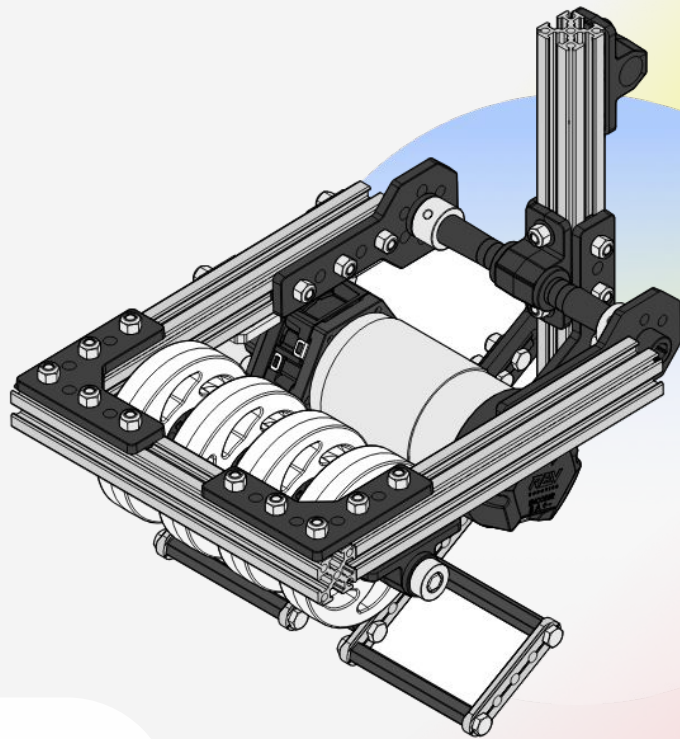


Workshop: Designing Effective Intakes

Julien Vanier
Coach, Rocket Robotics 21615
2025 FTC Kickoff



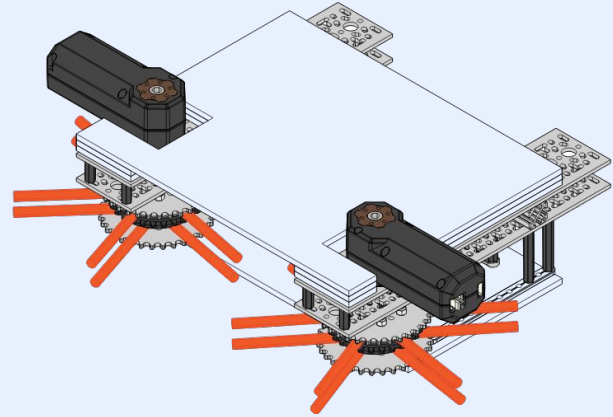
↓ What's an Intake?

Purpose

Acquire → Secure → Transfer game pieces

Active intake vs passive intake

- Active: motors or servos do the work
- Passive: rely on geometry and driver skill
- Tradeoff: reliability, speed, complexity



