

GEAR GIRLS

23469

AWARD BADGE KEY:

Think.....	
Connect.....	
Reach.....	
Sustain.....	
Design.....	
Innovate.....	
Control.....	

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Innovate.....	8, 9, 10
Control.....	8, 11, 12, 13

TEAM OVERVIEW



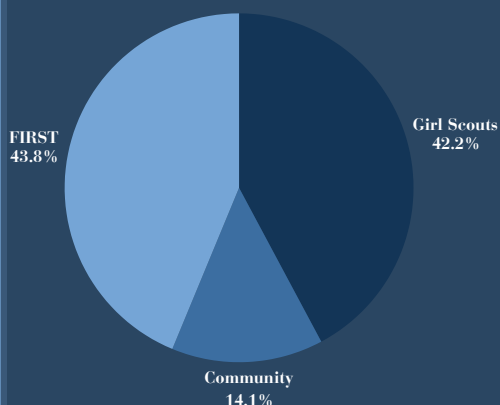
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PART 1

OUR MISSION STATEMENT:

We continue to pursue our goal of getting more girls involved in STEM and changing the status quo.

- A majority of our outreach is dedicated to *FIRST* and Girl Scouts
- Pictured to the left is the percent ratio of our 3 outreach types



All things furthermore pertaining to our mission statement will be marked with a white gear



OUTREACH OBJECTIVES

1. To get more girls involved in STEM
2. To give back to the *FIRST* community and remain present in FLL
3. To bring the joys of *FIRST* to people who have not yet been impacted

TEAM SUSTAINABILITY

- GOAL: Gain new team members from outreach events

- HOW: We met Natalie and Eleanor at the Mission To Mars STEM Camp (Pg.4)
- Gave a presentation to the older campers on FTC and what being on a team entails
- Invited both girls to the New Member Meeting
- Introductions, driving, coding, and building



Eleanor
Drive - Operator
ROOKIE



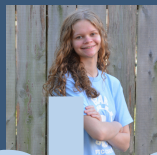
Natalie
Build
ROOKIE



Emily
Scouting
FLL Coach
2nd Year



Moira
Design - CAD
3rd Year



Aubrie
Main Driver
Software - Coder
2nd Year



Olivia
Design - CAD
3rd Year



Kristyn
Drive - Human Player
Build
3rd Year



Bill
Drive - Coder
Build
2nd Year



Abby
Build
FLL Coach
3rd Year



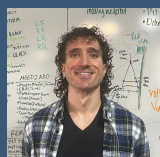
Gabby
Scouting
FLL Coach
3rd Year



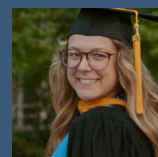
George
Head Coach-10 Years
Boeing Software
Lead



Natalie
Co-Coach-8 Year



Marco
Moccetti
Software Help-First
Year
Senior Project
Manager at Boeing



Sarah
Hayden
CAD & Build Help-First
Year
R&D Design
Engineer at Permobil

TEAM ROLES

- Each girl is able to **experiment with different roles and tasks on the team**, giving them a taste of what FTC has to offer
 - We welcome and encourage our team members to experiment with new, unfamiliar tasks to build their knowledge



NEW MENTORS



- This season, we have gained **two new full-time mentors** (other mentors on Pg. 7)
- Sarah-100+ meeting hours
- Marco-75+ meeting hours

TEAM OVERVIEW

CONTINUED



2



Lego Ninjas at their first competition

FIRST Lego League

- 3 of our team members coach 2 Girl Scout FLL teams
- This was the teams' rookie season, with none of the girls having experience in robotics prior to joining
- Once they reach 8th grade, the girls will join Gear Girls FTC, as many have already expressed a strong interest in learning more about the *FIRST* program.

PLANNING OUR SEASON

- At our kickoff campout we developed an **estimated timeline for the season**
 - Included what tasks need to be done by which week, and completion statuses
- We used this timeline to **optimize meeting time--** each team member having a task to complete at all times

Our Season To-Do List:

Miscellaneous Tasks	State of Completion
Update website	Started
Create need should want list for Bot 2	Finished
Reformat goal slides	Finished
Schedule/have a finance meeting	Not Started
Come up with a plan for season (i.e. timeline)	Finished
Create clear team roles	Started
Strengthen control award premises	Not Started
Determine what makes Bot 2 innovative	Started
Write document on sustainability w/ timeline	Not Started
Go over electrostatic email	Finished

Item Purchased	Intended Use Upon Purchasing	How Did the Purchase Help	Cost of Item
Hitec Linear Servo	-Lift the robot for a 2-robot park in endgame	-Not used	\$109.99
Canva Pro Subscription	-Make imagery for social media posts -Make promotional flyers -Educational presentations for outreach -Portfolio design help	-Pleasing portfolio design -"How To Code" presentation for FLL Kickoff -FLL mentoring flyers -Meet handouts -Poster designs	\$120.00
Limelight Camera	-Scan April Tags in autonomous -Determine artifact colors	-9 artifact autonomous for all sides -Able to scan April Tags on obelisk to shoot in given motif order	\$189.00
Canon EOS T7 Camera	-Take photos at outreach and meets -Document events -Aid in social media posts	-Appealing designs for flyers -Good promotional photographs -Pleasing portfolio design	\$529.99
goBILDA starter bot	-Get build practice -Understand shooter mechanism	-Good understanding of shooting mechanism -Inspiration for final robot design	\$1,637.08

Our current robot costs \$4,000, including:

- Hubs (\$650)
- Sensors (\$272.22)
- Motors (\$384.93)
- Servos (\$110.97)

SPONSORS

Our sponsors, those of which we have found through family, friend, and local connections, allow us to fund our team finances, including food, build materials, and so much more.

