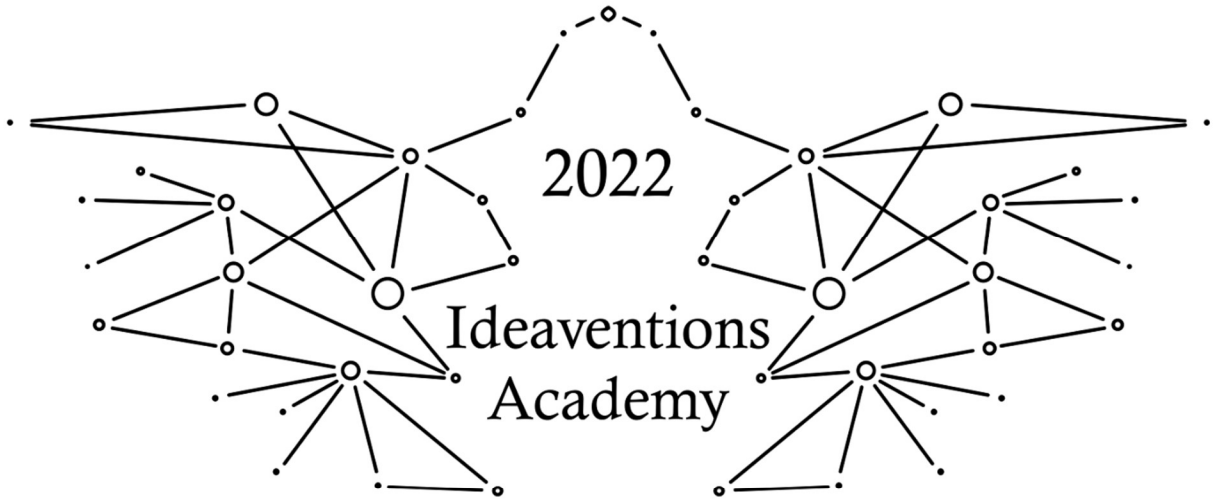


Daedalus Robotics

Daedalus Robotics
Engineering Notebook

Team 76122A - Ideaventions Academy for Math and Science

Table of Contents

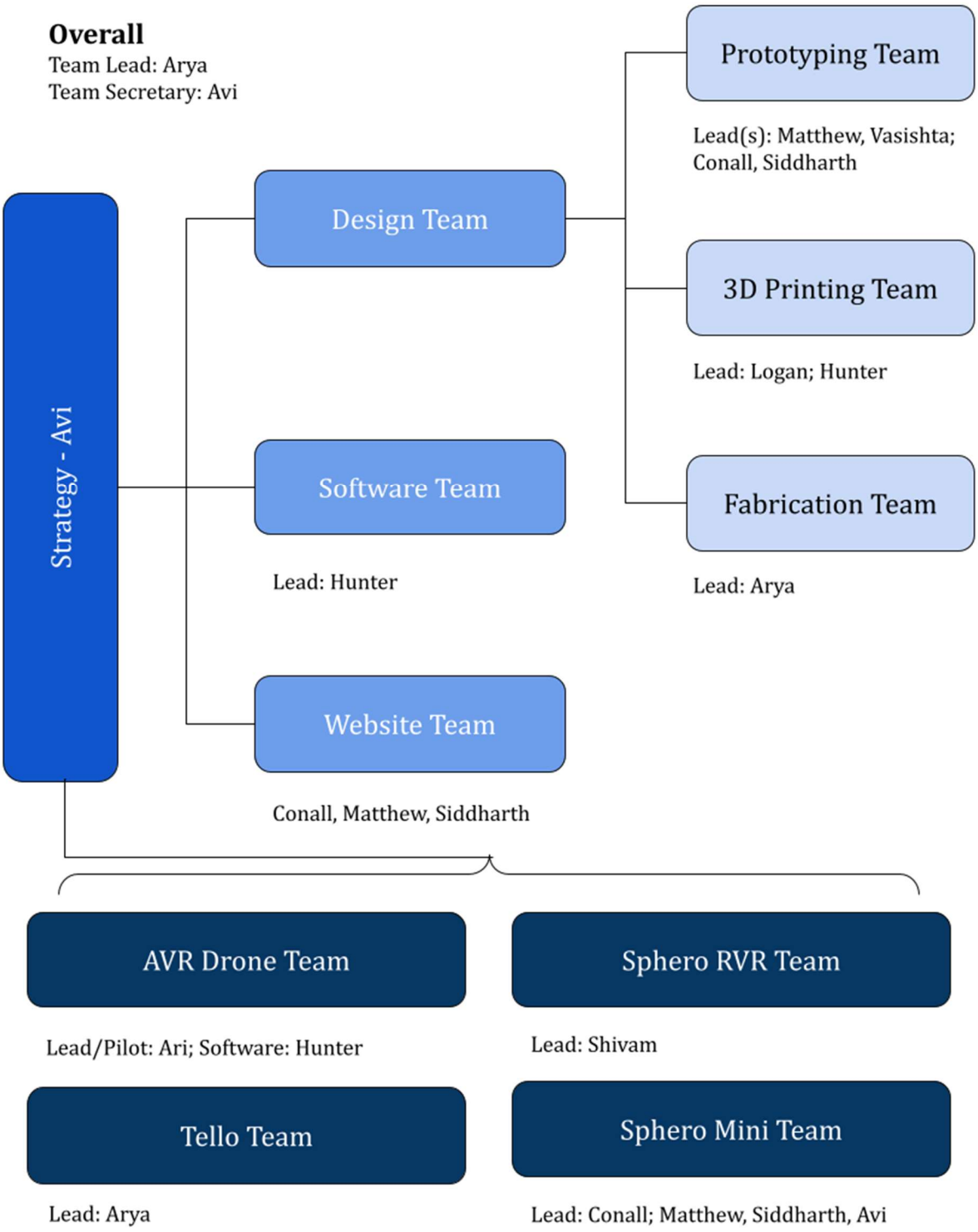
Summary of Highlights

The following sections are various highlights of our team's work engineering design this season.

I. Team Bios and Organization

- **Organization of Team**
- **Team Bios**

a. Organization of Team



b. Team Bios

Arya

Role(s):

- Overall, Team Lead
- Tello Lead/Pilot
- Design Team Lead

This season, I worked on this team in several capacities. From one angle, I served as the team leader, responsible for coordination, direction, scheduling, and more. From another angle, I was also responsible for coding the Tello Drone. I learned the ins and outs of block coding (mostly a Python and Java coder till this point) and worked to come up with code based on our strategies from Avi. It was a challenge working with beta software, but I made do with what we had. Additionally, I was responsible for fabricating the final versions of several of our design projects including the BPU/BDU (Ball dropper/picker unit), and the Sphero Mini containment unit mounted on the Sphero RVR. I already had proficiency in using Autodesk Fusion 360 as well as a laser cutter and was able to use CAD to design parts and fabricate them quickly and accurately.

Avi

Role(s)

- Lead Strategist
- Team Secretary
- Main Forum Correspondent (Trust Level: Member)
- Sphero Mini Pilot

As the Lead Strategist, I consulted with all our teams; working with them to implement solutions to our various strategic problems. As a result, I worked on optimizing Tello and RVR code. I used the rulebook to plan strategic game plans that reflected the current capabilities of our vehicles and told our team what needed to be done for us to win this competition. One of my greatest tools was the forum, as I could clarify any problems I had and validate any strategy that impugned a rule. It also kept me up to date with the problems every team was facing. Finally, as the Team Secretary, I assisted Arya in organizing team meetings, scheduling, and assigning tasks all throughout this season.

Ari

Role(s):

- AVR Drone Team Lead
- AVR Drone Pilot

This year I led the AVR team in building, tuning, and testing the drone. I am also the pilot for our team. At the beginning of the season, a few other teammates and I worked to assemble and set up the AVR drone while making some modifications to clean up and enhance the original configuration. After assembling the AVR drone I worked with Hunter on software for the drone, gimbal, and Apriltag detection while assisting other teams with preparing and programming their additions to the drone. This year's challenge has required a lot of problem-solving and streamlining work. I've enjoyed applying my knowledge from FPV in order to be competitive, and that is what I have enjoyed the most.

Hunter

Role(s):

- Lead Software Engineer
- AVR GUI Controller
- 3D Print Team

I was the main software engineer for the team and assisted everyone with any general problems. I mainly worked on the software for the AVR drone and the AVR GUI. I modified a large amount of the VMC code, so it was not as MQTT heavy and all ran in the same program without docker. I made an algorithm that aims the LWC at the center of the largest blob in the thermal camera image. I also made a way to use relative positioning for the gimbal. I added controller support for the AVR GUI using a custom library. I also programmed autonomy for water dropping and switched gimbal controls from MQTT to ZMQ.

Shivam

Role(s):

- RVR Team Lead

As the lead for our RVR team, I was responsible for creating and managing the software that runs on the RVR and managing the construction of our modifications to the RVR. As part of this, I worked with the design team to create the BBA (Beanbag Arm) and the SMC (Sphero Mini Container). In addition, working with Avi on the strategy, I developed the software that runs on the RVR to complete the objectives of the course.

Matthew

Role(s):

- Prototype Team Co-Lead
- Website Team
- Sphero Mini Team/Pilot

Throughout this season I've worked on many prototypes for systems to solve problems we've had. I also worked to help finish building and servicing the AVR drone after parts failures. I worked on the prototype BPU/BDUs and assisted in the creation of the BPU/BDU mounting mechanism. I worked on many of the designs for the prototypes as well as fabricated multiple prototypes and optimized the consistency of the prototypes. I also worked on the team website writing the about and contact pages.

Conall

Role(s):

- Sphero Mini Team Lead/Pilot
- Website Team
- Prototype Team.

I designed the first version of the team shirts. I assisted in fabricating proofs of concept for the Sphero Mini containment unit (SMC) and the BDU/BPU. I worked on the website, and I added the pictures. I built a training course for the Sphero Minis that had us knocking down trees in the course. I also helped mount the motors on the drone.

Siddharth

- Prototype Team
- Website Team
- Sphero Mini Team/Pilot

I contributed to brainstorming possible proof of concepts and fabricating them for the BDU/BPU and the SMC (Sphero Mini containment unit). I additionally helped in creating the website by extracting videos and photos from different sources, including my recordings and those of others, and gathered them all into one place. Furthermore, I assisted in creating the training course that would be used for the AVR Drone, the RVR, and the Sphero Minis. I also accompanied in controlling and directing the Spheros through the course.

Logan

Role(s):

- 3D Printing Lead

I was the main lead on 3d printing and 3d design. My biggest job was to work with Sivam to help design modifications for the RVR that would help him improve its performance. The two biggest things I helped to design were the Sphero Mini Containment Unit and the Bean Bag pusher. I made the initial design in Fusion 360.

Vasishta

Role(s):

- Prototype Team Co-Lead
- Sphero Mini Team/Pilot

I worked on the Sphero Mini cage, and the RVR beanbag pusher. I also worked on the AVR Drone BDU/BPU. I also trained with the Sphero Minis

II. Safety

Workshop Safety

Several safety measures were applied to the use of our various tools in the workshop.

- Safety glasses were used while any power tools were operated, as well as during drone testing
- Each schoolyear all students get annual safety training for working in the engineering workshop
- All students using power tools were given instruction in the proper use of them
- First aid and fire extinguishers were available in the event of an accident
- Other common sense shop safety was employed
- Adult safety supervision was provided by our coaches

Vehicle and Testing Safety

For all testing, suitable measures were taken to ensure the safety of all participants and viewers.

