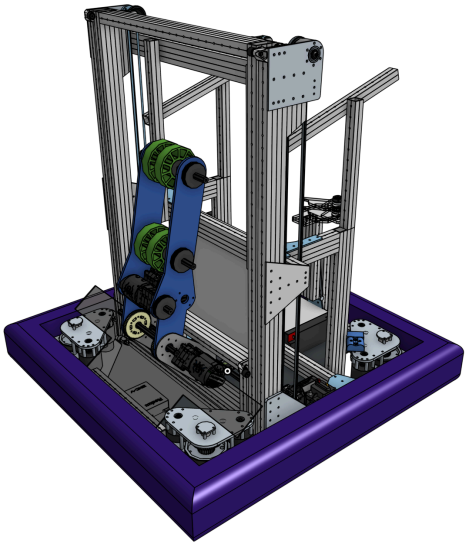
- The ball was ~41cm in diameter, making it hard to grip
- The mechanism to pick up the ball also had to lift it to about 2m

FRC game manual 2025: https://firstfrc.blob.core.windows.net/frc2025/Manual/2025GameManual.pdf

Requirements

- The mechanism would have to grab and lift the ball to a height of 2m
- Intaking and outtaking the ball had to be as fast as possible
- The mechanism must take up the least amount of space possible
- Must maintain a low center of gravity to avoid tipping

CAD Drawings



Process

- Brainstormed and created rough sketches for potential ball intake mechanisms
    - Design 1: Vacuum suction
        - The vacuum had to be perfectly aligned to suck in the ball, making it unreliable
        - The vacuum module was heavy and took up too much space on the robot
        - Grip on the ball was very strong, making it harder to drop and let go

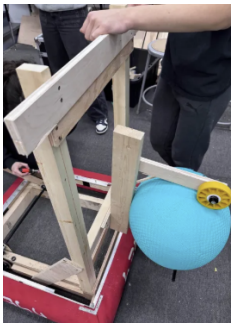
    - Design 2: Claw intake
        - More reliable than the vacuum since the alignment didn't have to be perfect
        - The ball was getting stuck occasionally, making it impossible to outtake
        - Took up a smaller footprint; was very light
        - Easy to fix

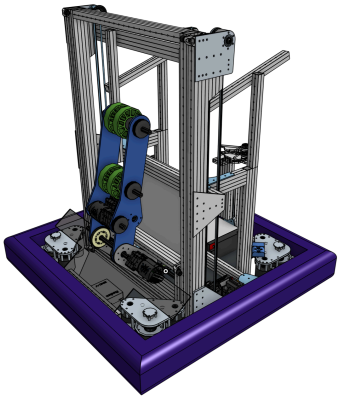
- Rapid prototyped elevator concepts to lift game objects using wooden planks
    - The elevator was easy to build, was very light and repairable
    - Made the center of gravity quite high, making the robot prone to tipping

Considerations/Decisions

- Chose design 2 since it was easier to implement, fix and was more reliable than the vacuum.
- Tested prototypes for both designs (see media section below for details). Even though design two had issues with making the ball get stuck, it only happened about 5% of the time, which we considered to be sufficiently low.
- Size and ease of use were our most important factors, which design 2 excelled at.
- For the elevator, we ended up confirming our design. We decided to add a steel plate to the bottom of the robot to lower the center of gravity.

Media

Image	Description	Designer(s)
	• **Elevator + claw-intake wooden prototype** • After confirming our designs for both aspects, we combined them into a singular wooden prototype to figure out approximate measurements for the steel channels	Arnav Saraf, Rosteen Alavi, Ben Naveret
	• **Finished Robot** • Elevator and claw mechanism	Entire Team

	• **Robot CAD with elevator** • Simulated the sliding joints in onshape	Mechanical subteam