SPONSORSHIP PLAN

We obtained grants by presenting to local communities, such as the O'Fallon, IL City Council through some of our sponsors, like IBEW, and sending out letters to ask people to be sponsors.



NEW SPONSORS	RETURNING SPONSORS
\$11,100	\$11,930
6 Sponsors	11 Sponsors

GOALS



3

KICKOFF

- Made list of robot **needs** based upon the season reveal video
- Viewed award criteria to set goals for each one

WEEK 2

- Further developed award criteria goals
- Set individual goals and goal accomplishment plans



MEET-BY-MEET

- Team members updated their status on their goals progress
- Accomplished tasks dependent on the award goals

Sept. to Oct.

I built our first robot based off of the gobuilda robot dual shooter and developed a solution for endgame.

BUILD GOALS

- Build a second FTC robot by January
 - Originally underachieved
 - Still reached goal by creating build plan** over winter break and building the robot often
- Build an innovative robot that can sort artifacts
 - Prototyped** a series of shooters
 - Built double shooter
 - Added a CADed spindex and flippers
- Score motifs
 - Added color sensors

SUSTAIN: BOT #1 BUILD PLAN

	10/23	10/26	10/30	11/2	11/6	11/9	11/13	11/16 MEET 1
CHASIS								
SHOOTER								
TRANSFER								
INTAKE								
TOP STRUCTURE								
ELECTRONICS								
CODE								
GENERAL DESIGN								
DRIVE PRACTICE								

MEMBER	GOAL	WHAT THEY DID	AWARD EVIDENCE
Abbie	- Build an innovative, competitive robot - Adaptable to multiple strategies	- Robot is able to shoot from both launching zones - Can self-intake artifacts - Both make our robot compatible to alliance partners	Engineering process - Lessons learned - Multiple iterations of robots
Aubrie	- Learn how to code in Android Studios - Subsystems and auto	- Coded 9-artifact autos for all alliance starting locations - Created spintake class - Uses color sensors and trigonometry	- Developed coding capabilities Learned independently along with help from mentors
Olivia	- Document build progress in OnShape - CAD final equipment	- Created multiple iterations of parallel plates - CAD of spindex and all of its' iterations - Created CAD of final robot	Multiple designs and practice for every component - Took constructive criticism from mentors - Used to make more innovative 3D-constructed parts

TEAM GOALS

- "Needs, wants, and shoulds" to develop robot and auto goals
- Developed build plan to identify problems and provide realistic timeline to the qualifier
- Performed "S.M.A.R.T" analysis to make goals in cooperation with each awards' criteria

WANTS:

- General-
- Adjustable angles
 - Lights (LEDs) & Light/Color Sensor
 - 3D Printed Ramp
 - Machined frame
 - 3D coverings
 - Robot/Code done 2 weeks before meet
- Auto-
- Pick up more Artifacts (off of field)

NEEDS:

- General-
- Scoring capabilities (In general)
 - Intake
 - Transfer
 - Mechanism wheels
 - Reverse for intake
- Auto Specific-
- Shoot preloads
 - Auto program for both sides

SHOULD:

- General-
- Double shooter
 - Limelight camera
 - Odometry
 - Internal Wiring
 - Read april tags
 - Strong Game Strategy

Robot 2 Build

- Mount control/expansion hub
- 3d print new spindex (note to CAD team that we need to mount the holes differently so they line up in the center) (changes to remove gear and make smaller around edge)
- 3d print new ramp (note to CAD team to lower height AND height; we'll figure out how much when we finish spindex height)(less chunky, change filling)

OUTREACH



4

From Girl Scouts to *FIRST*

GIRL
SCOUTS



- 2 Girl Scouts FLL teams
- Coached by 3 members from Gear Girls FTC
- Flower STEMs: 6-7th grade
- Lego Ninjas: 4-5th grade
- Majority of members discovered robotics via our Girl Scouts outreach



FLL 
TEAMS



- Our current FTC team
- Preparation for FRC and real-world STEM careers
- All Girl Scout participants
- Multiple members from Girl Scouts outreach events



GEAR
GIRLS
FTC

VOLT
FRC

- Girl Scouts rookie FRC team
- Team members from both Gear Girls FTC and Polytechnic Puzzle Pieces FTC



GS STEM Camps

- Mission to Mars, GSSI STEM Camp, GSSI Mini STEM Camp
- 7 total days of volunteering for and/or hosting camp activities
- 25+ STEM activities planned
- Girls ages 5 to 13
- Many recognized us and our robots from other events



CITYFEST PARADE

- 100+ Girl Scouts in the parade
- Built a float for GSSI and drove robots around it
- Showcased robots to the hundreds of bystanders at the parade

GS BADGE WORKSHOPS

- We worked at Marie Schafer with younger girls and showed them robots, and let them build lego bots
 - STEM related badge work
- We plan and host various engineering and building activities