- During team meetings, testing safety was discussed and reviewed before carrying out tests
- The AVR drone was only tested outside and with all people safely away from it or behind a barrier
- While testing the drone safety glasses or glasses were always worn.
- When flying the drone, all parts were inspected for failure and replaced to avoid malfunctions and other hazards
- Specially added components to reduce risk of parts flying off (i.e., lock nuts)

Battery Safety

We used proper storage and charging for all LiPo batteries.

- All batteries were charged under supervision
- All batteries were stored in fire-safe bags

III. Vehicle Designs

- **AVR Drone**
    1. Overall Design Changes
    2. Design Process
        1. Ball Dropper/Picker Unit (BDU/BPU)
    3. Engineering Drawings (*See Appendix B*)
        1. CSI Camera Mount
        2. Modified Gimbal
        3. Modified Landing Gear Mount
- **Sphero RVR**
    1. Design Version History
        1. Bean-Bag Arm (BBA)
        2. Sphero Mini Containment Unit (SMC)
    2. Engineering Drawings (*See Appendix B*)
        1. Sphero Mini Containment Unit (SMC)

Overall Design Changes

- Added BDU to the drone
    1. Plate with prongs
    2. BDU 20 kg servo and arm
- Gimbal V2
    1. Moved laser to center of gimbal
    2. Thickened some areas
- CSI Camera mounted to sides of BDU mount
- Nameplate
- Painted prop guards
- New BECs (replaced after we broke one of the old ones in a crash)

Ball Dropper/Picker Unit (BDU/BPU) Design Process

Goal in Mind - To make a component for picking up and dropping balls of water

Ideas

1. Suction activated mechanism
2. Hopper system
3. Archimedes Screw
4. Bucket-like scooper
5. Flexible plate with prongs

Proof of Concept Phase

1. Archimedes screw
2. Bucket-like scooper
3. Flexible plate with prongs

<u>Idea 1 (Scrapped):</u>

For the Archimedes screw design, we used stiff paper for the screw and a dowel for the middle. This design immediately showed many flaws while testing, such as the balls rolling down the screw faster than the screw could turn, so we scrapped it.

<u>Idea 2 (Scrapped):</u>

For the bucket proof of concept, we just had a cereal box with some string in each of the corners. After testing this proof of concept on our AVR Drone we found a fatal flaw: the prop wash did not let the box hang low enough to pick up any balls. Another problem was that due to the free-hanging nature of the setup, the CSI camera would be continually blocked during gameplay, so we ultimately decided to scrap this idea.

<u>Idea 3:</u>

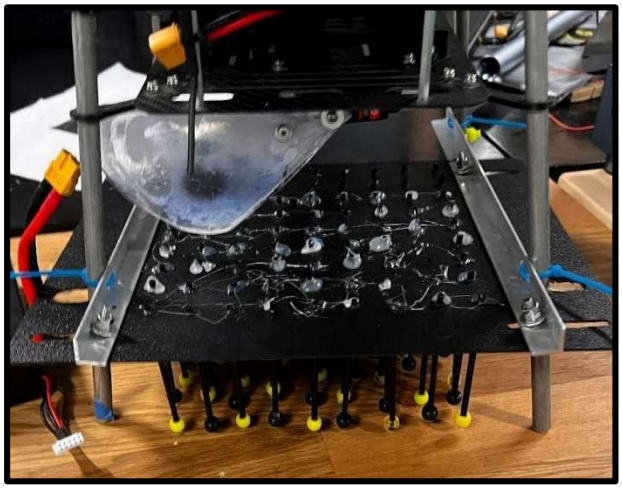
For the proof of concept of the ball dropper design, we decided to stick prongs (cut skewers) into a Styrofoam surface. It worked as a proof of concept but had some problems that would have to be fixed in the prototype, such as that the prongs were too close, and it was somewhat unstable. This was improved some when we used a polycarbonate plate as a back.

Prototyping Phase

- <u>Flexible Plate with prongs:</u>

Prototype 1:

For the first prototype, we used Lexan polycarbonate for the back and coffee straws with beads on them for the prongs. Then we started brainstorming on a mechanism to drop the balls by flexing the plate. We ended up with a 20 kg servo and a custom servo arm mounted to the bottom plate on the main drone to flex it.

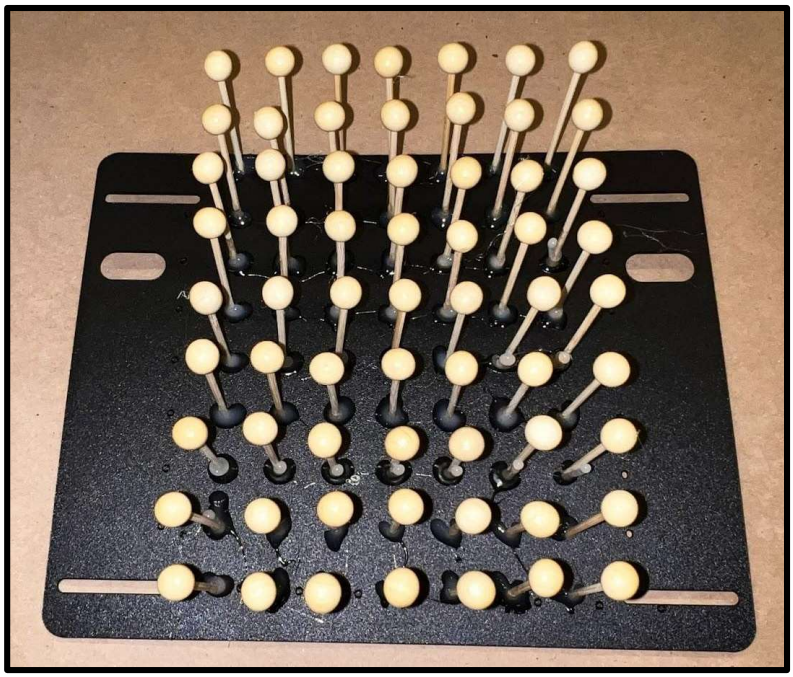


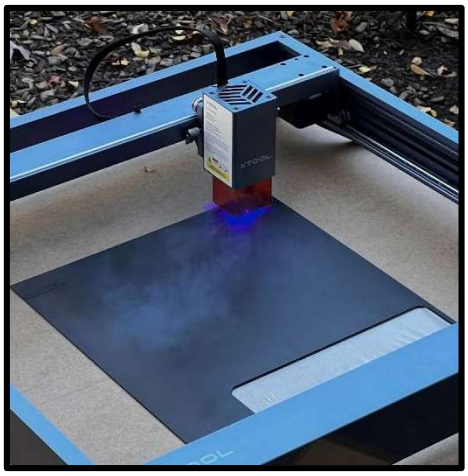
Prototype 2: Testing different spacing accuracies

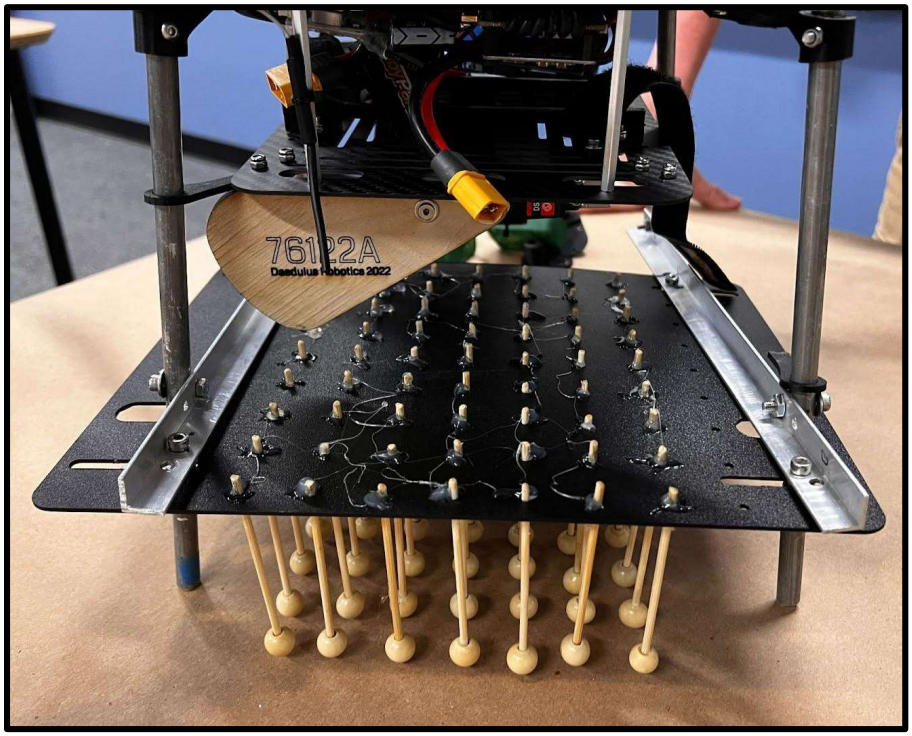
To test the different spacings, we laser cut 22.7, 23.7-, and 24.7-mm distanced holes in a flexible acrylic surface. We saw that the 23.7 mm apart holes were the most reliable at picking up balls. (*Right: two test plates with different hole spacing. The left-side plate is 22 mm from the side of one hole to the next side, and the right-side plate is 21 mm from the side of one hole to the next side.)*

Final Design Going into Washington DC Competition Weekend (Nov. 19th and 20th)

Final Spacing and correct slots. (23.7mm from center to center, see *BDU Plate CAD v4.dxf* for what we laser-cut). (*Top left: final laser-cut plate with hot-glued prongs. Top right: laser-cutting the plate. Bottom: BPU/BDU plate assembly on the drone including newly laser-cut servo arm with team name/number)*







Post-Competition Improvements (BDU)

After our competition on Nov. 19th and 20th, we identified several problems with the BDU that if we could fix, would increase our performance a lot. We immediately began brainstorming fixes to our problems and came up with a list of 6 issues and 5 solutions. We were able to test all of our ideas using rapid prototyping and our laser cutter.

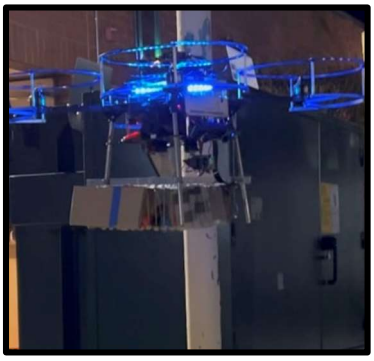
Problems from Competitions

1. Balls were hitting the building at weird angles and flying out
2. Balls were being pushed out of the drop zone by propwash from the drone
3. The servo actuator arm was having trouble actuating (required wiggling)
4. Balls were getting stuck in the device
5. Autonomous waterdrop not working yet

Possible Solutions (Ideas)

1. Cardboard or Lexan (polycarbonate) feathers around the BDU to block interfering air
    a. *We chose feathers because the plate still needed to bend easily*
2. Airflow holes in the top of the BDU to increase downward air flow and increase flexibility of the plate for the actuator arm
3. Wider spacing at the edges of the prongs to decrease the chance of balls getting stuck
4. Using a laser cut jig to assemble the BDU to get a more exact version of the final build
5. Finished coding and testing autonomous waterdrop

We then build prototypes to test each of the new hardware ideas for the BDU. *Left: Cardboard and Lexan feathers to test. Middle: Airflow holes in the BDU and wider spacings at the edges. Right: Laser cut jig to decrease assembly error.*



Testing

We tested all 5 improvements and found a mixed bag of results. The airflow holes both helped with lowering the rigidity of the plate and the maneuverability of the drone (an unintended side effect). We realized that using polycarbonate feathers would be too heavy and the feathers rubbing together would cause too much friction. The cardboard feathers also didn't seem to be so effective, and we ended up scrapping that idea. It seemed like they weren't rigid enough to help. The laser cut jig, however, helped a lot—increasing the overall ease of movement and use.

