

GEAR GIRLS

23469



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-TEAM OVERVIEW-



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OUR MISSION STATEMENT

As a Girl Scouts robotics team, our overall mission is to get young girls more involved in the STEM community, within and out of FIRST. We strive to change the status quo, and break gender barriers. We believe that it is extremely important for women to be more involved in the STEM community.

MOTIVATE, CONNECT

ENGAGING NEW TEAM MEMBERS

- **Team member recruitment event:** Helped Rookies learn the basics
- Starter kit building
- Coding tutorials
- CAD tutorials
- Drive team tryouts
- Summer outreach



★ ROOKIE ★ 3RD YEAR ★ 5TH YEAR ★ 6TH YEAR ★ 7TH YEAR

TEAM ROLES

BUILDING

OUTREACH

CODING

DRIVE TEAM

SCOUTING

MEDIA:
NAKIYA

AUTONOMOUS: AUBRIE

DRIVER: LILLY

DRIVE COACH: GABBY

MARKETING: MEDHA

DRIVER CONTROL: NAKIYA

SUBSYSTEMS:
MOIRA

HUMAN PLAYER:
NAKIYA

SCOUTING: AUBRIE, EMILY, MARIAH,
TRISTYN, MEDHA, OLIVIA

SUBSYSTEMS: AUBRIE

LIFTS: NAKIYA, TRISTYN, MOIRA

HEAD ALLIANCE PARTNER:
OLIVIA

CHASIS: NAKIYA & TRISTYN

SUBSYSTEMS: NAKIYA, TRISTYN, ABBIE, LILLY

CAD DESIGN: MARIAH

ENGINEERING INSIGHTS: TRISTYN

PIT CREW: ABBIE

HOW WE CONNECT WITH OUR SPONSORS

Throughout the season we kept our sponsors up to date with a **robot progression slideshow**.

Week 1
(9/12 + 9/15)

Instead of using a claw or pinchers for intake, Abbie, Emily, and Lilly tested out the idea of a "Spin-Take". We figured that this might be more efficient, since we wouldn't have to tediously adjust our robots position for picking up samples.

TOTAL OUTREACH HOURS

783

INCREASE SINCE LAST YEAR

308%

TEAM SPONSORS:

Daugherty
BUSINESS SOLUTIONS
girl scouts
of southern illinois



wieland
NEAL'S
PLUMBING, LLC

EMBARK
FOUNDATION
EMBAROKING ON A PATH OF POSSIBILITIES

MIKE AND JAN WINKLER

Ehrhardt
Automation Systems
BOEING



1



-SEASON GOALS-



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TEAM GOALS



= New member

MOTIVATE, CONNECT

Team goal	What we did to achieve it
Have a functional robot for meets 1 & 2 and a improved robot for meet 3 and the qualifier	Started building the chassis while we were prototyping and took notes on what we could do to improve robot one
CAD prototype our entire robot	Had a team member learn how to do it
Create a strong portfolio and engineering notebook	Have each team member work on a page or two
Reach out to the community more	Total hours this season : 649
Improve cycle times	Had Driver tryouts for best drivers, added dual motor system for faster vertical slides, changed hor. slides to servos for quicker deployment
Improve Scouting Communication	Practice scouting by watching the past live streams

Team Member & Goal	Actions Took	Contribution To Team
Abbie Use last season's experience to better build & prepare	-Worked w/new team member -Fixed robot in high stress situation	-Solutions for cord management -Created gearbox
Olivia Advance in CADing	-Cad the bucket and try out some CADing ideas for the claw.	-Mentored Mariah in Onshape -Made multiple iterations of claw
 Lilly Improve driving in tele-op	-Used a series of drills to practice grabbing samples	-Reduced cycle times down to 12 seconds for a high-basket
 Emily Improve building	-Built a GoBilda starter bot	-Built starter bot to use for demos
 Aubrie Learn how to code without assistance	-Began learning with coach/teammate help -Started coding with additional help	-Coded Autonomous
Moira Improve in coding and CADing	-Went through OnShape tutorials -Practiced CADing	-Prototyped some buckets
 Nakiya Improve building	-Built a GoBilda starter bot -Built a drive chassis -Learned how to build linear slides	-Built linear slides for robot #2
Gabby Better communication	-Thrived with alliances due to good communication and planning	-Able to compromise with our alliance
 Mariah Learn as much as I can about Onshape	-Completed Onshape tutorials	- Created and improved the robots' basket - CAD a version of our robot
Tristyn Improve building	-Helped members learn how to build -Became adept at building slides	-Built slides for the robot
 Medha Help the team long-distance	-Watched YT tutorials for building a website	-Built the website



Lessons
Learned =



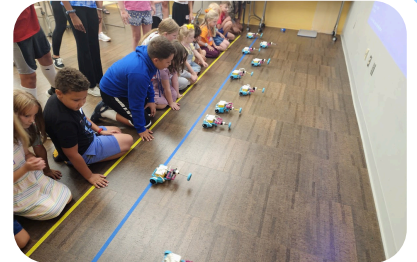
TOTAL HOURS:
324

24
TOTAL EVENTS

CONNECT, MOTIVATE

LIBRARY STEM CLUB

- In the spring-summer the O'Fallon Library STEM Club was planned and supported by The Gear Girls
 - It occurred **once a month**, spanning from **February to July**, and was open to ages **3-12 years old**.
 - We hosted various new and creative activities for the children to participate in
- **FEBRUARY:** Flashlight circuit making
- **MARCH:** SPIKE Prime paper airplane launcher
- **MAY:** FTC robot driving game
- **JUNE:** Coding CUBELETS
- **JULY:** Mouse maze coding
- **AUGUST:** Wall bumper robots



Wall bumper robots being launched

- By hosting the STEM club, we **IMPACTED** our community by **introducing** the world of STEM to a wide variety of ages
- We **LEARNED** how to lead the kids. With our guidance, they were able to **engage** in the activities better.