392
HOURS

27
EVENTS

1,150
PEOPLE

OUTREACH

FIRST



5



FIRST Championship

- 2 members volunteered as FTC field reseters
- Volunteered as Student Ambassadors
 - Introduced two families-- both unfamiliar with *FIRST* --to the program
 - Gave advice on how to get their children and others in their area involved in the *FIRST* program

FLL —

- Hosted 2 programming breakout sessions at FLL kickoff
 - Beginner session: Basic code for rookie teams
 - Intermediate session: Challenging code for seasoned teams
- Met with Girl Scout FLL team Minecraft Bees 
 - Helped give advice on increasing sensor usage
 - Long time mentors since 2022



GLOBAL OUTREACH

- Our team joined the *FIRST* Global Exchange program
- 4 Zoom meetings with teams from Morocco, Libya, and the United States
- Presented our robot and advice on outreach

CROSS TEAM COMMUNICATION

- Invited our friends on team 21418 SeaCow Robotics, from Arkansas, to the Robot Rumble at the Raceway
 - Our 2nd pick for our winning alliance
- Team 19448 X BOTS reviewed our presentation over zoom
 - See more about this on Pg. 7
- Joined Discord server with Robo Raiders, Wormgear Warriors, P3
 - Discussions of creating collaborative autos

VOLUNTEERING —

- We volunteer at ALL Southern Illinois FLL events
 - Emcees, field reseters, queuers, assistant judges, referees
- We recruit FLL participants for our FTC team  



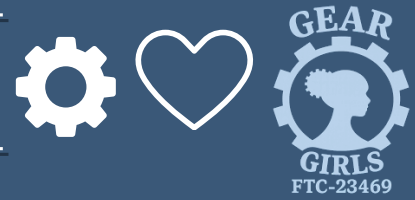
306 HOURS

29 EVENTS

1700+ PEOPLE

OUTREACH

COMMUNITY



6



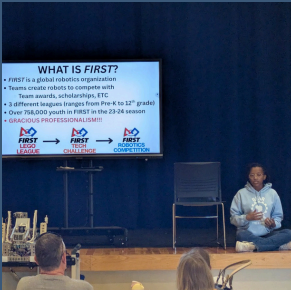
O'Fallon City Council

- Spoke to council members about our successful season
- Jessica Lotz, an alderman, got us a grant from Thrivent (Pg. 7)



Moyer Reading Night

- Invited girls from our FLL team to volunteer with us
- Brought field and robots for kids to drive



Jr. High Recruitment

- FTC recruitment event at Carriel Jr. High
 - 7-8th graders
- Presentation about *FIRST*
 - Interactive stations



PYC STEM Event

- Brought LEGO Spike Prime catapult and FTC field
- Introduced *FIRST* to many kids and parents



Hinchcliffe STEM Night

- Brought FTC field and robot
 - 2 demo bots and fun challenges
- LEGO Spike Prime spirograph
- Partnered with SIUE STEM Center and provided volunteers



IBEW Presentation

- Season overview presentation to IBEW
 - One of our sponsors
- Walkthrough of robots' mechanics & season success



Sci-Fest Expo

- St. Louis Science Center's annual Sci-Fest Play and Creativity Expo
- Ran FLL 'Bumper Bots' station
 - Taught **hundreds of kids how to code** and launch a Spike Prime robot
- Over 1,800 people reached
- Worked alongside P3, Force Green, and XBOTS

ADVISORY COUNCIL

- Monthly Zoom calls with a panel of women in STEM
- We ask for advice
 - Robot, strengthening outreach, and overall team-strengthening and enlightening insight
- 8 participants from various STEM fields

73 HOURS

12 EVENTS

1900+ PEOPLE

EXPERTS



Vanessa Diaz

Instrumental and Electrical
Team Lead At Phillips 66

19448-XBOTS

Missouri FTC Team

- Gear Girls Advisory Council participant
- Helped us articulate our technical design



- 5x Inspire Award winners
- Watched and critiqued our presentation over Zoom
 - Gave advice on what information we should/shouldn't include



Matt Hui

Retired Air
Force Member

Elizabeth Niebrugge

Fulton Jr. High FLL
Mentor

- Helped with early robot design iterations at kickoff
- Gave suggestions for optimal hardware and softwares



- Gear Girls Advisory Council participant
- Aided in planning of more impactful outreach
- Discussed future plans for our robot



Dorothy Metcalf-Lindenberger

Retired NASA
Astronaut

Connor Banard

SWIC Machinist

- Keynote speaker at GSSI Big STEM Camp
 - Was also a Girl Scout
- Inspiration to us and other girls at the camp



- Hosted ACE machining camp
 - Course on MasterCam, Fusion360, and a Machining Dynamics Tutorial
- Machined robot parts

AJ Gniotczynski

SWIC Machinist

Megan Zaiz

Manufacturing
Engineer at Boeing

- Hosted ACE machining camp
 - Course on MasterCam, Fusion360, and a Machining Dynamics Tutorial
- Machined robot parts

- Shares insights into FTC as an alumni
- Supports team at events and kickoff



CONNECTIONS



SIUE STEM Center

- Worked with Emily Stanley
 - Supplies kits for STEM camp activities

Women in STEM Webinar

- Introduced multiple keynote speakers at 2 sessions
 - 30+ Girl Scouts in attendance