We also managed to get autonomous water dropping working; we already had April Tag detection, and it was a simple task to add in the rest of the functionality. We tested the code on multiple days in different light conditions. It worked to a high level of accuracy; always detecting the April Tag quickly. *Below: Testing the AVR Drone with April Tag detection and autonomous waterdrop functionality.*

Post Competition Improvements (3D parts)

During the competition we had many 3D parts fail. We were saved due to our planning; we brought many extras of everything. We also noticed the gimbal laser was harder to control with its placement on the side. We came up with a list of 3 issues and 4 possible solutions.

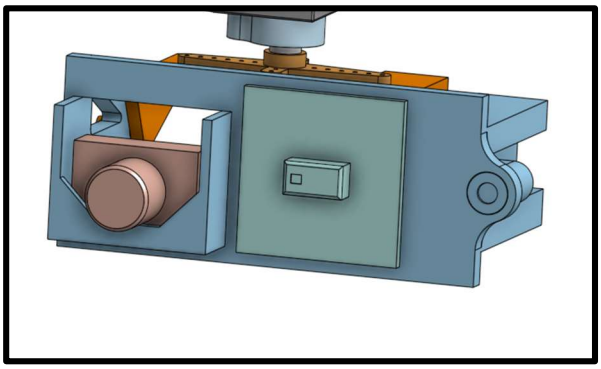
Problems from Competitions

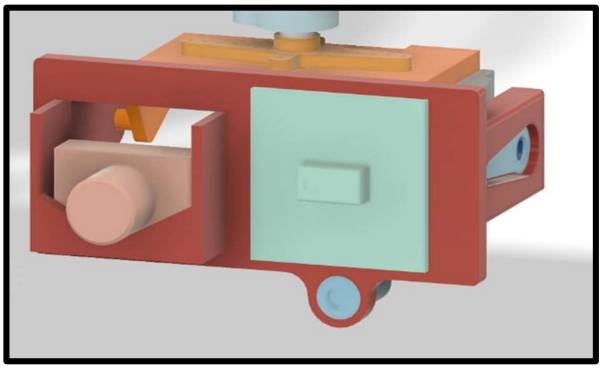
1. 3D parts cracking in impact
2. Gimbal laser difficult to control
3. Gimbal not capable of very fine control

Possible Solutions (Ideas)

1. 100% infill for the ABS parts
2. Metal machined joints – abandoned due to time contains and expense
3. Move gimbal laser to center of gimbal
4. Send commends microsecond PWM instead of millisecond PWM controls

The 100% ABS parts seem to be much more capable of standing up to abuse. The gimbal is also much more responsive after the microsecond control software. The new laser position has also made control much easier. *Left: Old gimbal laser design in CAD. Right: New gimbal laser in the center.*





Front Bean-Bag Arms (BBA) Design Process

Goal in Mind - To make a way for the RVR to push the bean bags into the tunnel.

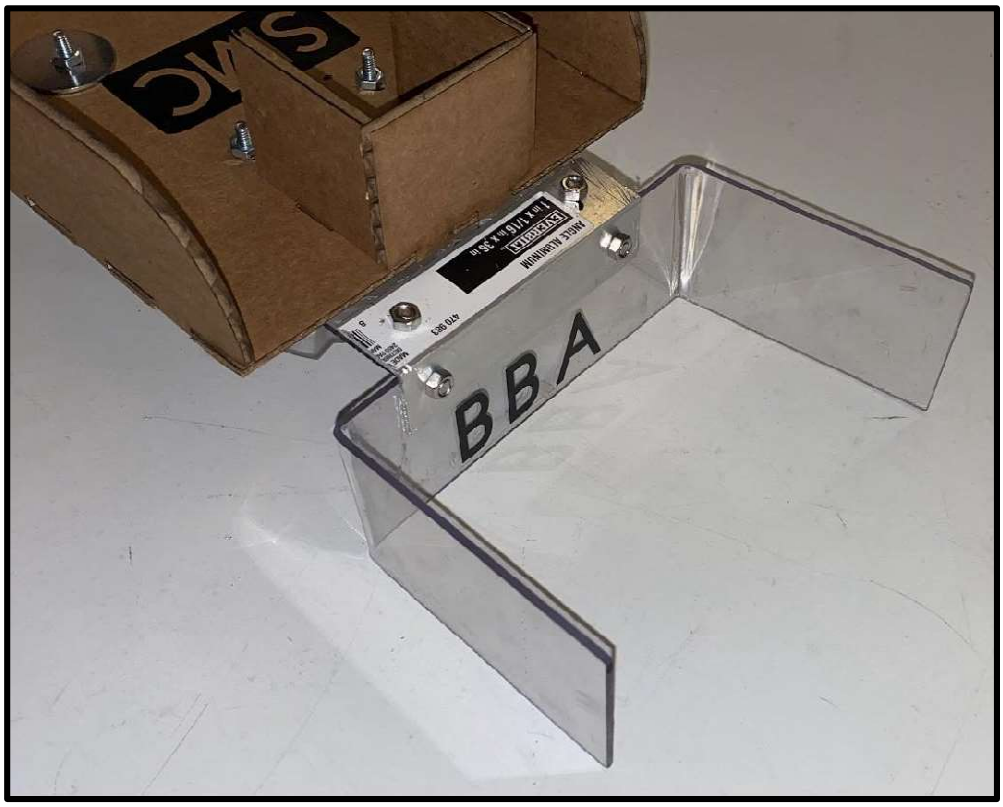
Proof of Concept
We had a design in Fusion 360 for the BBA, but we went with a slightly simpler design than what was made.

First Prototype

Heat-molded Lexan polycarbonate pusher arms. We used Lexan because it was light but durable. We made the arm angle 135 degrees because we thought having a wider angle would catch all the beanbags when the RVR goes in a straight line.

Final Design Going into Washington DC Competition Weekend (Nov. 19th and 20th)

The angle of the arms was decreased to 90 because our straight-line strategy was rejected due to issues in pushing the bean bags into the trenches. We then opted to sweep the RVR in zigzags and decreased the angle to make the RVR more drivable. Finally, we added a sticker with the component name. *(Below: BBA attached to Sphero RVR lid)*

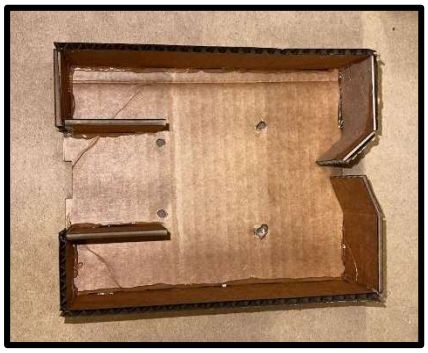


Sphero Mini Containment Unit (SMC) Design Process

Goal in Mind - To make a light and easy way to shuttle Sphero Minis to the top of the hill.

Proof of Concept

The Proof of concept was a hand-cut cardboard design, so it was not to the exact specifications that we wanted. We put some supports for the one-way door in the back, which would let Spheros in but not let them out through the back. We included holes for the screws that would integrate the SMC and the RVR.

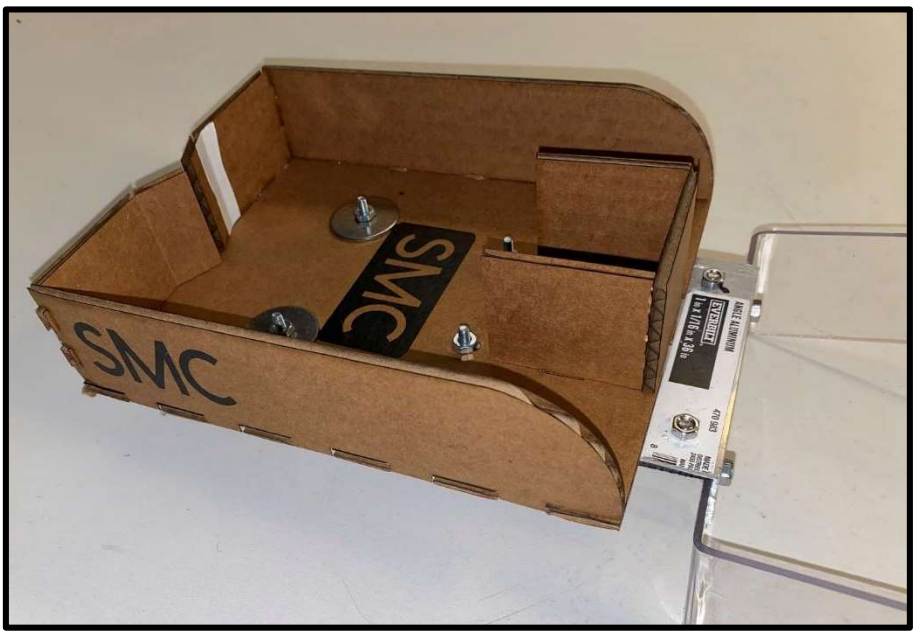


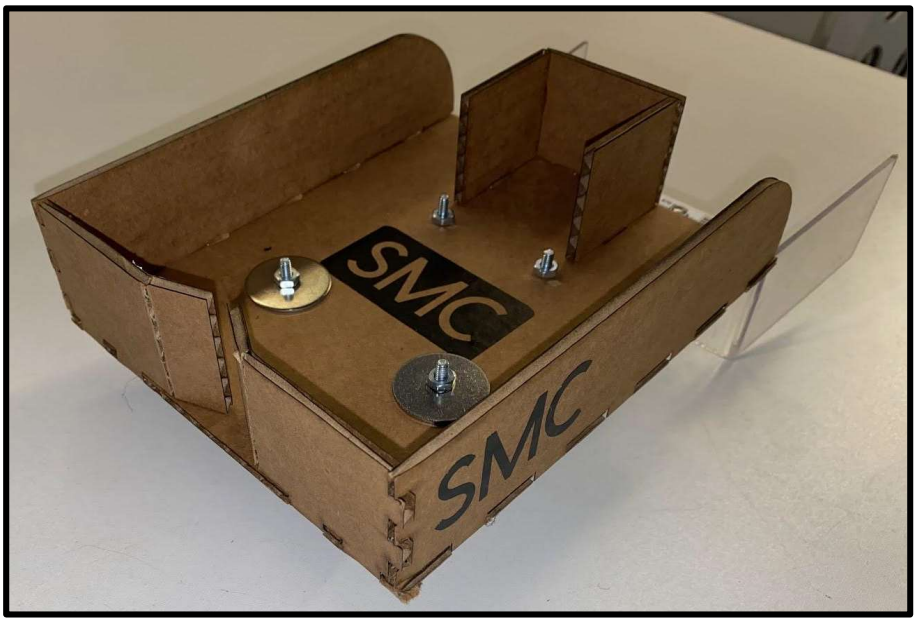
Revisions/Laser Cutting

This version was laser-cut instead of hand-cut for accuracy. Although we originally planned to use light wood, we found that reusing old cardboard boxes was not only more planet-friendly, but it was also quite light and made the Sphero RVR more maneuverable. We also added slots to improve strength and durability and increase ease of assembly.