Types of Intake

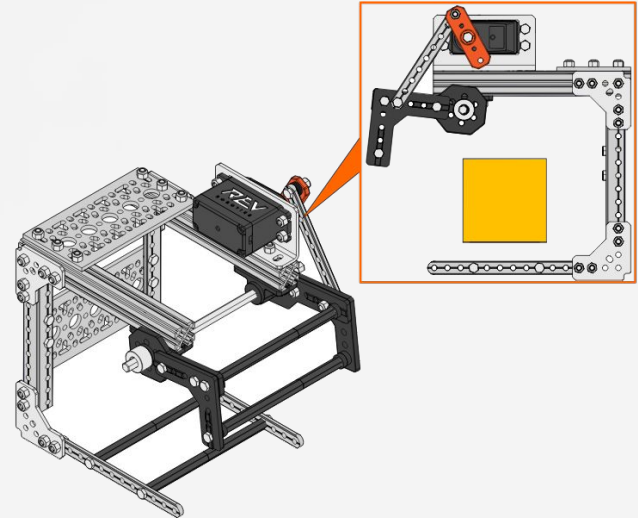
Claw

Pros

- Easy to build
- Intuitive to operate

Cons

- Requires accurate alignment
- Often slower
- Fragile



Think Beyond The Claw

Claws seem obvious but often not optimal

Types of Intake

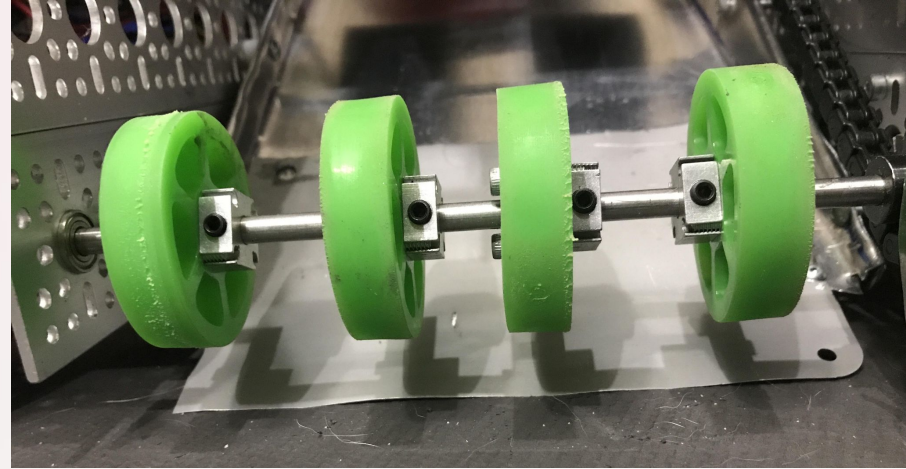
Compliant Wheels

Pros

- Rollers pull pieces in
- Wheels conform to game piece shape
- Great for irregular or misaligned pieces
- Different colors for different hardness
- Durable!

Cons

- Can cause pieces to tumble into dead spots
- Needs friction to pull pieces in



AndyMark compliant wheels and sushi rollers
Different options available from REV and GoBilda

Types of Intake

Flapper Wheels

Pros

- Flexible fingers or rubber “flaps” spin to guide pieces in
- Very forgiving when approaching from an angle

Cons

- Simpler but less precise control



GoBilda and REV flapper wheels

Types of Intake

Conveyor Belt

Pros

- Moves pieces up and into the robot
- Can store or transport multiple items
- Useful for feeding directly into scoring mechanisms

Cons

- More complex
- Need to maintain tension in belt



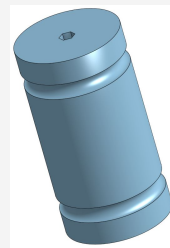
AndyMark rollers and polybelt



GoBilda round belt pulley



Custom pulley with 6mm Urethane Belting



Tip: to make custom belt, cut, meld ends with heat gun, press together and hold for 2 minutes.

Case study

Power Play (2022)

Game piece: Cones

Challenge: Cones stacked 5 high

Intake: Claw with wheels

Observations

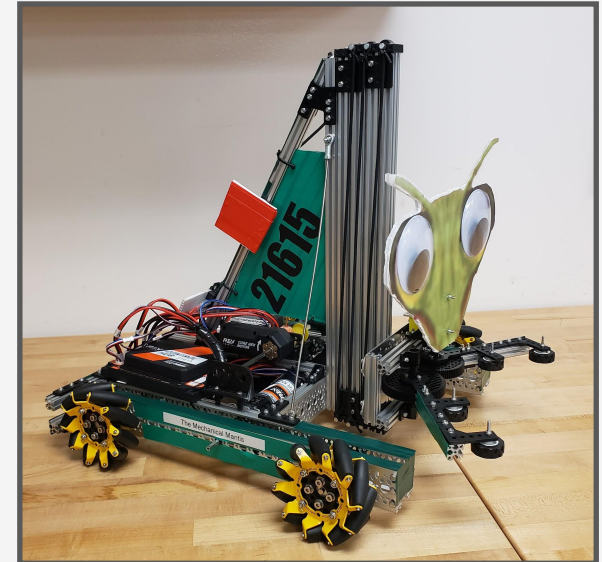
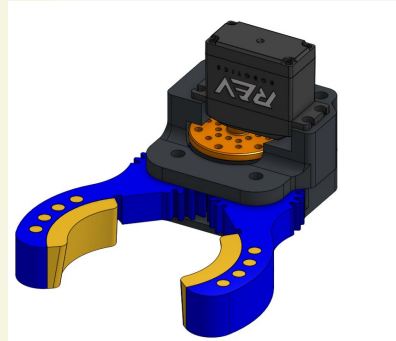
- Simple to build