INTRO TO ROBOTICS

- Met twice in July, each class was two hours
- Taught 6 kids how to build and code Spike Prime robots
- Activities included wall-bumpers, dancing bots, and FLL missions w/ADB

MOYE ELEMENTARY FAMILY NIGHT

- Lego Drawing Machines
- FTC Field and Robots
- 100 Kids attended and participated in driving robots
- **Inspired** a parent to start a **FLL Explore Team**
- We **LEARNED** that it is good to have a **plan** for the children or else the robots will be turned into **battle-bots!**



LIBRARY ROBOTICS CAMP

- Throughout the month of August, we hosted **weekly robotics STEM meetings** at the local library.
- The age group that attended ranged from 6-12.
- We taught kids how to **build** and **code** the Lego Spike Prime Advanced Driving Base, Introduced to **FLL** Replay Challenge Field
- Our team acted as mentors and role-models for the younger kids, helping us **learn how to foster leadership & public speaking skills**.

COMMUNITY EVENTS

- Library Robot Demo - 2/1
- Moye Elementary Family Reading Night - 3/12
- Library Stem Club - 3/11, 5/13, 6/10, 7/8
- Library Kickoff Demo - 5/25
- Governor French Academy Showcase - 7/20
- Library Robotics Camp - 8/1, 8/8, 8/15, 8/22, 8/29
- Indy Car Race - 8/16
- Robot Rumble @ The Raceway - 8/31
- O'Fallon Cityfest Parade - 8/24

**3 NEW
TEAMMATES
GAINED FROM
OUTREACH**



3



O'Fallon Cityfest Parade (P3 & Gear Girls)



**120
PEOPLE REACHED**

**TOTAL HOURS:
188**

**14
TOTAL EVENTS**

CONNECT, MOTIVATE

GIRL SCOUT LEADER MEETINGS

- Three of our members spoke on the importance of involving girls in STEM and our experiences in FLL & FTC
- Gave leader flyers on FLL and badgework, as well as statistics on girls in STEM and how to get girls more involved

GEAR GIRLS MENTORING

- Mentoring program for new FLL teams
- Teach coding and building
- Presented to 25+ GS leaders

GEAR GIRLS MENTORING PROGRAM

WHAT IS FLL CHALLENGE?

- FIRST Lego League challenge is a robotics program for ages 9-14
- During the season teams will:
- Use LEGO Technic pieces to build a competition robot which they code using the Spike Prime robot kit
- design a innovation project that solves a problem relevant to the season's theme

WHAT WE'LL DO

- Some mentoring responsibilities include:
 - providing resources to coaches
 - providing technical support
 - and non-based on team needs
- We will provide a regular number of hours of mentoring for each team and will be present at competitions.

OUR CONTACTS

- geargirlsgssimail.com
- Coach Mike's contact: 201-637-2015
- Please reach out to us with any questions



WHERE

- In person meetings will be available for teams in:
 - Belleville, O'Fallon, Skidley, and Fairview Heights
- For teams in other locations, we will mentor via Zoom



We **learned** the lesson of how important it is for us to be positive role models to the youth. By actively participating, we can **inspire** them.

STEM CAMP

- Hosted **3 interactive stations** for **5 days** at Girl Scout STEM camp
- Creative activities using Spike Primes
- Introduced a variety of challenges so girls could **explore coding in hands-on ways**
- Girls coded basic wall bumper robots & got to experiment w/advanced coding blocks
- **Volunteering at the event helped introduce many Girl Scouts to FLL (First Lego League) & sparked interest in robotics**



**TEAMS REACHED:
61**

**TOTAL HOURS:
145**

**EVENTS:
5**

FLL MENTORING

- We **helped a total of 3 teams**
 - Robot Rookies, Lego Lunatics, and Robo Scouts
- Advised their robot game & gave feedback for both robot & project



FLL QUALIFIER SETUP & VOLUNTEERING

- Provided a MC, Judge's Assistant, Referee, Field Resetter, and Queuer.
- Ensuring the event was fully staffed for smooth operation.
- **Inspiring all-girls teams**
- **Learned** the importance of setting a good example
- Important for girls to do jobs in the robot game to help other teams



FTC QUALIFIER

- **3** team members, **2** coaches, and **1** parent.
- Lafayette Sr. High School in Missouri
- **12 hours** per girl
- We worked as Judges Advisors Assistants
- Completed extra tasks around the event
- **Learned** about other teams portfolios & robots for inspiration, as well as insight to judging

PONTIAC SCRIMMAGE

- Helped team with coding issues
- Taught rookie team how to code
- Used previous FLL skills



FLL REGIONALS VOLUNTEERING

- Created fun games w/demo bots for kids to play with
- Got 2 people interested in FIRST
- **Learned** importance of reach out to FLL coaches so they can start FTC teams



FRC KICKOFF

- Demoed the robot
- Handed out flyers for **Girls In STEM panel**
- Had kids drive a Demo bot





ENGINEERING EXPERTS

ETHAN FISHER Mechanical Engineer

- September 7th – kickoff event, gave **advice regarding subsystems** and a boom arm for intake
- November 5th – design review and advice on main problems
 - Suggested **small changes to intake system**
 - Suggested **using a limit switch to ensure that the horizontal slides had retracted**



Earhardt Tour

ACTION ITEMS

- Added limit switch to horz. (see design overview)
- Rebuilt slides w/tensioner
- Dampener to reduce bucket angle
- Increased torque on elbow servo
- Used horizontal & vertical slides for reliability, no boom arm

VANESSA DIAZ Instrumentation Lead

- Gave **advice on whether to go with a new slide design**
 - Changing slides to pivoting vs staying the same
- Specifically on **not getting attached to a specific idea**

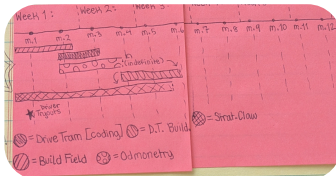
ACTION ITEM

Let go of idea to pivot horizontal slide

- Inspired her to volunteer at Missouri FTC meet

RUTH SCHNEIDER Industrial Engineer & **MEGAN ZAIZ** Mechanical Engineer

- September 7th – at kickoff gave **advice on how to plan and schedule** our season



ACTION ITEM Post meet plans throughout season

MATT SAIBO Innovation Lead Scott AFB

- December 8th – **Design review on plans for second robot**
 - Best option for hanging is 3D printed hook
 - Best material to print a hook to hang is Nylon X**
 - Hold the weight of our robot
 - Durability and structural support.
 - Weight sensor** to know when samples are in bucket

CONNECT, MOTIVATE

GIRLS IN STEM PANEL

Katie Dollahon – Jr. High Technology Teacher
Elizabeth Niebruegge – FLL Coach
Michael Harvey – **Southern Illinois FIRST Coordinator**

- January 11th– hosted Girls In STEM panel
 - Invited **twenty-one professionals in our local STEM communities**
 - Discussed **challenges in women's leadership roles, and increasing female participation in the STEM community**

We learned how experts & adults can give a lot of insight into unique perspectives.