O'Fallon City Council

- Met O'Fallon City Council alderman, Jessica Lotz
 - Grant from Thrivent

ROBOT OVERVIEW

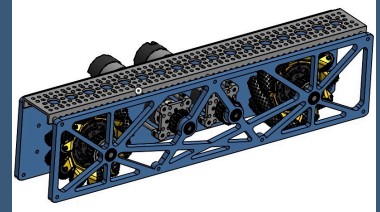


ROBOT 1	ROBOT 2
Built 1 st robot and then began working on a final design	
Gecko wheels as outtake transfer	Spindex and flipper as outtake transfer
Double intake using 2 sets of boot wheels	Triple intake with a roller and 2 sets of boot wheels with surgical tubing



OG PROTOTYPE

- Early drawings of cannons, turrets, etc.
- Built goBILDA starter bot for ideas
 - First time building a shooter
- Inspiration from Robot in 3 Days



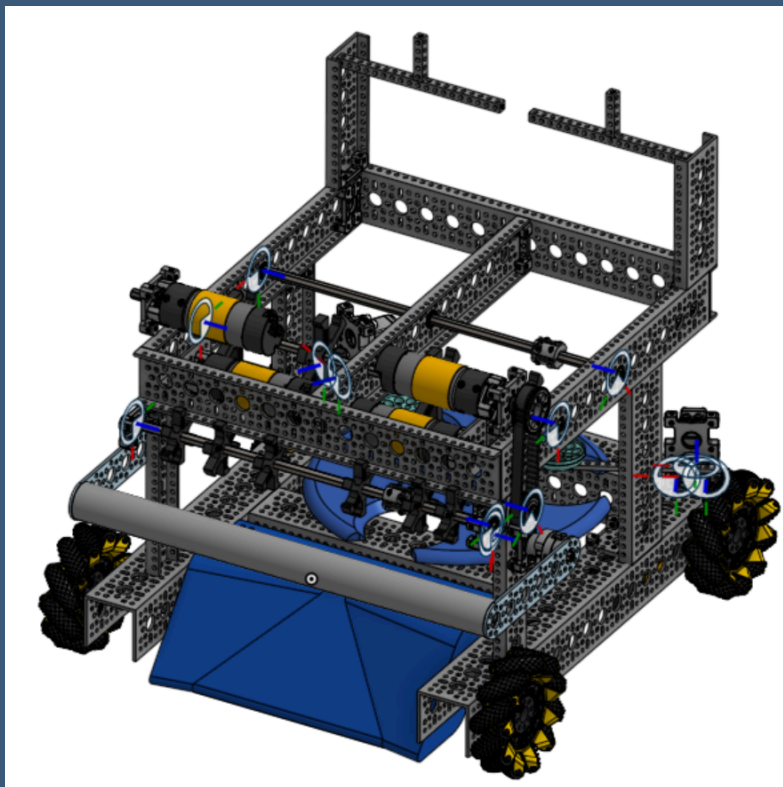
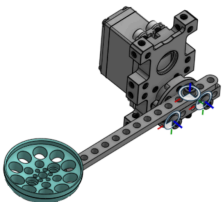
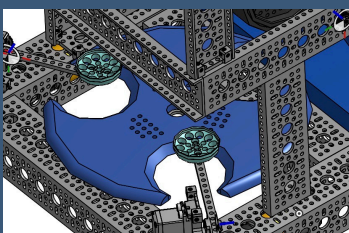
PARALLEL PLATES

- Second robot originally included design for parallel plates
- Plates kept delaying after machining errors
 - Put on hold



TRANSFER

- Uses a spindex and flippers to transfer artifacts
- Custom CAD spindex



OUTTAKE

- Uses fly wheels to shoot
- Added weights for accurate shooting

INTAKE

- 1st set uses belts to power a roller
- 2nd set uses small boot wheels to propel artifacts up ramp
- 3rd set uses boot wheels to push artifacts past dead zones

SENSORS



- Limelight Camera
 - Scans April Tags to determine how to run auto, alongside Auto Aiming
- Color sensors in each spindex divot
 - Allows for proper indexing of artifacts
- Odometry pods
 - Accurate field orientation within auto and adjusting outtake motor speed for aiming

RISK

Intake motor drew too much current

Robot shutting down due to complications in wiring

MITIGATION



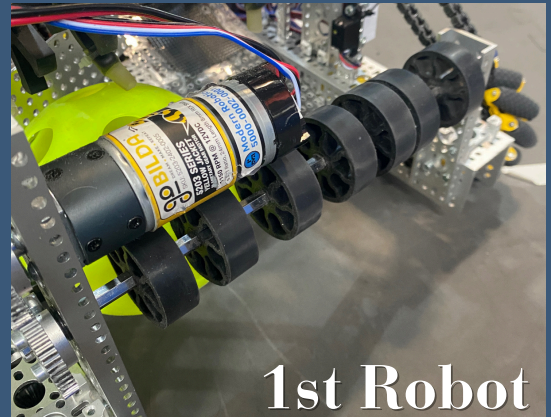
Adjusted motor for better torque

Mounted control & expansion hubs on plastic, added power distribution hub, wrapped wires in figure 8, & installed grounding strap

INTAKE

1ST ROBOT

- 2 sets of wheels and one divider
- 1st set uses small gecko wheels for initial intake
- 2nd set of higher boot wheels to move artifact up ramp
- Divider can control artifacts going into left or right shooter