- Cones slipped

- Required precision

- Couldn't pick up fallen cones

Improvement: Custom claw to match shape of cones



Case study

Centerstage (2023)

Game piece: Thin hexagonal Pixels

Challenge: Hexagon shape means the piece has 2 “diameters”

Intake: Active compliant wheels with hinges

Observations

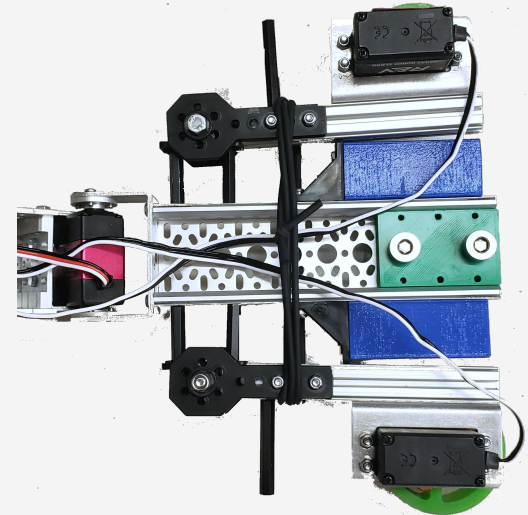
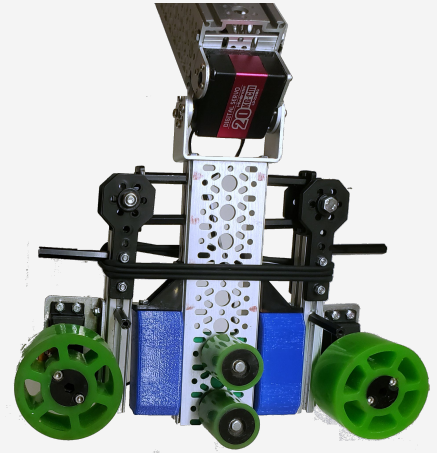
- Continuous rotation servos for in/out

- Held 2 pixels

- Low precision needed

- Best against wall (struggled with floor pickups)

- Wrist was a weak point



Case study

Into the Deep (2024)

Game piece: Hollow rectangle Sample and Specimen

Challenge: Concave sides make it hard to grip.

Clipping Specimens needs a lot of force.

Intake: Active intake with 2 servos and compliant wheels

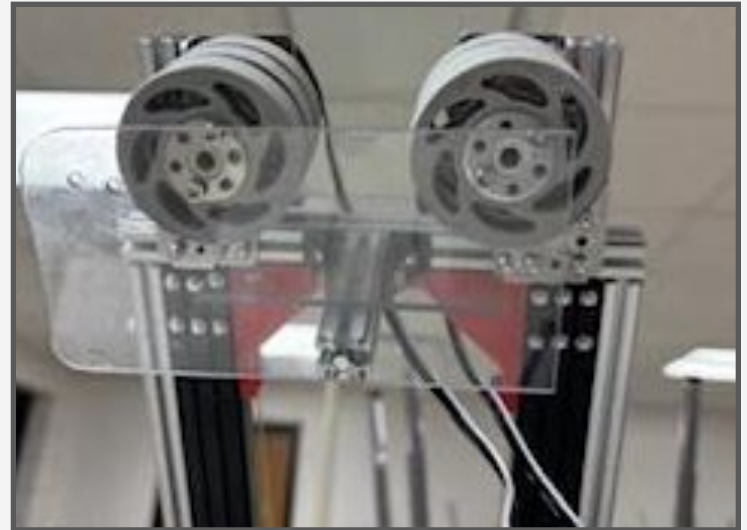
Observations

One intake for Samples and Specimens

Self-aligning, allowed controlled release

Specimens rotated and had to be ejected, tried again

No wrist meant approach mattered



↓ How to Design an Intake

Golden Standard: **Touch It, Own It**

Principles

Reliability: durable against impact

Consistency: picks up quickly every time

Controllability:

Efficiency: short cycle time

Design factors

Shape, size, symmetry of the game piece

Entry conditions: floor, wall, dispenser, stack

Possession limits

Precision vs forgiveness

Good Luck!



This presentation



Driving Mecanum
Wheels Presentation



Machine Vision
Presentation



REV Starter Bots
Documentation



Questions? Contact
jvanier@gmail.com

See also gm0.org for additional resources!

Image credit: Rocket Robotics, REV Robotics, GoBilda, AndyMark