ACTION ITEMS

- ✓ Contact elementaries to attend Hinchcliffe STEM night
- ✓ Create pamphlet for parents on how to involve girls in STEM
- ✓ Plan for a Fulton & Carriel STEM Night
- ✓ Create a team website
- ✓ Plan to participate in Girl Scout Camps
- ✓ Plan a FLL Mentoring Program
- ✓ Plan a STEM Camp

TOURS OF WIELAND & EARHARDT

Connecting to the Engineering Community

- November 5th – **toured companies and their facilities.**
 - Earhardt and Wieland
 - Shared our robot and what our team and FIRST is**

ANDY BELL Surface Warfare Officer

- Helped form **angle Risk Mitigation measurements for System:** Coming up with solutions
- Developed our **risk slide-cover** to prevent future problems
- Developed our **risk mitigation system**



- Made detailed notes of things we wanted to be on robot

STEP 1: ANALYZE

- Made lists of everything the robot required

INNOVATE, DESIGN

Challenge 1:

- Autonomous period
- collect samples into baskets
- get samples into the net zone
- player period
- assemble clips and get robot to pick it up
- put clips on low/high bars
- put samples in high basket
- end game
- hang from high bar

low bar → high bar

Challenge 2:

- Designing the collection arm
- only collect one sample at a time
- collects samples at different heights/positions
- collection arm doesn't interfere with ascension arm

Designing ascension arms

- reaches top bar without catching
- can't drop robot
- has to be strong enough yet light enough
- has to carry double the weight

Challenge 3:

- Reliability, Dependability, and Effectiveness
- make sure all systems work 100% of the time
- make sure all arms are quick

Needs	Wants	Shoulds
arm with elbow	possible intake	limit on intake
wrists on collection arm	bucket system	light to signal intake full
mainwheels	scoop system	identifies color
collection system	pulley	spit out wrong color
	360° hole clamp	

Our design process allows us to:

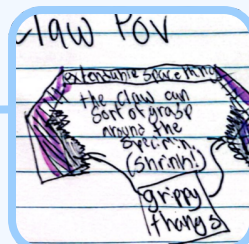
- give structural support to ideas
- break down our main ideas into smaller ones

STEP 2: SYNTHESIZE

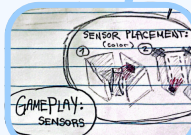
- Created simplistic designs
- Visualized how the robot would actually function
- Evaluate if it was achievable

STEP 3: RESEARCH

- Figure out how to build it
- Pros and cons
- Materials required



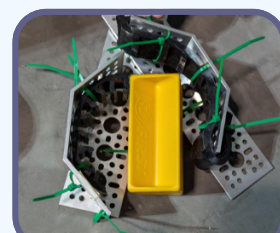
CLAW SKETCH



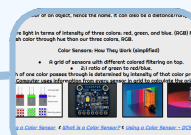
COLOR SENSOR CLAW



ARM HIGH BASKET



CLAW PROTOTYPE #1



COLOR SENSORS

STEP 4: PROTOTYPE

- Ensured everything fit our space constraints
- Lots of trial and error

STEP 5: TESTING & ITERATIONS

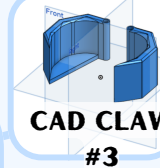
STEP 6: FINALIZE DESIGN

- New design allowed our robot to score specimens
- Vertical lift wires no longer stuck
- Replaced motors w/linkage-servo mechanism for slides

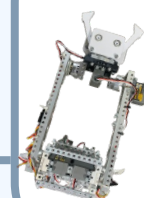
- Between 1st & 2nd robots large parts of intake/outtake were changed



CAD CLAW #1



CAD CLAW #3



CLAW

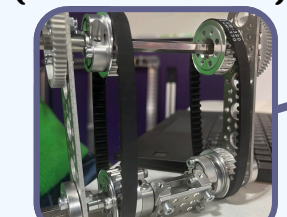


TWO MOTOR GEARBOX



4 BAR LINKAGE PARTS

TOUCH SENSORS (ROBOT OVERVIEW)

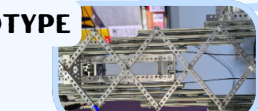


4-BAR LINKAGE PROTOTYPE

LINKAGE PROTOTYPE



DUAL LIFT SYSTEM PROTOTYPE



INSTALLED LINKAGE

Robot 2 Speed
Horiz. Slides: 2.4
Vert. Slides: 3.7
Sample cycle time: 8.4

Robot 1 Speed
Horiz. Slides: 2.9
Vert. Slides: 4.1
Cycle time: 12.5

Aprox. **48.81%** speed decrease in Cycle Time

- Helped refine robot design



-ROBOT OVERVIEW-



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8 MOTORS
8 SERVOS

15
SENSORS

8
SUBSYSTEMS

NEW TECH:
SERVO HUB
OPTICAL ODOMETRY
DS SERVOS

INNOVATION, DESIGN

Specimen
Claw

Vertical
Slide

Horizontal
Slides &
Linkage

Elbow

Swiveling
Wrist

Linear
Actuators

Claw

ORIGINAL PROTOTYPE

Some differences include:

- One horizontal slide
- Vertical slide centered
- Horizontal slide on the right



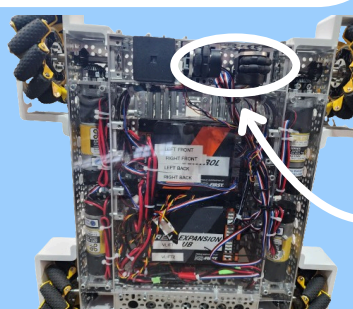
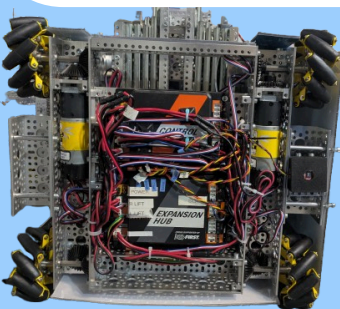
ROBOT COMPARISON

First Robot

- Two wheel motors in channels
- Old mechnum wheel
- Old miter gears
- Wider and shorter robot

Second Robot

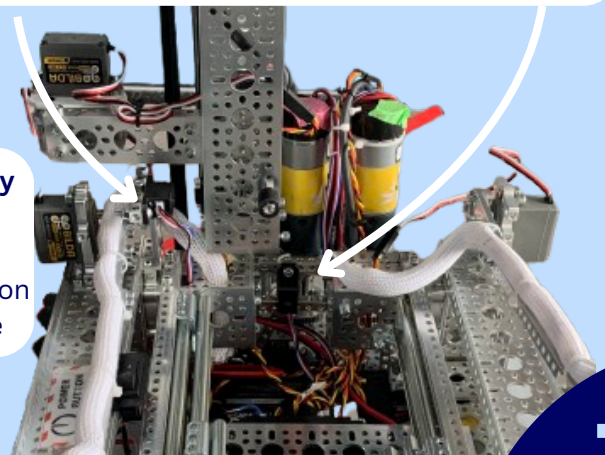
- 4 wheel motors in chassis- more top room
- New wheel- more grip + larger
- New miter gears- less grinding
- Thinner, longer robot



Odometry
Pods
more info
available on
auto page

SENSOR LOCATIONS

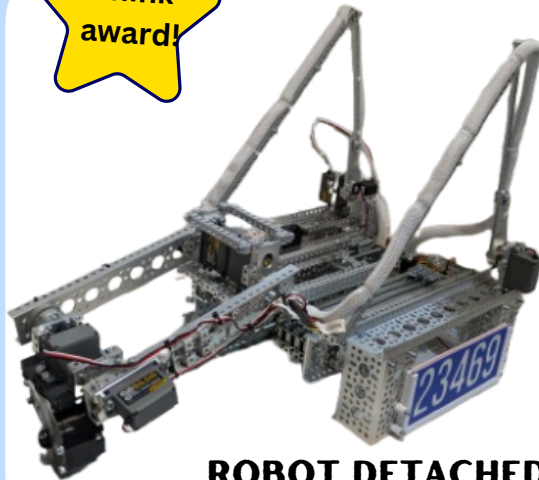
This season we used **two magnetic limit switches** to **enhance our autonomous** and our **accuracy during tele-op** by **ensuring our slides were completely up or down** after each action.





THE PROS OF MODULARITY:

- Allows to reach parts of our robot quicker
- Horizontal subsystem and frame are completely detached
- Fully detachable in 4 screws



ROBOT DETACHED FROM THE BASE

INNOVATE, DESIGN

LINEAR ACTUATORS



- Allows robot to hang at end of match
- Hook from Seacows (Arkansas Sate Outreach)



CAD lessons learned:

- **Problem solving skills**

Ex: Asking for help when not knowing how to import GoBilda files.

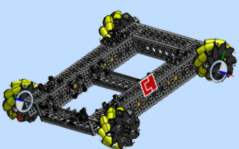
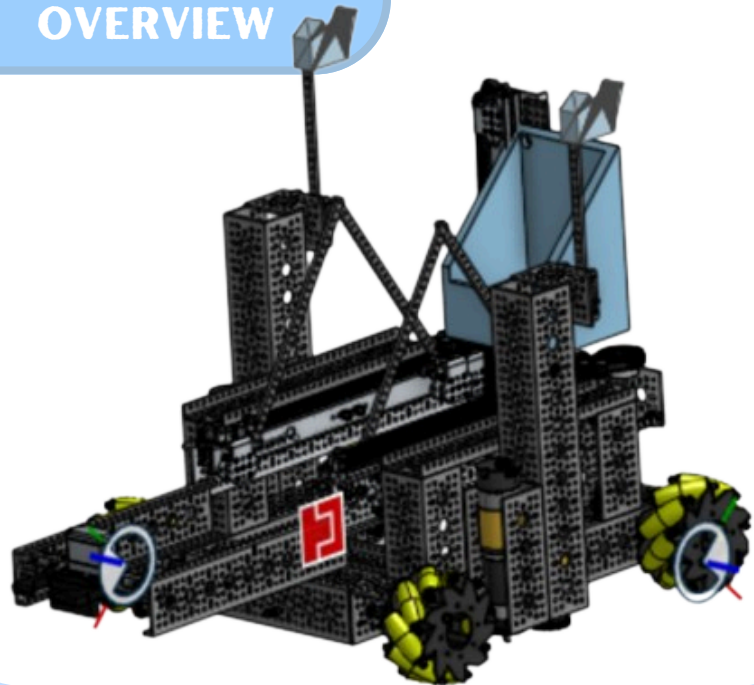
- **Thinking outside the box**

Ex: Coming up with ideas for the bucket.

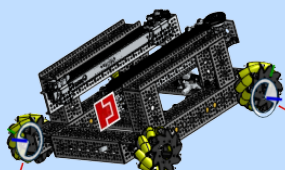
- **Learning how to understand orientation**

Ex: Discovering the different ways to view the part studio.

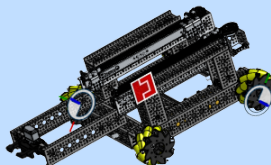
ROBOT #2 CAD OVERVIEW



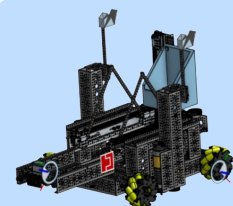
Chassis



Side supports & slides



Elbow and claw



Vertical slides & Linear Actuators

ELBOW + CLAW

5 ITERATIONS

- Both are attached to our Horizontal Slides.
- The Elbow moves up and down
- The Elbow also pivots left to right
- 3D printed** and had grippers that fit into the divots of the samples for the ease of the operator.
- We've changed to a smaller, more effective 3D printed claw

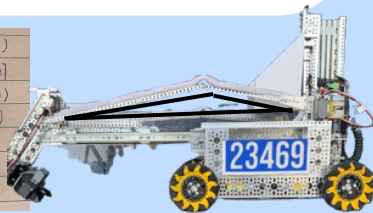
HOW FAR CAN WE EXTEND OUR SLIDES?