Final Design Going into Washington DC Competition Weekend (Nov. 19th and 20th)

We switched the placements of the openings and the barrier so that the barrier was in the center instead of on the sides. We rounded the far edges of the walls for aesthetic purposes. Cleaned up the laser-cut pieces. Changed the width of the slots to improve installation onto the RVR. We used Fusion 360 to quickly design and laser cut the component. We also added stickers with the component name. *(Below: Sphero Mini Containment unit [SMC])*





IV. Autonomous Code / Manual Code Improvements

- **Overall Code Thought Process**
  - **AVR Drone**
    - Autonomous Code
      - April Tag Water Drop
    - Improvements to Manual Code
      - Support for Dual-Sense Controller to control many functions
      - Restart individual components in GUI
      - Sound Alerts
      - Live Feed from ZED Camera
      - Increased Efficiency
      - Switched from MQTT to ZMQ for controls
  - **DJI Tello**
    - Autonomous Code
    - Improvements to Manual Code
      - Implementation of DJITelloPy python library
      - Manual Control with Xbox One S Controller

All code is available in our GitHub organization at (https://github.com/Daedalus-Robotics)

a. Thought Process

AVR Drone

For this season's challenge expect many errors and bugs to deal with along the way. Over the course of the season, our team's talented software engineers continuously found ways to increase the efficiency of our AVR Drone's base software, allowing it to be a lot more effective during the match. Throughout that process, there were times when we faced a multitude of errors, yet we persevered because we knew there always had to be a solution.

- https://github.com/Daedalus-Robotics/avr-vmc-2022
- https://github.com/Daedalus-Robotics/avr-gui-2022
- https://github.com/Daedalus-Robotics/avr-pcc-2022

Sphero RVR

At the beginning of the season, our plan for the Sphero RVR software was to use the built-in block language's color sensor code to dictate the events that would happen as it drove around the course. After trying to use the block code, we found that it was not able to perform to the standard we wished it too due to the oncolor block not accurately detecting colors. After we switched to using text code, the accuracy of the RVR significantly because we gained the ability to manipulate the color sensor threshold. We then created several iterations of the code, eventually refining it down to converting all of the tasks into functions that could be repeatedly called and a while loop with if statements to continuously detect the color we want. We worked around using the setHeading function, due to it not working properly, by creating two new functions to turn the RVR Drone instead. We also previously made our own auto course correction software but opted to use the built-in one when it was released. While we were accomplishing these tasks, we extensively referenced the Sphero JavaScript Wiki, as well as used the Edu app to convert the built-in functions into text so we could modify or learn how to use them in their text forms.

- https://github.com/Daedalus-Robotics/avr-sphero-2022

DJI Tello

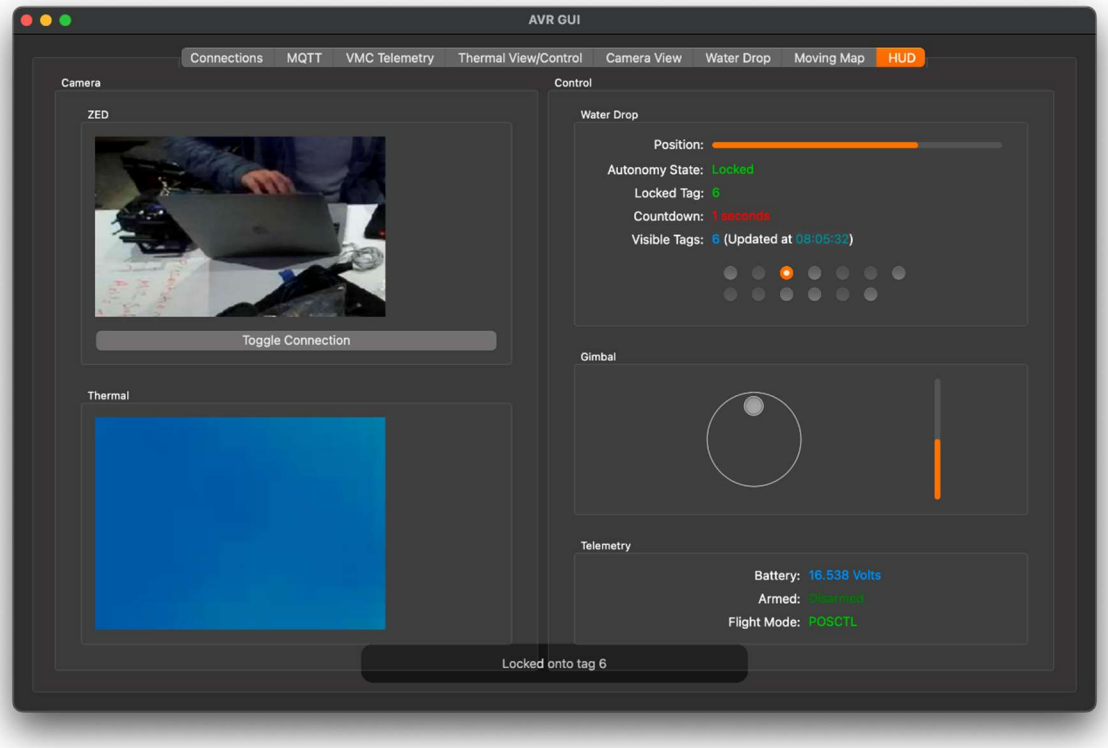
The Tello drone proved to be quite a difficult task to plan for. Working with beta software is always a challenge and we were having lots of trouble getting our code to work. In the final days, they started allowing the use of python which helped get our code working and more streamlined. We also were able to get manual control of the drone on an Xbox One controller which increased handling quite a lot. We then added support for the 3 missions in the GUI activatable with the Xbox Controller. It was quite handy to include everything in one streamlined GUI.

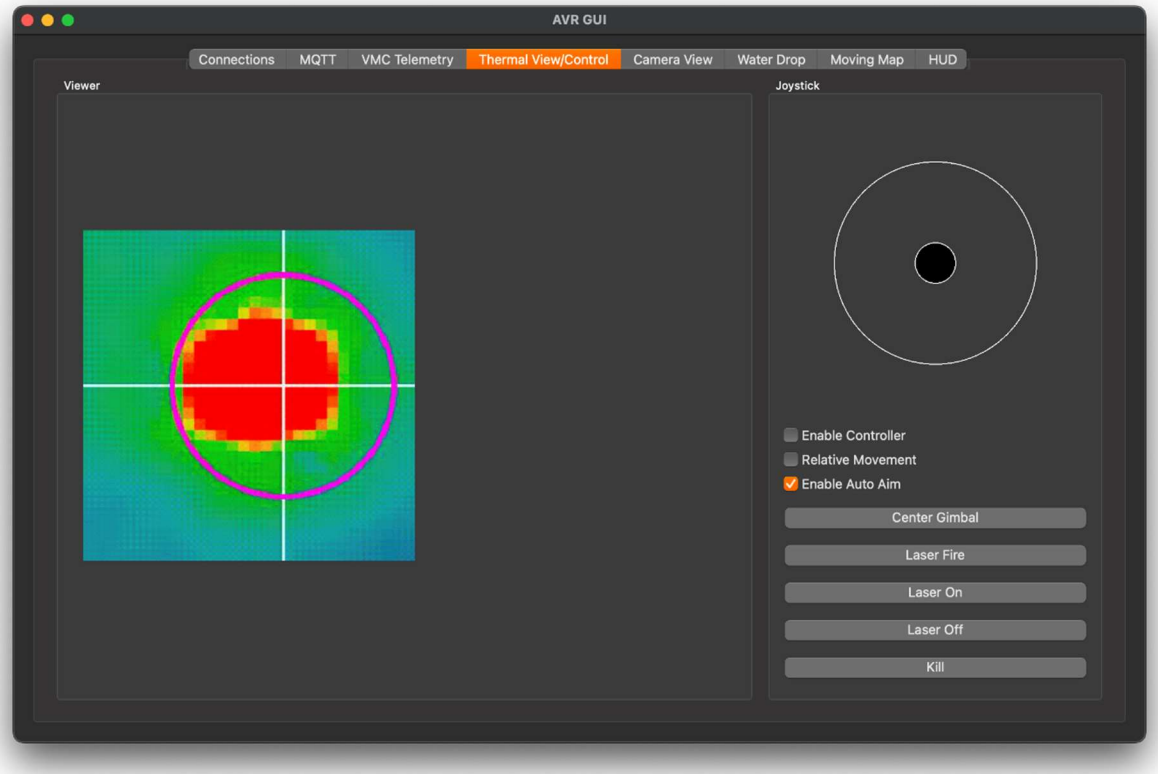
- https://github.com/Daedalus-Robotics/avr-tello-2022

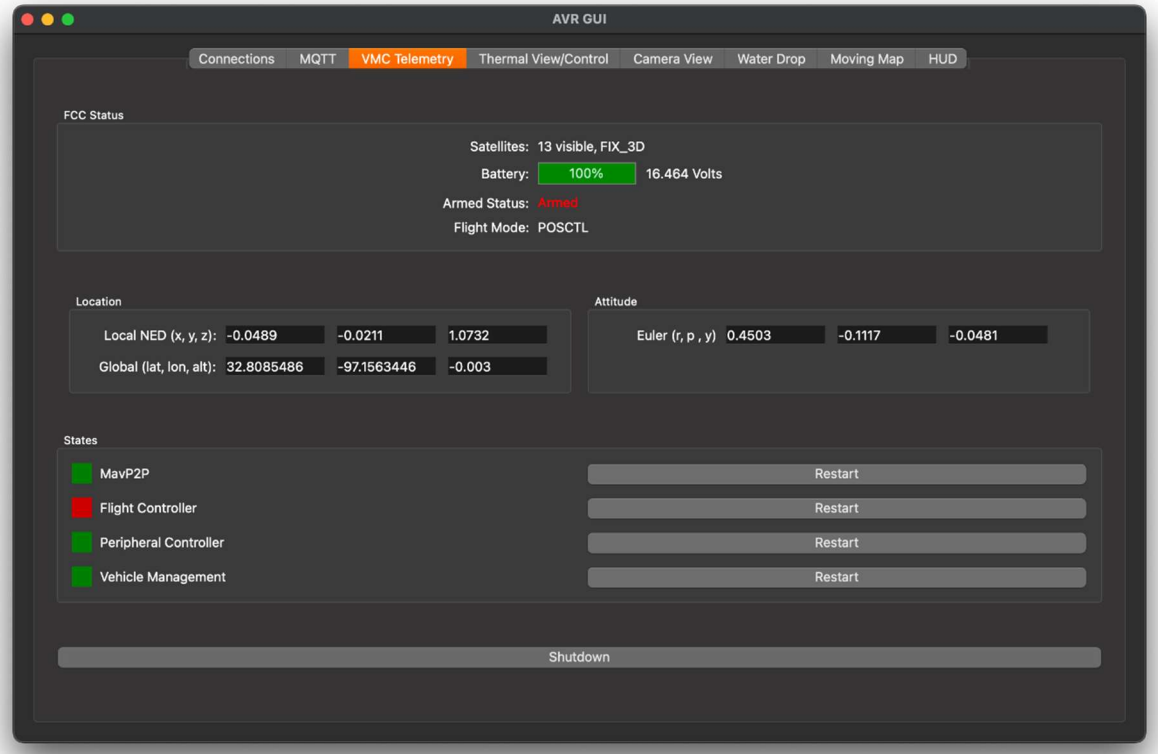
b. AVR Software

General Improvements

- Support for a Dual sense controller
- Zed Camera streaming to the GUI
- Relative Gimbal Control
- Automatic aiming the gimbal at the hotspot
- Autonomous water drops
- Statuses for everything
- Swap controls to ZMQ
- Add the ability to fire a set amount of times to the PCC firmware
- Remove IPC (No more MQTT in the middle of the position updates (dramatically faster))
- Add HUD (Heads up display) page in the GUI
- Add hotspot detection algorithm
- Stop using docker and run everything in one program




AVR GUI
Connections
MQTT
VMC Telemetry
Thermal View/Control
Camera View
Water Drop
Moving Map
HUD
Viewer
Joystick
Enable Controller
Relative Movement
Enable Auto Aim
Center Gimbal
Laser Fire
Laser On
Laser Off
Kill


AVR GUI
Connections
MQTT
VMC Telemetry
Thermal View/Control
Camera View
Water Drop
Moving Map
HUD
FCC Status
Satellites: 13 visible, FIX_3D
Battery: 100% 16.464 Volts
Armed Status: Armed
Flight Mode: POSCTL
Location
Local NED (x, y, z): -0.0489 -0.0211 1.0732
Global (lat, lon, alt): 32.8085486 -97.1563446 -0.003
Attitude
Euler (r, p , y) 0.4503 -0.1117 -0.0481
States
MavP2P
Flight Controller
Peripheral Controller
Vehicle Management
Restart
Restart
Restart
Restart
Shutdown

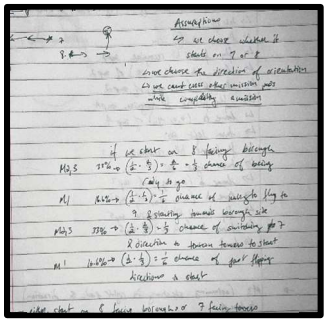
c. Tello

Switch from Droneblocks to python

We began the year trying to use the new version of Droneblocks desktop to code our Tello. Unfortunately, the code was quite buggy, and we were unable to get repeatable results. Because of our sufficient experience in Python, as soon as the rules committee allowed the *DJITelloPy* library, we switched to Python.