1st Robot

2ND ROBOT

- The 3D printed ramp allows the artifacts to enter the transfer
- 1st set of intake:
 - Wide roller maximizes all 18 inches in order to decrease intake time
 - Metal bar covered in grippy tape to increase friction between artifact and roller
 - used a limit bar to hold at the right height
- 2nd set of intake:
 - Small boot wheels with surgical tubing
 - Give artifacts extra kick up the ramp
- 3rd set of intake:
 - 4 larger boot wheels with surgical tubing
 - Push artifacts out of the “dead zone” inside our transfer

RISK		MITIGATION
		
Artifacts sometimes didn't have enough power to reach transfer		Added 3 rd set of intake to push artifacts past dead zone
Artifacts sometimes had too much power, bounced, and shooter flung them out randomly		Added plastic blocker in front of shooter wheels



APPLICATIONS

- Used Scouting data to realize the need to increase artifact intake
- Changed the stationary intake to one that moves with the artifact

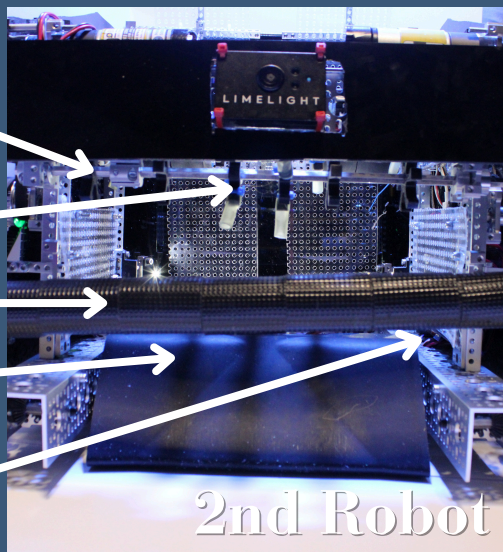
3rd Intake

2nd Intake

1st Intake

CAD Ramp

Dead Zone



2nd Robot

CHALLENGE	SOLUTION	
The artifact's were catching on the intake's axle	We changed the axle into two smaller separate ones	
Roller sat too low, artifacts bounced off when intaking	We moved the 'limit bar' upwards to force the intake to rest at a higher position	

TRANSFER

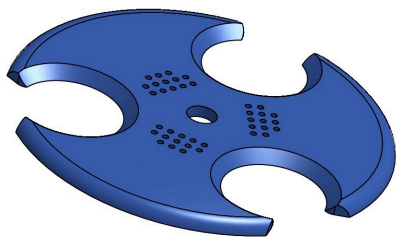


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CHALLENGE	SOLUTION 
After moving to larger wheels on outtake, transfer no longer fit	Switched out transfer wheels for a larger size and moved them outwards in both directions
Flippers didn't line up with spindex	Moved flippers to an angle and gave them shorter arms

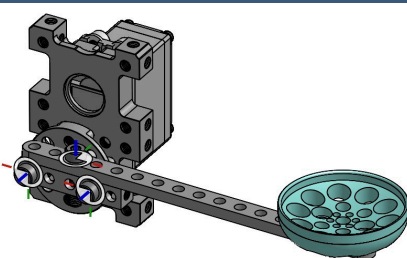
OG TRANSFER

- 4 medium fly-wheels
- Allowed motors to get up to speed before feeding artifacts
- Used 2 CNC'd weights



FLIPPERS

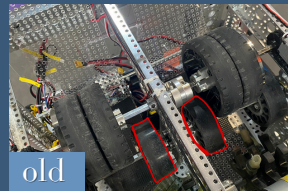
- Used to move the artifacts from the spindex to the outtake
- Custom CAD cup to push artifact upward attached to arm
- Angled towards divots



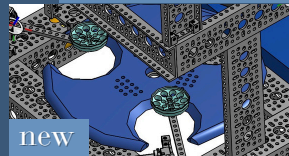
MOTIF RELIABILITY

Using Color Sensors

- Robot uses 5 color sensors total
 - 1 in front position of spindex, 2 positioned behind each flipper
- Determines color and possession status of artifacts in all 3 spindex positions
 - Shuffles the order of the artifacts to shoot in the correct motif
- Color sensors fuse to ensure all readings are correct
 - If the artifacts hole is facing the color sensor, the one across from it can still provide a reading

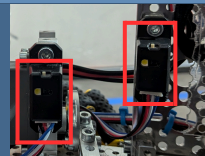


old



new

2 Color Sensors positioned at the base of one of the flippers:



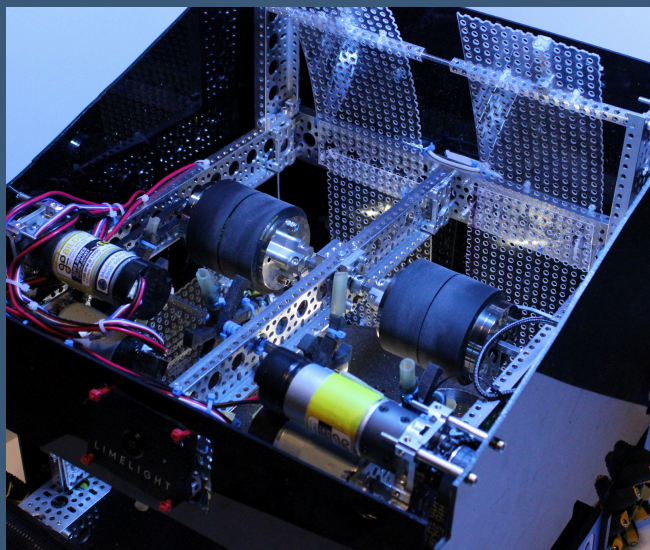
SPINDEX

- Used to move artifacts into flipper position
- Color sensors identify artifacts in order to achieve motifs
- Custom CAD design
- Sarah Hayden advised modifications
 - Adding more fillets too increase strength and decrease printing time