Think
award!

$$C=174 \quad b=8 \frac{3}{4} \text{ in}$$

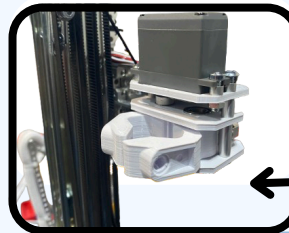
$$c \sim 22 \text{ in}$$

$$\begin{aligned} c^2 &= \left(\frac{174}{2}\right)^2 + \left(\frac{8.75}{2}\right)^2 - 2\left(\frac{174}{2}\right)\left(\frac{8.75}{2}\right)\cos(179) \\ c^2 &= \left(\frac{174}{2}\right)^2 + \left(\frac{8.75}{2}\right)^2 - 2\left(\frac{174}{2}\right)\left(\frac{8.75}{2}\right)\cos(179) \\ c^2 &= \frac{1476}{4} + \frac{19}{4} - 2(174)(8.75)\cos(179) \\ c^2 &= \frac{289}{4} + \frac{19}{4} - 2(174)(8.75)\cos(179) \\ c^2 &= \frac{2017}{4} - 2(174)(8.75)\cos(179) \\ \sqrt{c^2} &= \sqrt{982.72} \\ c &= 21.97 \end{aligned}$$



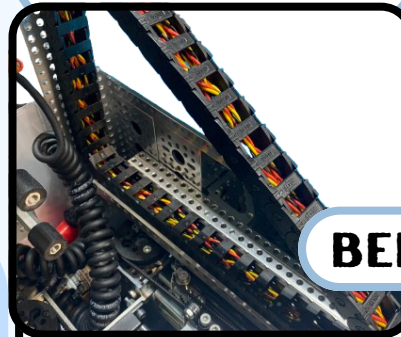
To find the length our slides could extend, we also needed to incorporate the extra distance our slides extend past the edge of the robot.

INNOVATE, DESIGN

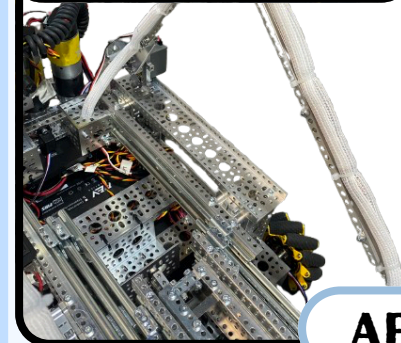


SIMON CLAW GRABS SPECIMEN AND CLIPS THEM ON THE LOW OR HIGH BAR.

HORIZONTAL SLIDES:

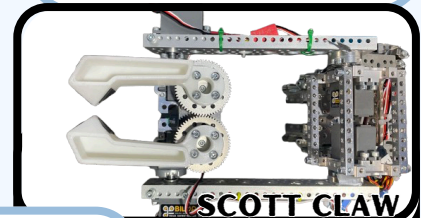


BEFORE

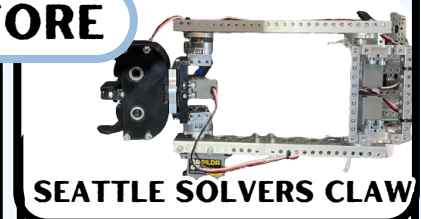


AFTER

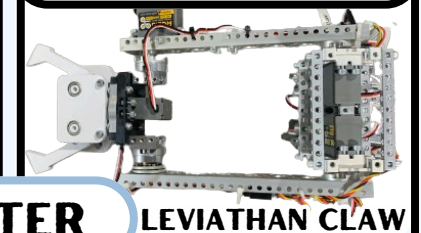
ELBOW + CLAW:



SCOTT CLAW



SEATTLE SOLVERS CLAW



LEVIATHAN CLAW

SCOTT CLAW VS. SIMON CLAW VS. SEATTLE SOLVERS CLAW VS. LEVIATHAN CLAW

Think
award!

	SEATTLE SOLVERS CLAW	LEVIATHAN CLAW	GREAT SCOTT CLAW	SIMON CLAW
PROS	Has sensor Smaller Can swivel	Allows claws to open wider	Has decent accuracy	Easy to use
CONS	Possibility of wires being snapped	Late edition, had to learn quickly	Too large	Hard to line up
USE	Collect samples	Collect samples	Collect samples	Hang Specimens

We chose the **Simon Claw** and the **Leviathan claw** for the **advantages they present to the drive team** (i.e. easy to line up, human player can predict its location better, ect.)

BELT DRIVEN VS. LINKAGE DRIVEN HORIZONTAL SLIDES

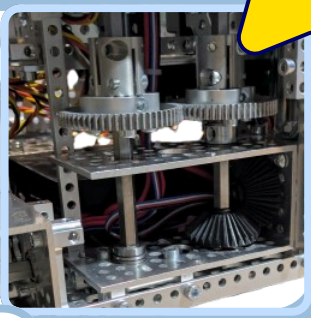
	BELT DRIVEN	LINKAGE DRIVEN
PROS	Easier to install Motors	Driven by 2 Servos Better cable management
CONS	Driven by 2 Motors- could use motors for other things Used more power Bulky Cable Chain	Servos can burn out
USE	Collect samples	Collect samples

We chose the **Linkage Driven** for our slides because they could **move quickly** and **use less current**.

CUSTOM GEAR BOX

Think
award!