Pseudocode

We first started coding the Tello software with pseudocode. This helped us create an efficient final product. (*Sample below*).

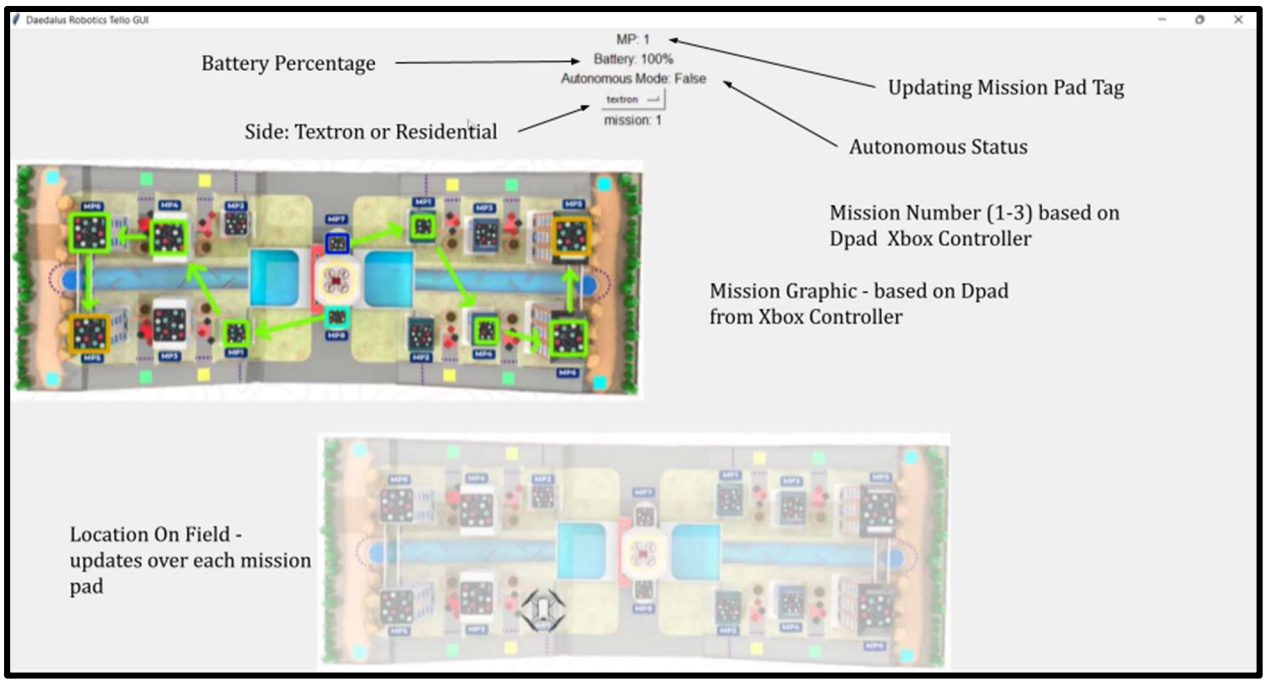


Quality of Life Improvements

To achieve better control of the Tello, we added several ease-of-use features. We added a GUI, and an Xbox Controller to manually control the drone. Having the manual inputs on the controller made it much easier to code and fly.

GUI

We used the python package guizero to create a simple GUI for the Tello.



V. Strategy

Our team took an iterative approach towards strategy. We began by simulating using a spreadsheet-based scoring calculator. We then live-tested our ideas using a board and foam replica of 1/3 of the course. As our hardware evolved (e.g., Ball Picker Upper), we updated our strategy and tested its efficacy. The following sections shows our main 5 versions of iteration and the reasoning behind them.

- **AVR Drone**
    1. Strategy V1
        1. Rudimentary Order
    2. Strategy V2
        1. Precision targeting
    3. Strategy V3
        1. Volume and speed
    4. Strategy V4
        1. Spreading fire
    5. Strategy V5
        1. Rule changes (no fire spread)
- **Sphero RVR**
    1. RVR Scoring/Strategy Version 1
    2. RVR Scoring/Strategy Version 2
- **Other Strategy Elements**
    1. Other Score Calculators
        1. Match Score Calculator
        2. Support Vehicle Score Calculator
    2. Small Strategies

a. AVR Drone

Game Planning

Through the course of this season, we've moved through a multitude of approaches to the challenge, learning something new in the face of failure, and continuing to question how we can improve our strategy.

Using the game manual, we created a plethora of tools to assist in strategy development, such as score calculators and timing tables. Using these tools, we worked our way to creating the most effective strategy for all aspects of competition.

Strategy 1: *Consolidation of Findings V1*[1]

This list is okay regardless of which tall roof building is active

1. Propwash - 5 - 10 sec
    - estimated time is 5-10 seconds as a range of capability
    - start doing propwash on the opposite side from where the first LWC closed roof is (if LWC is on the left, go through the right)

2. LWC 1 - 10-15 sec (lower depending on RNG)
    - the side that the active fire starts on (on the LWC building) has a 50% chance of being in a good spot,
    - after LWC 1, the fire from the LWC building will then spread at 1:45 min instead of 1:15.

3. Hotspot - 15-20 sec (lower depending on if it's an open or closed roof)
    - Go up and check for Hotspot
    - Best scenario is an LWC hotspot because we preserve water drops
    - In the case of an Open-Roof Hotspot, Doing it manually is viable, but doing it autonomously sets us up better in terms of time (refer to table in section 4)
    - (Note that the Hotspot has a 50/50 chance of being on either building type, no matter the starting condition)

4. Open-Roof 1 - 15-20 sec

[1] Note that both *Consolidation of Findings V1* and *V2* are under the assumption that we have a ball dropping mechanism that can precisely drop X amount of balls and takes a substantial amount of time to refill from the reservoir. This assumption changes when moving onto *Consolidation of Findings V3*.

All tables work for any time before 1:15.

8-Ball Drop (meaning open roof hotspot was done manually)

New Fire Spread Time	For T < 1:15
Done Auton	2:15
Done Non-Auton	1:45

12-Ball Drop (meaning open roof hotspot was done auton)

New Fire Spread Time	For T < 1:15
Done Auton	2:45
Done Non-Auton	2:00

16-Ball Drop (meaning hotspot was LWC)

New Fire Spread Time	For T < 1:15
Done Auton	Cleared
Done Non-Auton	2:15

5. Refill Reservoir - 15-20 sec; 1:25

6. LWC 2 - 10-15 sec; 1:40

- (IN A REASONABLE TIME SCENARIO YOU ARE AT 1:25 AT THIS POINT, HAVE TO DO LWC 2 SINCE SPREAD IS AT 1:45) **(MIN OF AN 8 BALL AUTON DROP (2:15 TILL SPREAD));** PROBABLY HAVE TO DO AT LEAST 3 WINDOWS TO AVOID SPREAD BY 2:15

7. Dump Open Roof (Auton is like 20, non auton maybe 10)
- WITH WHAT TANK SIZE CAN YOU DUMP OPEN ROOF?? - 32 max for non auton, NEED GOOD AUTON
- MOST LIKELY DOING OPEN ROOF AT ABOUT JUST UNDER 2 MIN

8-Ball Drop (meaning open roof hotspot was done manually)

New Fire Spread Time	For T < 1:15	FS at 2:00 min
Done Auton	2:15	8
Done Non-Auton	1:45	Spread already

12-Ball Drop (meaning open roof hotspot was done auton)

New Fire Spread Time	For T < 1:15	FS at 2:00 min
Done Auton	2:45	6
Done Non-Auton	2:00	Possible, but cuts it close (spread is at 2 minute, only have ~5 sec to clear)

16-Ball Drop (meaning hotspot was LWC)

New Fire Spread Time	For T < 1:15	FS at 2:00 min
Done Auton	Cleared	Cleared
Done Non-Auton	2:15	8

TO ACCOUNT FOR REASONABLE/MAX TIME SCENARIO, NEED TO REFILL WITH A TANK OF 32 MAX (==if doing non auton, otherwise 16 max tank for 100% autonomy)

9. LWC CONTROL / CLEAR

- In a reasonable time scenario, if you only did 2 windows on LWC 2, you have miniscule time to control LWC(spread at 2:15) , but if you did at least 3 windows, you have more time (spread at 2:30

Another note-- what if we do half auton and half non-auton? (probably not viable)

For Phase 2

This list is okay regardless of which tall roof building is active

2. LWC 1 - 10-15 sec (lower depending on RNG)
    - the side that the active fire starts on (on the LWC building) has a 50% chance of being in a good spot,
    - after LWC 1, the fire from the LWC building will then spread at 1:45 min instead of 1:15.
3. Hotspot - 15-20 sec (lower depending on if it's an open or closed roof)
    - Go up and check for Hotspot
    - Best scenario is an LWC hotspot because we preserve water drops
    - In the case of an Open-Roof Hotspot, doing it manually is viable, but doing it autonomously sets us up better in terms of time (refer to table in section 4)
    - (Note that the Hotspot has a 50/50 chance of being on either building type, no matter the starting condition)

4. Open-Roof 1 - 15-20 sec

All tables work for any time before 1:15.