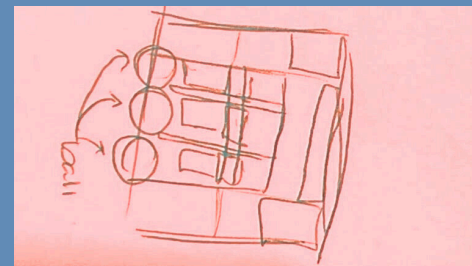
Cost Benefit Analysis

ITERATION	COST	BENEFIT	SOLUTION
Spindex: adding CAD gear teeth	• Requires movement of control & expansion hub • Doesn't move as quickly	• Saves space within lower channels	• Used a servo between channels
Flippers: changing angle	• Limits the design of back plate	• Accurate • More streamlined transfer	• Moved flippers to better angle • Increased length of arm
Fully CAD Flippers: unused	• Takes time to print • Unsure of ability to use	• Can put sensors under flipper	• Use only the cup from the flipper



ORIGINAL OUTTAKE DESIGN

- 2 large wheels
 - same-axle wheels allow for more torque
- 2 corrugated plastic ramps



Multi-shooter sketch at kickoff

SECOND ROBOT OUTTAKE DESIGN

- 4 medium wheels
 - Axles & motors spin independently
 - allows for the creation of motifs
- 6 GoBuilda weights attached to wheels
 - originally had 2 CNC'd by our mentor Sarah Hayden
- 2 corrugated plastic hoods
- 2 corrugated plastic guides

CHALLENGE

On 1st robot we struggled to achieve motifs since both artifacts shot at same time

SOLUTION



On 2nd robot allowed each shooter to move independently of the other, split motors

MOTOR SPEED CALCULATIONS

- We use Linear interpolation, a way to find values between data points, and a Look Up Table, with set distances and speeds, to find our motor speed based on our distance.

LIMELIGHT CAM

- Locks onto April tag to shoot
- Reads motif pattern in auto
- Placed on the front of robot to avoid obstructions



Cost Benefit Analysis



ITERATION	COST	BENEFIT	SOLUTION
changing wheel size and using 2 wheels on each side	• Requires movement of axle forward • Requires movement of hood/back	• Makes room for transfer • Provides more coverage on artifact • More accurate shooting	Moved axle and hood, replaced large single wheels with smaller double wheels

DESIGN PROCESS

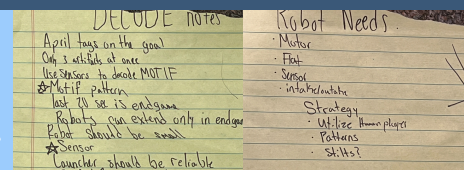


12

1

ANALYZE

- Took notes on what features our robot would need upon first viewing the field
- Needs: To shoot in the far and close zones, fit in the parking box, read the obelisk to determine the motif, and self-intake artifacts off of the field rather than use a human player

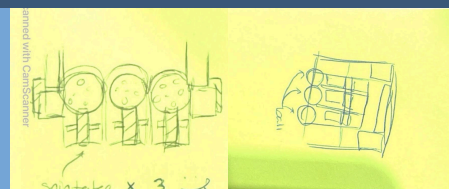


Field Analysis Notes

2

SYNTHESIZE

- Drafted a multitude of designs dependent on the needs determined
- Concepts include: 3-artifact intake, cannon-like launcher, spring loaded launcher, claws for intake, catapult outtake, and scoop



Tri-Cannon designs

3

RESEARCH

- Viewed F.U.N Robotics page on Youtube to see the seasons robot design meta
- Watched tutorial on fixing disconnects by using specific wiring methods
- Built goBILDA starter bot and Robot-In-3-Days to learn how to build a shooter and a self-intaking robot

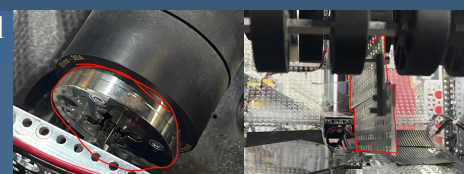


Tut on fixing disconnects 3-Day Bot

4

IMPLEMENT

- Added multiple features to Robot-In-3-Days build to make it more adaptable
- Limelight Camera to scan April Tags, flipper wall to sort artifacts by color, and weights on flywheels to make the speed remain constant between shots

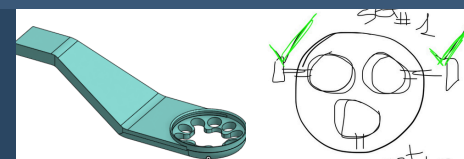


Flywheel Weights Artifact Sorter

5

PROTOTYPE

- Cardboard design of a spindex, inspired by research done on the Blue Bot Builder's robot
- Drafted designs for Bot #2: spindex, parallel plates, CAD ramp, and flippers to send artifacts up to flywheel,