- Fits **two motors**
- More torque and speed
- Can design around our space constraints
- More secure connection points between gears

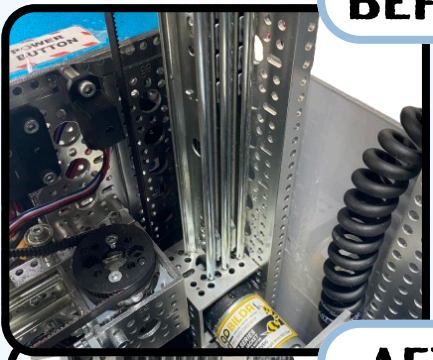


INNOVATE, DESIGN

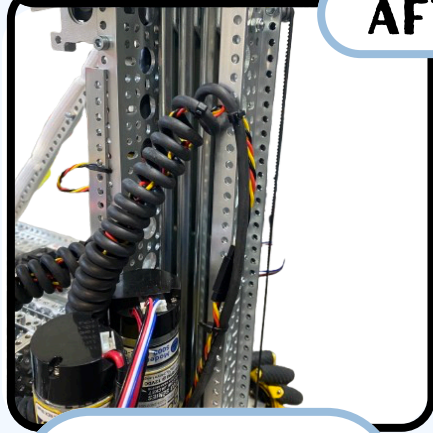
VERTICAL SLIDES

- Belt driven slide.
- **Used** to score into the high basket, using the bucket.
- Decided to use **2 motors instead of 1** so the lift would go double the speed of the original.
- **Because we use 2 motors**, more space is taken up and gears are more finicky.
- The gear box is custom made to fit both motors.

BEFORE



AFTER



VERTICAL SLIDES:

BUCKET:

CUSTOM CAD BUCKET

5 ITERATIONS

- A **3D printed** container attached to a rotating servo.
- Attached to the Vertical Slides.
- Dumps samples into the baskets.
- The bucket has an **added** ridge at the bottom that used to be spacers screwed in.
- We **added** a padding to the bottom to stop samples from bouncing out.
- Made smaller to fit constraints

SINGLE VS. DOUBLE MOTOR COST ANALYSIS

Think
award!

# OF MOTORS	COST	BENEFITS
SINGLE MOTOR	• Slow • Could barely support itself	• Uses less space • Lighter if we wanted to hang
DOUBLE MOTORS	• Hard to mount onto the robot • Chassis complications • Draws more current • Takes up more space	• Much faster • Decrease cycle time by 2 seconds

INTAKE - SWIVEL WRIST

- Added after State
- Elbow/wrist has the ability to swivel in order to minimize main robot driver control while operating intake
- Makes transitions away from submersible smoother



10-0-5
MATCHES

AUTO
POINTS:
27-30

SPECIMENS
IN AUTO: 3

HIGH BUCKET
SAMPLES IN
AUTO: 3

DESIGN

SCOUTING TEAM:

- Take notes every match of:
 - Points per team
 - Autonomous consistency
- Report to DT our alliance's autonomous consistency for strategizing w/ alliance

END GAME

- We get one or two final samples/specimens
- We then park or do a Level 1 or 2 ascent
- This is the most efficient strategy for us.

ADAPTABILITY:

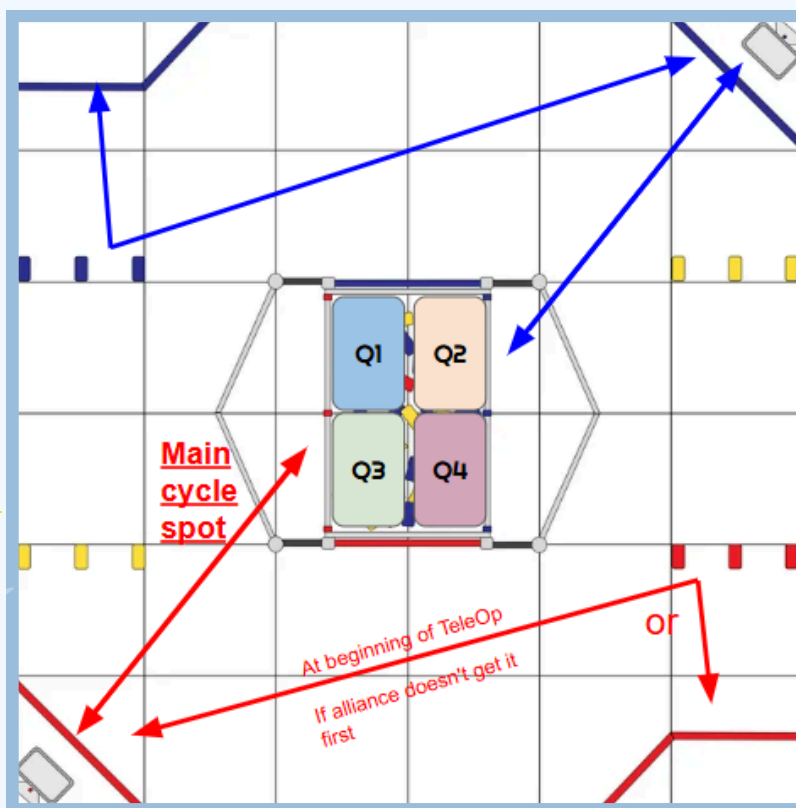
- We can score specimens or samples in auto & teleop
- We can score quickly and hang efficiently for scoring the most points

COMMUNICATION ON FIELD:

- At the beginning of season had poor communication
- Trouble figuring out specimen location
- Quadrant system created** to find pieces easier
- DC can say "[Bottom/Middle/Top] [Left/Right] Quadrant [#]"

Lessons Learned:

- Drive Coach:** How to accommodate my coaching to the abilities of the team
- Robot Driver:** The importance of communication and identifying pieces for the fastest cycles of scoring
- Subsystem Driver:** The importance of listening to your teammates and trusting them.