8-Ball Drop (meaning open roof hotspot was done manually)

New Fire Spread Time	For T < 1:15
Done Auton	2:15
Done Non-Auton	1:45

12-Ball Drop (meaning open roof hotspot was done auton)

New Fire Spread Time	For T < 1:15
Done Auton	2:45
Done Non-Auton	2:00

16-Ball Drop (meaning hotspot was LWC)

New Fire Spread Time	For T < 1:15
Done Auton	Cleared
Done Non-Auton	2:15

5. Refill Reservoir 15-20 sec; 1:25

6. LWC 2 10-15 sec; 1:40

- (IN A REASONABLE TIME SCENARIO, YOU ARE AT 1:25 AT THIS POINT, HAVE TO DO LWC 2 SINCE SPREAD IS AT 1:45) **(MIN OF AN 8 BALL AUTON DROP (2:15 TILL SPREAD));** PROBABLY HAVE TO DO AT LEAST 3 WINDOWS TO AVOID SPREAD BY 2:15

7. Dump Open Roof (Auton is like 20, non auton maybe 10)
- WITH WHAT TANK SIZE CAN YOU DUMP OPEN ROOF?? - 32 max for non auton, NEED GOOD AUTON
- MOST LIKELY DOING OPEN ROOF AT ABOUT JUST UNDER 2 MIN

8-Ball Drop (meaning open roof hotspot was done manually)

New Fire Spread Time	For T < 1:15	FS at 2:00 min
Done Auton	2:15	8
Done Non-Auton	1:45	Spread already

12-Ball Drop (meaning open roof hotspot was done auton)

New Fire Spread Time	For T < 1:15	FS at 2:00 min
Done Auton	2:45	6
Done Non-Auton	2:00	Possible, but cuts it close (spread is at 2 minute, only have ~5 sec to clear)

16-Ball Drop (meaning hotspot was LWC)

New Fire Spread Time	For T < 1:15	FS at 2:00 min
Done Auton	Cleared	Cleared
Done Non-Auton	2:15	8

TO ACCOUNT FOR REASONABLE/MAX TIME SCENARIO, NEED TO REFILL WITH A TANK OF 32 MAX (if doing non auton, 16 max for 100% auton)

9. LWC CONTROL / CLEAR

- In a reasonable time scenario, if you only did 2 windows on LWC 2, you have miniscule time to control LWC (spread at 2:15), but if you did at least 3 windows, you have more time (spread at 2:30)

Although still somewhat incoherent, this was all transcribed from many whiteboard think tanks trying to figure out a strategy that would prioritize doing the Closed-Roof Building and then Hotspot. In hindsight, this strategy was a mistake because it was much more efficient to prioritize the Open-Roof Building first, but this first document is still useful when thinking of contingency plans in a situation when we're running behind schedule.

Consolidations of Findings V2 applies this finer prioritization strategy, and reduces the theoretical Phase 1 time by over 1 minute:

Different Strat- Starts with clearing open roof
LWC spreads at 1:00 Minute

NOTE: really only have to do one side of propwash (the side with the non-active building), because it only spreads to non-active buildings and doesn't stack onto already burning buildings (confirmed on forum), but we still have to clear it eventually to finish the phase and to avoid it spreading once we clear that tall building

1. Propwash; 5-10 seconds; 10 sec
    1. estimated time is 5-10 seconds as a range of capability
    1. start doing propwash on the opposite side from where the first LWC closed roof is (if LWC is on the left, go through the right)

0. Open Roof; 15 seconds; 25 sec
    1. At 15 seconds, FS = 5, Auton is 10 balls and non is 20
    2. At 30 s, FS = 6, auton is 12, non is 24
0. Hotspot; 20 seconds; 45 sec.
    1. Only need 4 balls if doing autonomously, otherwise need 8 balls

0. LWC, Control/Clear; 20 seconds; 1:05 +++ (NEED TO GET TO UNDER MINUTE OR SPREADS)
    1. PROBABLY don't need to actually control/ clear if we can do phase two with no spread, otherwise it's best to block fire spread paths. The only real influence that pertains to the situation in phase 2 is the trees, which should be cleared pretty fast. RVR can operate and still gain points after phase 1 is complete, no penalty incurred.

FOR RVR:

If we really want to maximize points, we need an interface that allows us to complete the full checkpoint path around the entire board and be able to actually choose which trenches to go into for clearing. If we want to grunt force, we do all of them once for checkpoint and then again to clear the two trenches, which doesn't actually have any downsides if we don't have any spread during phase 2, but to minimize time then option one is better.

Phase 2 PLAN-

LWC First is maybe better?

0. (PROPWASH IF REQUIRED) +5-10 sec
1. Refill Water; 15-20 seconds; **20**/30 sec
2. Open Roof; 15 seconds; 35/45 sec
    1. At 30 s , FS = 6, auton is 12, non is 24
        1. Use 12 anyways just in case
3. Hotspot; 20 seconds; 55/1:05 sec.
    1. Only need 4 balls if doing autonomously, otherwise need 8 balls
4. LWC, Control/Clear; 20 seconds; 1:15/1:25 sec +++
    1. NEED TO CUT DOWN, HAS ALREADY SPREAD

THIS TAKES TOO MUCH TIME, CUTTING IT CLOSE BECAUSE OF THE RESERVOIR

This version came out a lot shorter as it doesn't involve staggering fire spread timers for buildings by partially clearing them.

Both *Consolidation of Findings V1* and *V2* are under the assumption that we have a refined ball dropping/picking up mechanism that can precisely drop as many balls as we want, but takes a while to refill from the reservoir. After some team brainstorming, we hypothesized a ball dropping/picking up mechanism that prioritized speed over accuracy. The theoretically ideal mechanism was able to drop everything we had collected in the mechanism all at once, and pick up a mass amount of balls in a short amount of time.

Consolidation of Findings V3 was built with this in mind:

This is a phase 1 scenario in which you can pick up and drop balls very quickly, allowing you to go through the game fully **non-autonomous** with the AVR (**use considerations from Consolidation of Findings V1 to create more time**)

Make another phase 1 scenario in which you can pick up and drop balls very quickly, allowing you to go through the game with **autonomous** dumping

This is true if you can easily pick up balls from the reservoir, and dump your full tank into buildings autonomously

Phase 1.

1. Open Roof Building; 15 seconds; 15 seconds
    1. Since Auton, building is cleared, need to refill from reservoir
2. Propwash; 5-10 seconds; 25 sec
    1. estimated time is 5-10 seconds as a range of capability

Branches into two scenarios here:

Hotspot is Open Roof

1. Refill from reservoir; 10 seconds; 35 seconds
    1. Any amount above 8 balls
2. Non-Auton Dump into Hotspot; 10 seconds; 45 seconds
3. LWC Building Control/Clear

Hotspot is Closed Roof

1. Hotspot; 20 seconds; 45 seconds
2. LWC Building Control/Clear

Phase 2.

Assume we start phase 2 side at about 1:00 Minute

1. Refill from reservoir 15 seconds; 1:15 min
    1. No matter what, we have to refill from the reservoir when starting phase 2. Either we used all the balls doing open-roof, or we already refilled once to do the hotspot.
2. Open Roof Building; 15 seconds; 1:30 min
    1. Since Auton, building is cleared, need to refill from reservoir

Hotspot(P2) is Open Roof

1. Refill from reservoir; 15 seconds; 1:45 min
    1. Any amount above 8 balls
2. Non-Auton Dump into Hotspot; 10 seconds; 1:55 min
3. LWC Building Control/Clear
    1. time most likely goes over, need to improve time assumptions

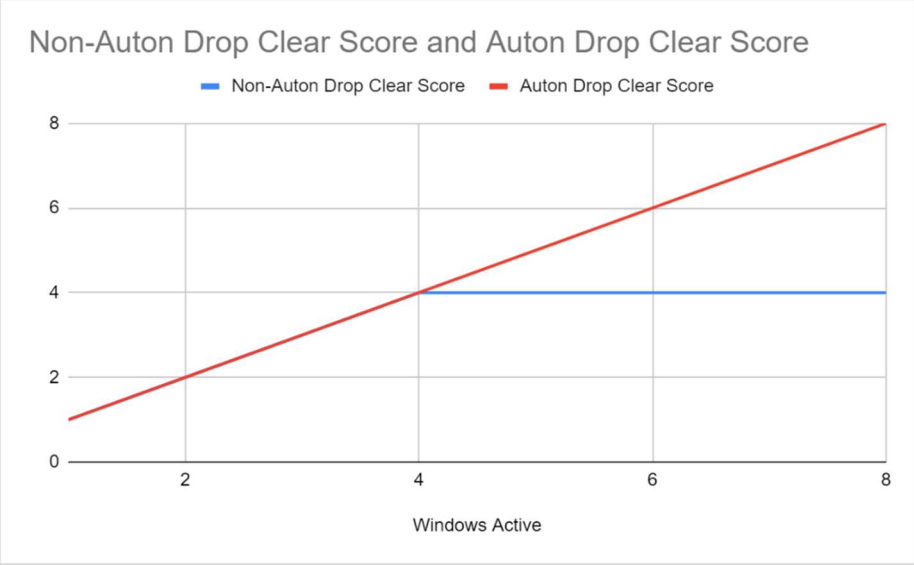
Hotspot(P2) is Closed Roof

1. Hotspot; 20 seconds; 1:50 min
2. LWC Building Control/Clear
3.

Phase 3.

Most efficient for points:

1. Refill From Reservoir
2. Clear Open Roof Buildings (go back to step 1, unless.)
3. No more Open Roof Buildings worth clearing, move to LWC buildings for that side
    1. An open roof building is the least worth clearing depending on points per ball dropped
    2. Assuming you get about 16 balls every time you refill from the reservoir, the Points per Ball value depreciates as the number of active windows on that building goes down.



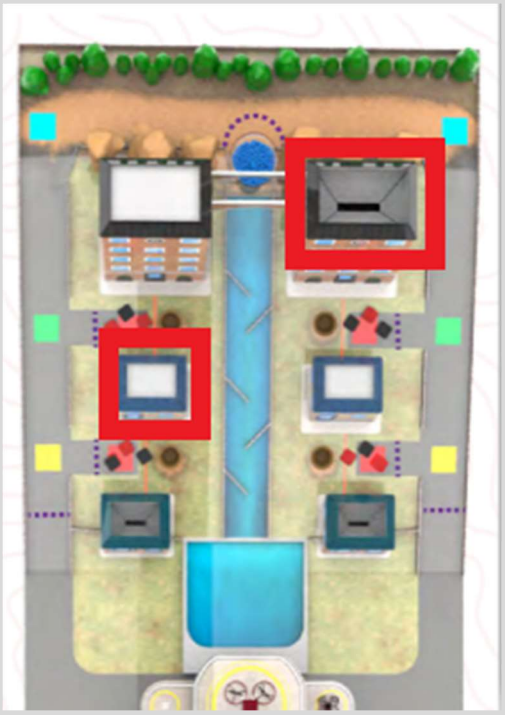
0. Once everything on that side is dry, move to side that has been stacking up windows

From here, we noticed some deviations from this strategy that work better depending on different starting fire scenarios

Consolidation of Findings V4:

Strategy is dependent on the starting conditions of the phase.

Fire Scenario 1:



Phase 1.

1. Open Roof Building; 15 seconds; 15 seconds
    1. Since Auton, building is cleared, need to refill from reservoir
2. Propwash; 5-10 seconds; 25 sec
    1. estimated time is 5-10 seconds as a range of capability

Branches into two scenarios here:

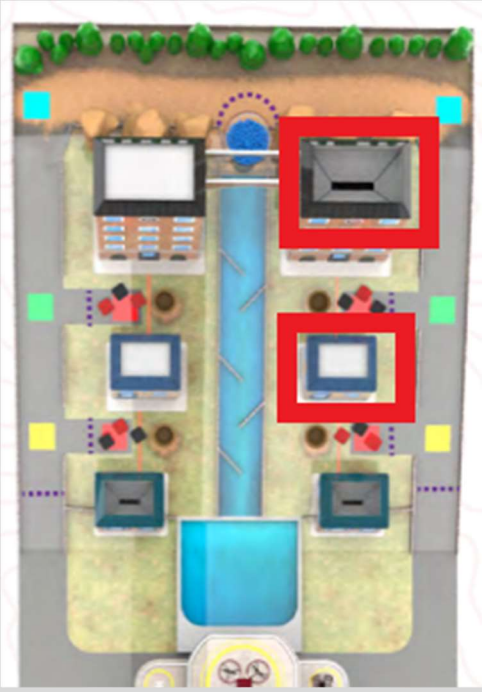
Hotspot is Open Roof

1. Refill from reservoir; 10 seconds; 35 seconds
    1. Any amount above 8 balls
2. Non-Auton Dump into Hotspot; 10 seconds; 45 seconds
3. LWC Building Control/Clear

Hotspot is Closed Roof

1. Hotspot; 20 seconds; 45 seconds
2. LWC Building Control/Clear

Fire Scenario 2:



Phase 1.