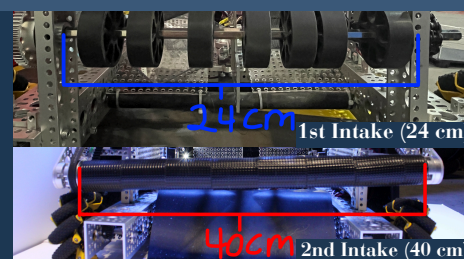


OG Flipper Design Spindex Draft

6

TEST AND MAKE ITERATIONS

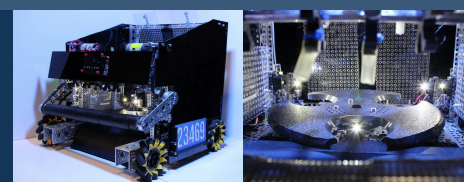
- Widened outtake to allow for faster intake of artifacts (see pg. 15)
- Changes made after seeing constant power shortage errors: mounting expansion hub on plastic, putting wires into figure-8s, and minimized amounts of metal around the hub



7

FINALIZE

- Mitigated minor errors to perfect the design, ensuring the robot is consistent in all operations
- Errors fixed: intake sitting too low, intake being too narrow, shots taken being below average, artifacts catching on intake's axel

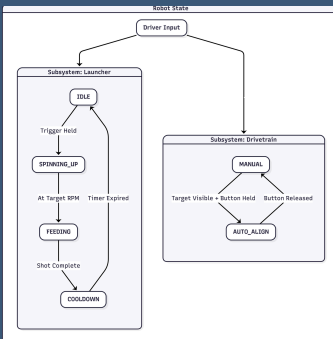


Final Robot Design



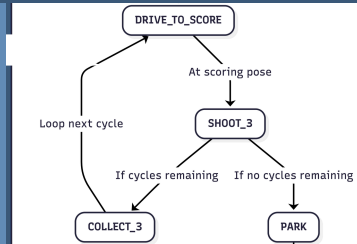
ALLIANCE SELECTION

- Selections we can make on the Drive Station dependent on our auto
- Can choose to shoot 1, 2, or 3 cycles
- Selection of which side we are shooting from within one single autonomous program



AUTONOMOUS LOOPS

- Loops help us to ensure artifacts are actually scoring, not stuck temporarily
- Especially helpful when trying to accurately score motifs



EXTERNAL SENSORS

- Limelight Camera
 - Scans April Tags for auto aiming and reading obelisk
- goBILDA Optical Odometry Pods
 - Field navigation for when Limelight vision fails
- 5 Color Sensors
 - Determine artifact colors for shooting correct motifs

MULTI-LAYERED STATE MACHINES

Auto-Aim and April code reading

- Calculates distance between robot and goal
 - Preset distances for short and long aiming
- Ensuring 2 artifacts don't get stuck in the intake
- Manual override, start out-take
 - Reading current from motor, reverses motor to avoid shut downs

Constant location checker, makes sure robot remain stationary

- Holding the aim button to keep the robot stable while shooting
 - Turning off the drive hub and restarting initialization

TRIG ON THE FIELD



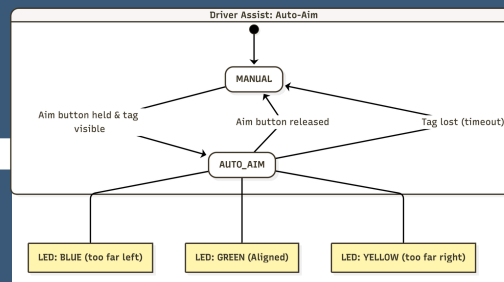
- Uses **trigonometry** to pinpoint location for active tracking
- Motors **adjust speed** according to the trigonometry on the field in teleop

FAIL SAFES

- **Time-Based Cooldowns**
 - If the spindex doesn't rotate in a given amount of seconds, an error will be sent out
- **Deadbands for Controller**
 - Prevents human errors with handling the controller

AUTO-AIM

- With the press of a button, the robot will align itself in a prime position for shooting
 - Limelight used to determine distance and positioning required

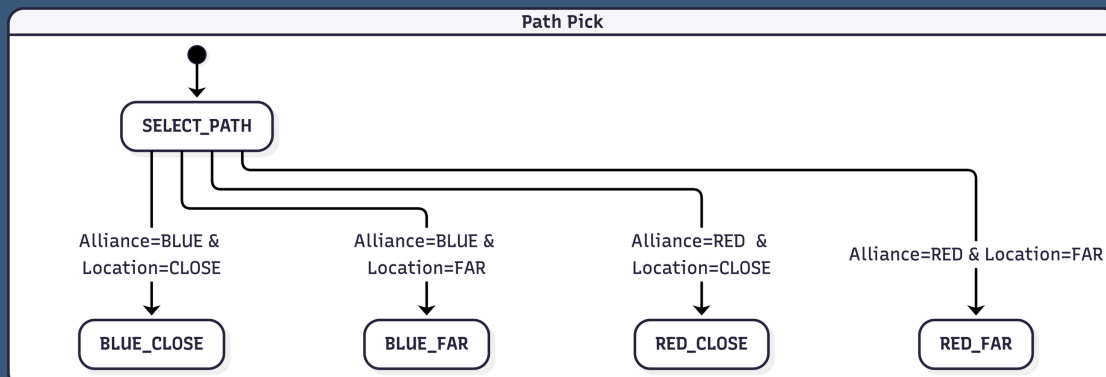


ALLIANCE SPECIFICATIONS

- Specifying which alliance were on makes the coding process smoother, we can decide which autonomous we want to run in the moment.
- Every autonomous is under the same code name, so there won't be any issues with misidentification or misreading.
- This makes our planning for the match smoother, quicker, and more effective.