DRIVE TEAM:

- Small area where we cycle
- Go for high basket or high bar
- Quadrant naming system
- Adaptable for other teams
- At end of Teleop park in observation or lv. 1 Ascent

DRIVER COACH (DC) JOB:

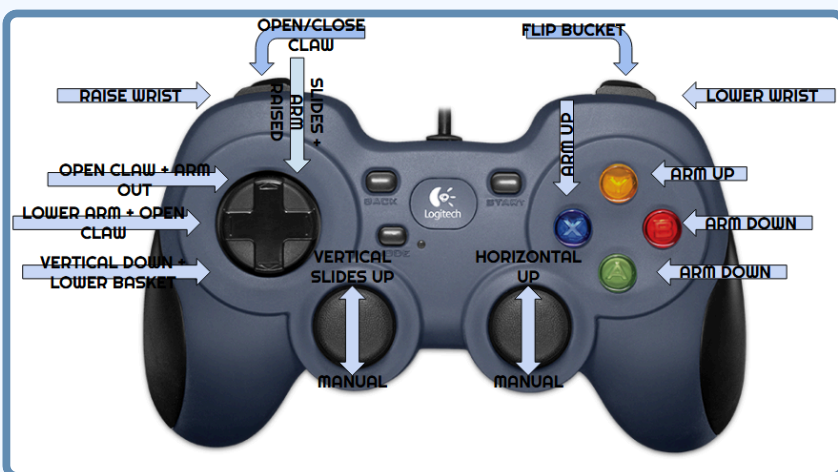
- Look for good specimens to collect
- Work with Alliance during game
- Say when it's time to park
- Call out quadrants

DRIVER/OPERATOR JOB:

- Follow Driver Coach's Instructions
- Remembering to stay calm
- Adjust to situations as needed



Sequence:	Check:	Action:	Requirement:
Acquire Piece	X	Lift moves out	Half € full permission needed
	X	Wrist moves down	None
	X	Claw closes onto sample	Driver Control
Load Piece	X	Arm moves up with sample	None
	Bucket is in the right place	Lift moves in	None
	Bucket is in down position	Vertical slides down	None
	None	Claw flips back	None
	None	Claw drops piece into bucket	None
Dump Piece	Is the claw open?	Wrist rotates to move out of the way	None
	Is the arm up?	Lift with bucket moves upward	None
	None	Servo rotates backward to dump piece	None
Neutral State	None	Bucket servo moves down	None
	Arm is not in	Vertical slides move down	None
	None	Arm moves in	Is bucket there?



Speed Controls

```
private void doDrivetrainControls() {
    //Set driver speed as a percentage of full (normally set to full)
    if (gamepad1.right_bumper && gamepad1.left_bumper) {
        DRIVE_SPEED = DRIVE_SPEED_SLOW; //set drive speed to 25%
    } else if (gamepad1.left_bumper) {
        DRIVE_SPEED = DRIVE_SPEED_MEDIUM; //set drive speed to 50%
    } else if (gamepad1.right_bumper) {
        DRIVE_SPEED = DRIVE_SPEED_FAST; //speed boost to 100%
    } else {
        DRIVE_SPEED = DRIVE_SPEED_DEFAULT; //default to 70% drive speed
    }
}
```

Object Oriented Program

```
waitForStart();

while (opModeIsActive()) {
    doDrivetrainControls(); // This method controls the robot's drivetrain.
    doHorizontalSlideControls(); // This method controls the horizontal slide.
    doVerticalSlideControls(); // This method controls the vertical slide.
    doClawControls(); // This method controls the claw.
    doWristControls(); // This method controls the wrist.
    doElbowControls(); // This method controls the elbow.
    doBucketControls(); // This method controls the bucket.
    doClawRotationControls(); // This method controls the claw rotation.
    doSpecimenClawControls(); // This method controls the specimen claw.
    doComboSequences(); // This method controls a combination of mechanisms.
    addTelemetry(); // This method sends data to the driver station.
}
```

CONTROL AWARD

SEQUENCES

What are Sequences?

- An order steps are performed in

How are Sequences used?

- They are used to figure out what order to code in
- They make the coding process easier by deciding requirements for the code to run

How do we use Sequences?

- We use sequences on our controller to make sure our code is ran properly.

SET - POINTS

What are Set-Points?

- Specific location that a subsystem is set to move to
- Ensures that our subsystems are positioned accurately

How do we use Set-Points?

- We use them in our controllers and attachments to position the robot

CODE

Speed Controls:

- Allows the driver to change how fast or slow the robot operates in a match

Object Oriented Program:

- In Teleoperated our code matches our robots subsystems and we can be modular in the way we program the robot and how we operate different subsystems

CYCLE TIME

Sample: 8.4 seconds
Specimen: 5.6 seconds



CONTROL

- ## SAMPLE AUTO

STEP 2

Picks up second

- Takes from first spike mark

STEP 4

Gets third piece

- Takes from second spike mark

STEP 6

Parks in the ascent zone

- Performs level ascent

SPECIMEN AUTO

STEP 2

Pushes second

- pushes from first spike mark

STEP 4

Scores third specimen

- scores on high bar

ROADRUNNER

- Allows for **complex autonomous movement**
 - Maintains **control of speed and velocity**
 - Gives robots **advanced path following abilities**
- Uses multiple paths algorithms
- Doesn't require a deadwheel

30

Sample Auto Specimen Auto



Lessons Learned: Optical odometry is less accurate in different lighting, while odometry pods are more consistent



CONTROL

SENSOR/CONTROL COMPONENT

USE CASE

HOW IT IMPROVES FUNCTIONALITY

LIFT MOTOR ENCODER

Tracks rotations & lifts motors

Increases operator speed through preset positions for scoring

VERTICAL LIMIT SWITCH

Determines when vertical lift has reached bottom of slide position

Ensures slides can reset at the bottom if belts slip

BUCKET DAMPENER

Dampens bucket movement when lowering bucket

Reduces the power the bucket servo has to draw to hold itself up

HORIZONTAL LIMIT SWITCH

Determines when horizontal lift has fully retracted

Mitigates risk of slides being stuck out during matches

ODOMETRY PODS

Sets a position like GPS so the robot stays on track.