1. Clear Left Half of the Forest Fire; 5-10 seconds; 10 seconds
2. Hotspot; 20-30 seconds; 40 seconds.
3. Reduce (not clear) Closed Roof building; 20 seconds; 1:00 Minute
    1. Don't clear it because it's stopping everything behind it from spreading down in a chain
4. Clear Forest Fire
5. Clear Open-Roof Building
    1. May take multiple runs to refill and do this non-auton. If you must reduce Closed-Roof building again, go for it.
6. Clear Closed-Roof Building (if not cleared already)

Fire Scenario 3 and 4:

Phase 1.

1. Forest Fire; 5-10 seconds; 10 seconds
2. Hotspot; 20-30 seconds; 40 seconds.
3. Clear Closed Roof building; 20 seconds; 1:00 Minute
4. Clear Open-Roof Building
    1. May take multiple runs to refill and do this non-auton. If you have to reduce Closed-Roof building again, go for it.
    1. Not a super important clearing objective because it doesn't spread anywhere

Important Notes:

- The only difference between the phase 1 and 2 procedures depending on the Fire Scenario is that you need to refill immediately when entering phase 2

This iteration accounted for every possible situation during the match, like every combination of buildings that can be on fire.

After our qualifier events on 11/19 and 11/20, we got to work creating a new strategy using the new rules introduced to us at the event. We had to rapid prototype a strategy the day of, basically starting from scratch, and came out with this:

--Iteration 1--
Phase 1.

1. Open-Roof Building
    . Attempt to finish within 30 seconds so no spread
2. Search for Hotspot and Clear

    - Try to get before it erupts at 1 minute
2. Closed-Roof Building
3. Handle spread

Phase 2.
Depending on which row of buildings we get:

1. Short Open-Roof Building → Refill → Tall Open-Roof
2. Closed-Roof Building
3. Hotspot building
    - Most likely erupted

Or

1. Short Open-Roof Building
2. Short Closed-Roof Building
3. Tall Closed-Roof Building
4. Handle Spreads

--Iteration 2--
With more clarification and realizing we don't have the time to especially prioritize the Hotspot, and the hotspot is less important due to how the other tall building can't attain fire score during phase 1

Phase 1.

1. Open-Roof Building
    - Attempt to finish within 30 seconds so no spread
2. Closed-Roof Building
    - 8 FS after 30 seconds, spread to other buildings at 1 min
2. Handle Spreads
    - We can do this before hotspot since the hotspot building doesn't actually spread to the other tall building in Phase 1
2. Hotspot
    - Allow it to erupt, finding hotspot using gimbal takes too much time, focus on the other building

Phase 2.
Decided it would probably be more efficient to just go straight for Short Closed-Roof after Short Open-Roof:

1. Open-Roof Building
    - Attempt to finish within 30 seconds so no spread
2. Closed-Roof Building
    - Go for Closed-Roof first now because we don't have to fly as far to get into position after we finish the Open-Roof Building.
2. Tall Open or Closed Roof Building
3. Handle Spreads
4. Hotspot

Very rough, but we used what information and little time we had to create a working plan for ourselves. After the competition, we had more time to think about how we can improve our strategy and what methods we could employ, especially now that we had a good grasp of what the game played out like, and how our drone fared.

Consolidation of Findings V5:

Methods and Strategies:

1. Immediate Refill into Open Roof→ higher chance of clearing the 4 fs
2. 4x4 Starting Position of balls?

0. Double Refill → refill twice to get as many balls as possible in one go
0. Triple Refill → refill 3 time (test how much better)
0. Quad Refill?
0. Can make a table showing (amount picked up vs refill amount)

0. Position holds in-between two buildings and aim the gimbal manually.

Phase 1.

If Top Hotspot is Open-Roof:

1. Start with double/triple refill
2. Bottom Open-Roof Building
3. Middle Closed-Roof Building
4. Switch regardless of finishing building (50 sec - 1 min) - (Hotspot explodes)
5. Double/Triple Refill
6. Other Bottom Open-Roof Building
7. Double/Triple Refill
8. Top Open-Roof Hotspot Building
9. Middle Closed-Roofs

If Top Hotspot building is Closed-Roof:

1. Start with double/triple refill
2. Bottom Open-Roof Building
3. Middle Closed-Roof Building
4. Switch regardless of finishing building (50 sec - 1 min) - (Hotspot explodes)
5. Double/Triple Refill
6. Other Bottom Open-Roof Building
7. Middle Closed-Roof Buildings
8. Top Closed-Roof Hotspot

Phase 2.

If Top building is Open-Roof:

1. Start with a double/triple refill
2. Bottom Open-Roof Building
3. Double/Triple refill
4. Top Open-Roof
5. Switch regardless of finishing building (50 sec - 1 min) - (Hotspot explodes)
6. Other Bottom Open-Roof Building
7. Double/Triple refill
8. Finish Top Open-Roof
9. Middle Closed-Roof + Top Closed-Roof

If Top building is Closed-Roof:

1. Start with a double/triple refill
2. Bottom Open-Roof Building
3. Middle Closed-Roof Building
4. Switch regardless of finishing building (50 sec - 1 min) - (Hotspot Explodes)
5. Double/Triple refill
6. Other Bottom Open-Roof
7. Double/Triple refill
8. Both Top (Hotspot and Norm) - (Open first, Closed)
9. Middle Closed-Roof

This is our final strategy, which will be employed during the championship event on December 3rd. It accounts for the two possible starting scenarios in each phase and is backed by both experience in game and logical reasoning for our best course of action.

b. Sphero RVR

Game Planning + Score Calculator

Early on, we recognized the Sphero as one of our highest point scoring potentials due to the autonomous point bonus that comes along with it. Most of the strategy planning for the season went towards the RVR in the hopes to maximize efficiency and points at the same time

We started off with our surface-level understanding of the rules, and as we delved deeper into the thick of the game manual, we found ourselves playing every rule we could to our advantage.

From Daedalus Score Calculator V1:

IDEAL RVR PATH			
Checkpoint/Action Completion	Score Bonus	Action Score	Total
Ramp 1	2		
Ramp 2	4		
Trench 1	6	5	11
Trench 2	8	5	24
Water Tower	10	5	39
Trench 3	12	5	56
Parking	12	1	69

*Note: T (1/2/3/4) Denotes a **trench** starting from the bottom right of a community and moving counter counterclockwise*

LONG RVR PATH	If taking more time, and going	over each trench then scoring?		
	Checkpoint/Action Completion	Score Bonus	Action Score	Total
	Ramp 1	2		
	Ramp 2	4		
	T1	6		
	T2	8		
	T3	10		
	T4	12		
	Water Tower	14	5	19
illuminated	T1	14	5	38
trenches	T2	14	5	57
filled	T3	14	5	76
	Parking	14	1	91

Between these first two tables, our first breakthrough in strategy was born. By sacrificing the total runtime of the RVR, we could maximize points by entering a trench, clearing the checkpoint, and leaving instead of pushing all the beanbags into the trenches. We then go back to reap our autonomous bonus after clearing every checkpoint in the dormant community. Again, this requires significantly more time opposed to if we weren't to do this strategy. Another thing to note is that at the time we thought that a "set" of illuminated trenches meant 3-4 trenches, but later we learned through the forum that it only meant 2 trenches.

From Daedalus Score Calculator V2:

Every Scoring Checkpoint but Faster				
	Checkpoint/Action Completion	Score Bonus	Action Score	Total
Dormant Community	Ramp 1 (Dormant)	2		
	T1	4		
	T2	6		
	Water Tower 1	8	5	13
	T3	10		
	T4	12		
Dormant Community end	Ramp 2 (Dormant)	14		
Fire Community	Ramp 1 (Fire)	16		
	T1	18		
	T2	20		
	Water Tower 2	22	5	40
	T3	24		
	T4	26		
Fire Community end	Ramp 2 (Fire)	28		
Dormant Finish	TA	28	5	73
	TB	28	5	106
	Parking	28	1	135

MOST POINTS				
do water towers and then finish trench	Checkpoint/Action Completion	Score Bonus	Action Score	Total
THIS WOULD BE DORMANT START	Ramp 1 (Dormant)	2		
	T1	4		
	T2	6		
	T3	8		
	T4	10		
	Ramp 2 (Dormant)	12		
This would be fire community starts	Ramp 1 (Fire)	14		
	T1	16		
	T2	18		
	T3	20		
	T4	22		
	Ramp 2 (Fire)	24		
Fire Community	Water Tower 1	26	5	31
Dormant Community	Water Tower 2	28	5	64
Into dormant trenches	TA	28	5	97
	TB	28	5	130
	Parking	28	1	159

Our next breakthrough in strategy was learning that the RVR can visit both sides of the field and accrue point bonuses from checkpoints in the Initial Burn community as well as the Dormant Community, and that the second water tower there is another possible scoring action. The second spreadsheet is the most time-consuming strategy we have because we push every scoring action to after we clear every checkpoint, but it gives us a grand total of 159 points.

Next, our goal was to experiment around with different strategies that prioritize time efficiency:

From Daedalus Score Calculator V2:

Note: TX (1/2) and TX (3/4) Denotes the possible trench pair, per side of the field. The 1st trench only pairs with the 3rd trench, and the same with the 2nd and 4th trenches.

	Checkpoint/Action Completion	Score Bonus	Action Score	Total
Dormant Community	Ramp 1 (Dormant)	2		
	T1	4		
	T2	6		
	Water Tower 1	8	5	13
	T3	10		
	T4	12		
Dormant Community	Ramp 2 (Dormant)	14		
Turn Around, back up	TX (3/4)	14	5	32
	TX (1/2)	14	5	51
	Parking	14	1	66

	Checkpoint/Action Completion	Score Bonus	Action Score	Total
Dormant Community	Ramp 1 (Dormant)	2		
	T1	4		
	T2	6		
	Water Tower 1	8	5	13
Dormant End	Ramp 2 (Dormant)	10		
Fire Community Start	Ramp 2 (Fire)	12		
	Water Tower 2	14	5	32
Fire Community End	Ramp 1 (Fire)	16		
Finishing Trenches	TX (1/2)	16	5	53
	TX (3/4)	18	5	76
	Parking	18	1	95

These two iterations taught us a fundamental understanding to prioritize time and point efficiency at the same time, which was to prioritize achieving every scoring action, but we don't

need to maximize the amount of scoring actions. This understanding was applied to the next and final iteration:

	Checkpoint/Action Completion	Score Bonus	Action Score	Total
Dormant Community	Ramp 1 (Dormant)	2		
	T1	4		
	T2	6		
	Water Tower 1	8	5	13
	T3	10		
	T4	12		
	Ramp 2 (Dormant)	14		
Fire Community	Ramp 2 (Fire)	16		
	Water Tower 2	18	5	36
	Ramp 1 (Fire)	20		
	TX (1/2)	20	5	61
	TX (3/4)	20	5	86
	Parking	20	1	107

An important note is that: technically, the point total at the end of each scoring table fluctuates by 2-4 points depending on which trenches activate during the game.

Just like for our main strategy, our RVR pathing strategy had to be updated in accordance with the new rule changes. The point total was cut down a lot, but it reflects our actual capabilities due to what we believe we can achieve during the match. Relative to the rule changes, this score does make up a good amount, and can contribute significantly to our total score in a match.