- **Cooldown between shots**
 - After one artifact is fired, robot waits until the motors velocity gets back up to speed before firing again
- **Last-Known-Good Shooter Velocity**
 - If motor speed calculations fail, robot opts to the last good shooter velocity
- **Vision Fallback Hierarchy**
 - If vision fails, the robot falls back to odometry. If that fails, it presets to close and far. If that fails, it goes to manual speed control.

AUTONOMOUS



- One selection screen on auto program
 - Allows for a variety of choices (Pg. 13)

3 Artifact Auto	6 Artifact Auto	9 Artifact Auto
Shoots the pre-load into the goal	Shoots the pre-load as well as the second spikemark into the goal	Scores the pre-load, first spikemark, and the second spikemark

COMPATABILITY

- Work with alliance partners easily
 - Select different states of autonomous
- Opens up higher opportunity for getting picked in playoffs
 - Portrays us as reliable and flexible

AUTO PROGRESSION

MEET 1

Objective: wanted at least 6 artifacts

- Achieved 6 artifacts, started working on 9

MEET 2

Objective: wanted 9 artifacts with motif

- Nearly achieved 9 artifact autonomous, some flukes remain

MEET 3

Objective: wanted 9 artifacts with motif

- Completed 9 artifact autonomous

WHY WE KEEP TRACK

- Allows for proper scheduling
 - EX: If we are behind in consistency, we focus more on perfecting it rather than adding more shots into the auto

```
redFarState = RedFarState.RED_FAR_COLLECT_SPIKEMARK3_BALL1;
}
break;

case RED_FAR_COLLECT_SPIKEMARK3_BALL1:
//swap middle bar -op-or+ - after first bar - third spike mark , frwd 1, swp
if (robot.drive.driveTo(robot.drive.pinpoint.getPosition(), G6RobotConstants.W
redFarState = RedFarState.RED_FAR_COLLECT_SPIKEMARK3_BALL2;
}
break;

case RED_FAR_COLLECT_SPIKEMARK3_BALL2:
if(robot.drive.driveTo(robot.drive.pinpoint.getPosition(), G6RobotConstants.W
redFarState = RedFarState.RED_FAR_COLLECT_SPIKEMARK3_BALL3;
}
break;
```

STRATEGY



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Meet 1 Team Stats:

23469	Gear Girls	43	54	79.63%
24060	Knights Robotics	32	41	78.05%
8620	Wormgear Warriors	52	72	72.22%
22864	Gearheads 2.0	35	49	71.43%
32311	EHS Robotics	29	41	70.73%
19938	Knights of the Ping Pong Table	47	67	70.15%
7129	Robo Raiders	26	42	61.90%
16751	Polytechnic Puzzle Pieces	23	40	57.50%
10254	MCHS RoboLions	13	23	56.52%
31769	The Flapjacks	14	25	56.00%
24030	Skyline Robotics	47	90	52.22%
13365	Gearheads	15	31	48.39%
31770	ROBORATORS	16	36	44.44%
6206	Ohms Olympians	24	62	38.71%
31771	Black Beans	11	31	35.48%
31768	Dabo Shabo	20	60	33.33%
15410	Welded Warriors	15	56	26.79%
27399	Beyond the Bell 4406	1	5	20.00%

KICKOFF

- Brainstormed ideas of offense/defense
 - How to block other robots
 - How to shoot artifacts effectively
- Used GOBILDA starter bot for ideas

TEAM STATS

- Ranked each team in our league based on their cumulative autonomous and teleop shot accuracies
 - Allowed for deeming who would be a reliable alliance partner

Scouting Spreadsheet:

Gear Girls - Meet 1		match 1	
team #	5187	24030	
team name	Translator Titans	Skyline	
artifacts scored auto	no auto	2	
artifacts attempted auto	no auto	3	
% accurate auto	-	67%	
artifacts scored teleop	broke	6	
artifacts attempted teleop	broke	15	
% accurate teleop	-	40%	
park?	TRUE		
Park points?	10	-	

MATCH SCOUTING

- Scouting team spends the day watching matches
 - Each girl chooses a certain robot to keep an eye on, paying attention to it the entire match
 - Takes note of number of shots attempted, how many were scored, and if they can park
- This data allows us to gather accuracy statistics for each team our region, and deem what changes we need to make in order to keep up

ROBOT REQUIREMENTS

- Deduced what features would be necessary at kickoff
 - Launcher, intake large enough for artifacts
- “Needs, wants, shoulds” list created

SHOULD:

General-

- Double shooter
- Limelight camera
- Odometry
- Internal Wiring
- Read april tags
- Strong Game Strategy

NEEDS:

General-

- Scoring capabilities (In general)
- Intake
- Transfer
- Mechanim wheels
- Reverse for intake

Auto Specific-

- Shoot preloads
- Auto program for both sides

CHANGES MADE BASED ON SCOUTING DATA

- Compared to the rest of our league, our number of artifacts shot was lacking
 - To fix this, we widened our intake to be able to grab more and adjusted our robot to be able to shoot 2 artifacts simultaneously, included launch flexibility