Allows the robot to constantly know where it is and creates successful autonomous

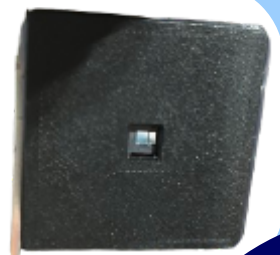
Magnetic limit switch



Odometry Pods



Optical Odometry





MEET SUMMARY



MEETS 1 - 3 STATISTICS:

MEET 1

Auto: 3 pts.
Teleop: 80 pts. (alliance)
Ascent: 3 pts.
NpOPR: 13.41

MEET 2

Auto: 16 pts.
Teleop: 128 pts. (alliance)
Ascent: 3 pts.
NpOPR: 75.08

MEET 3

Auto: 27 pts.
Teleop: 108 pts. (alliance)
Ascent: 3 pts.
NpOPR: 55.76

WHAT WENT WELL

Meet 1- Coded a functioning autonomous
Meet 2- Improved driving abilities
Meet 3- Independent specimen autonomous

WHAT DID NOT GO WELL

Meet 1- Inefficient alliance scouting
Meet 2- Unfinished pit display
Meet 3- Poor autonomous consistency, lack of backup plans

IL. STATE QUALIFIER STATISTICS:

HIGH SCORE

Auto: 60 pts.
Teleop: 174 pts. (alliance)
Ascent: Level 1 (3 points)
OPR: 72.74
Percentage Increase: 30%

WHAT WENT WELL

- Both autos were consistent
- 3rd place Inspire Award
- Our highest scoring match
- Advanced to state championship
- Reliable info on teams from scouts

WHAT DIDN'T GO WELL

- Non-ideal pit display
- Inconsistencies on robot
- Communication between drive and scouting team
- Scouting checklist
- Autonomous presentation

ARKANSAS CHAMPIONSHIP STATISTICS:

MATCH SCORE

Auto: 60 pts.
Teleop: 202 (alliance)
Ascent: Observation zone (3 pts)
OPR: 90.86
Percentage Increase: 25%

WHAT WENT WELL

- Made it to semifinals in the playoffs
- Won the motivate award
- Improved driving skills with backup drive team
- Connected with many teams

WHAT DIDN'T GO WELL

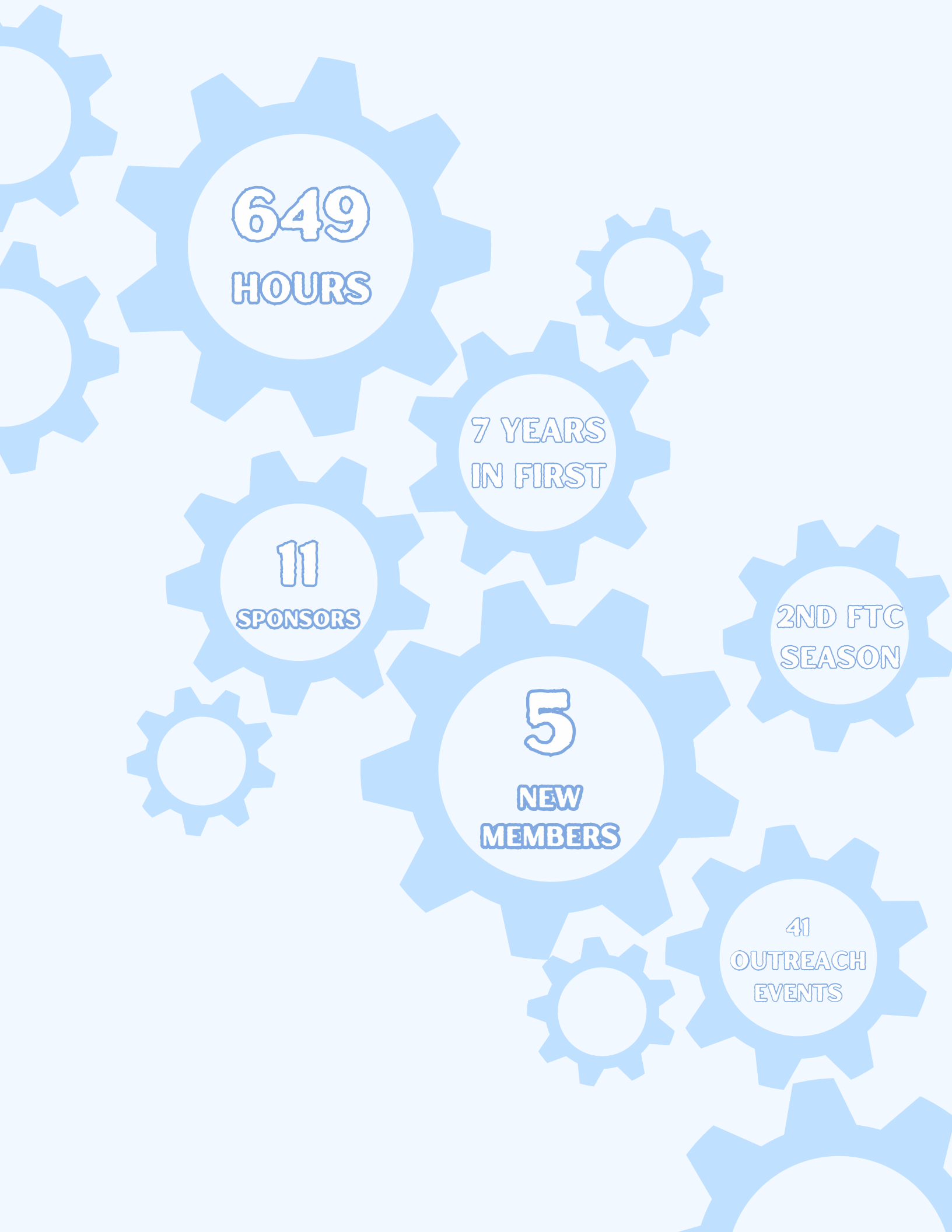
- Motors were loose
- Unable to efficiently communicate with alliance partners
- Unprepared for judges mid-day questions

IMPROVEMENTS

- **Seacows** showed us **hook for hanging**

OUTREACH

- **portfolio overview** for **rookie** team **Junior Goonies**

An infographic featuring several interlocking blue gears of various sizes on a light blue background. Each gear contains a white circle with text. The gears are arranged in a cluster, with some overlapping. The text inside the gears includes: '649 HOURS' (top left), '7 YEARS IN FIRST' (top middle), '11 SPONSORS' (middle left), '5 NEW MEMBERS' (center), '2ND FTC SEASON' (middle right), and '41 OUTREACH EVENTS' (bottom right).

649
HOURS

7 YEARS
IN FIRST

11
SPONSORS

2ND FTC
SEASON

5
NEW
MEMBERS

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