	Checkpoint/Action Completion	Score Bonus	Action Score	Total
Dormant Community	Water Tower	4	5	9
Fire Community	Water Tower	4	5	18
	TX (1/2)	4	5	27
	TX (3/4)	4	5	36
Fire Station	Parking	1	2	39
Total W/O Auton Trenches				31

c. Other Strategy Elements

Other Score Calculators

Along with the RVR score calculators, we also have a score calculator for each match:

Theoretical Game Score	
Phase	Point Range
Phase 1	0-50
Phase 2	0-50
Phase 3	0-?
Total	0-100+?

And we have a score calculator for each support vehicle:

Support Vehicle Actions		
Tello	Points	Auton Bonus
Recon Path	10	N/A (Must be Auton)
Parking	1	2 (Optional)
RVR	Points	Auton Bonus
Trench	5-10	4 per (Optional)
Water Tower	5-10	4 per (Optional)
Parking	1	2 (Optional)
Minis	Points	Auton Bonus
Parking	1-3	N/A
Total	From Actions	From Bonus
Max Total Score	35	20
Trench Done Manual	35	12

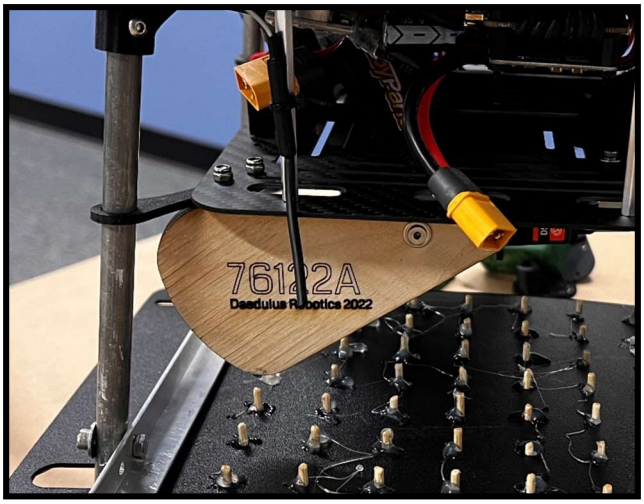
Small Strategies

1. During the match, we plan to have our Lead Strategist, Avi, be an in-field commander and one of the Sphero Mini Pilots. He will immediately park his Sphero Mini when the game starts and direct the other departments in terms of strategy.
2. In the beginning of the match, the AVR drone will prioritize the forest fire only if the Active Open-Roof Building is a Tall Building. Within that scenario, the most efficient way for the AVR drone to fly around the two tall buildings is by wrapping around the non-active side and ending up on the active building side, which would be wrapping from the left around to the right.
3. The DJI Tello MUST complete its recon path before the RVR drone starts filling in trenches. This is because for the autonomy bonus from the RVR to be applied to the action of filling a trench, the RVR must be the one to *finish* the trench requirement. We had this specified on the forum.
4. Another thing to think about is that we don't need to clear the entire forest fire in the beginning, just the side that is with the non-active building. We had this clarified on the forum.

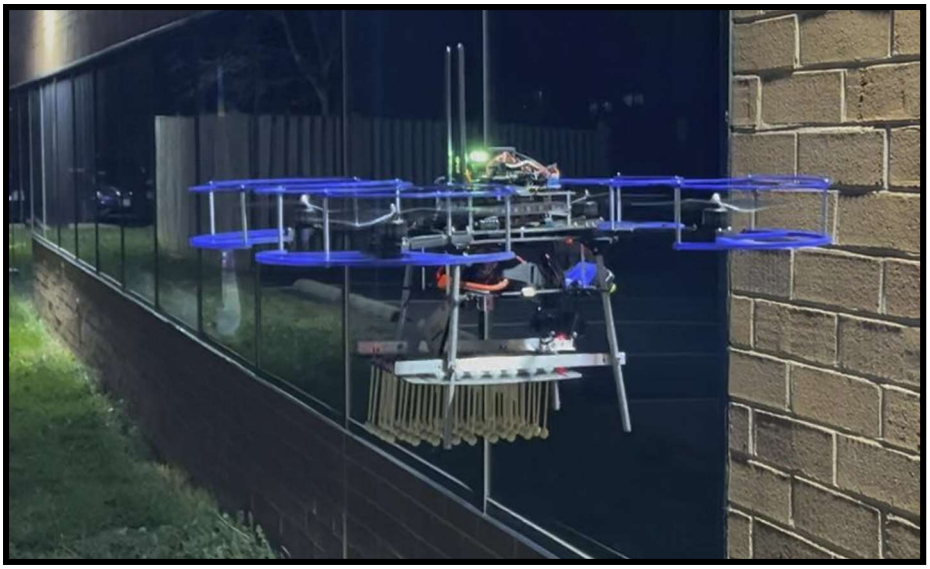
VI. Artistic Elements

Our artistic efforts throughout the team were focused on a clean professional look. We created a cohesive ecosystem throughout vehicles, logos, mottos, shirts, naming, etc… This season, we also designed a shirt, and a logo (title page).

a. AVR Drone



Servo Arm with team name and number.



Prop guards painted blue—our team color.

FPV Camera Display - Nicknamed *Fork Display XDR* because of our system to hold it up using plastic forks.

VII. Team Meeting Logs

We held brief meetings at the beginning and end of each meeting. These meetings were short but caught the most important decisions and processes during the meeting.

In total we held 29 official meetings and many shorter meetings outside of school and practice.

11/16/2022	Ideaventions Academy Bell Advanced Vertical Robotics (AVR) Team					
	Fall 2022 Schedule			Version: 8/17/2022		
When	Week	What	Location	Time	Objective	Put your name down if you cannot make it
Sat, 9/10	1	Meeting	Ideaventions Academy	2:00-6:00 pm		
Mon, 9/12	1	Meeting	Ideaventions Academy	4:15-5:15 pm		
Wed, 9/14	1	Meeting	Ideaventions Academy	4:15-5:15 pm		
Sat, 9/17	2	Meeting	Ideaventions Academy	2:00-6:00 pm		
Mon, 9/19	2	Meeting	Ideaventions Academy	4:15-5:15 pm		
Wed, 9/21	2	Meeting	Ideaventions Academy	4:15-5:15 pm		
Sat, 9/24	3	Meeting	Ideaventions Academy	2:00-6:00 pm		
Mon, 9/26	3	Meeting	Ideaventions Academy	4:15-5:15 pm		
Wed, 9/28	3	Meeting	Ideaventions Academy	4:15-5:15 pm		
Sat, 10/1	4	Meeting	Ideaventions Academy	3:00-6:00 pm	School Event: Upper School Open House (Grades 9th - 11th); 10 am - 12 noon	
Mon, 10/3	4	Meeting	Ideaventions Academy	4:15-6:00 pm		
Wed, 10/5	4	Meeting	Ideaventions Academy	4:15-6:00 pm		
Sat, 10/8	5	Meeting	Ideaventions Academy	2:00-6:00 pm		
Mon, 10/10	5	Meeting	Ideaventions Academy	4:15-5:15 pm		
Wed, 10/12	5	Meeting	Ideaventions Academy	4:15-5:15 pm		
Sat, 10/15	6	Meeting	Ideaventions Academy	3:00-6:00 pm	School Event: PSATs and Elementary School Open House (Grades 1st - 5th); 10	
Mon, 10/17	6	Meeting	Ideaventions Academy	4:15-5:15 pm		
Wed, 10/19	6	Meeting	Ideaventions Academy	4:15-5:15 pm	School Event: 6th-8th - GBORS Overnight; **MR RYAN OUT**	
Sat, 10/22	7	Meeting	Ideaventions Academy	2:00-6:00 pm	Mr. Ryan out	
Mon, 10/24	7	Meeting	Ideaventions Academy	4:15-5:15 pm		
Wed, 10/26	7	Meeting	Ideaventions Academy	4:15-5:15 pm		
Sat, 10/29	8	Meeting	Ideaventions Academy	3:00-6:00 pm	School Event: Middle School Open House (Grades 6th-8th); 10 am - 12 noon	
Mon, 10/31	8	Meeting	Ideaventions Academy	4:15-5:15 pm	8:24:22 PM	
Wed, 11/2	8	Meeting	Ideaventions Academy	4:15-5:15 pm	High School Overnight	
Sat, 11/5	9	Meeting	Ideaventions Academy	2:00-6:00 pm		Avi
Mon, 11/7	9	Meeting	Ideaventions Academy	8:00-6:00 pm		Logan, Avi, Matthew(12-3)
Tue, 11/8	9	Meeting	Ideaventions Academy	8:30-4:30 pm		Logan, Matthew
Wed, 11/9	9	Meeting	Ideaventions Academy	8:30-4:30 pm	Presentation	Logan, Matthew(9-12)
Thu, 11/10	9	Meeting	Ideaventions Academy	8:30-4:30 pm	Presentation	Logan, Matthew(9-12), Siddharth
Fri, 11/11	9					Logan
Sat, 11/12	10	Meeting	Ideaventions Academy	2:00-6:00 pm		Logan
Mon, 11/14	10	Meeting	Ideaventions Academy	4:15-6:00 pm		
Wed, 11/16	10	Meeting	Ideaventions Academy	4:15-6:00 pm		
Thur, 11/17	10	Extra Meetings?	Ideaventions Academy	4:15-6:00 pm		
Fri, 11/18	10	Extra Meetings?	Ideaventions Academy	4:15-6:00 pm		
Sat, 11/19		Competition	Maryland	8 - 5 pm	Presentation with details	
Sun, 11/20		Competition	Maryland	8 - 5 pm	Presentation with details	
Tue, 11/22	11	No Meeting	Ideaventions Academy			
Wed 11/23	11	No Meeting	Ideaventions Academy			
Thur 11/24	11	No Meeting	Ideaventions Academy			
Fri 11/25	11	No Meeting	Ideaventions Academy			

Pre-Meeting Tasks

Date: 9/7/22
Time: 4:05
Location: Ideaventions Academy; Room: Carson

Meeting Goals:

- Clarify meeting times
- Separate different teams
- Designate Roles to lead teams
- Discuss Challenge

Post-Meeting Tasks

Accomplishments:

- Created and assigned teams
- Manager
    - Team Lead: Arya
- Communications
    - Team Lead: Conall & Matthew
- 3-d printer/design
    - Team Lead: Logan
    - Ari
    - Arya
    - Hunter
- Strategy
    - Team Lead: Avi
    - Shivam
    - Arya
- Main Drone
    - Team Lead: Ari
    - Matthew
    - Avi
    - Conall
- Support (Sphero)
    - Team Lead: Shivam
    - Logan
    - Need more
- Support Tello
    - The team lead still needed
- Software & Computers
    - Team Lead: Hunter
    - Ari
    - Shivam

Issues/things for the next meeting:

- **Finish assigning roles**

Pre-Meeting Tasks

Date: 9/10/22
Time: 2:00 PM - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

Our kit hasn't come yet, so we will be focusing on:

- Strategy
- Setting up computers
- Begin Designing
- Set up Website/Outreach
- Think about model buildings/model of field

Post-Meeting Tasks

Accomplishments:

- Begun to discuss strategy
    - We came up with a list of questions to answer on the forum
    - Began development of a score calculator
- Software
    - Testing sphero minis
    - Began setting up a ground control laptop
    - Researching some programming methods for tello (fiducial libraries)
- Started creating a website

Game Strategy Planning:

- We worked on understanding the rules to craft basic game strategy
    - Thoroughly went through the rules, recording all the important strategies, questions, and important information we wanted

Event and Presentation Discussions:

- Discussed the addition of new members
    - How many do we need and where to place them on our team
    - What communities to hit for new members
- Outreach and Communication developments
    - Are we going to get sponsorships from local businesses?
    - Do we want to get marketing help for our team?

Issues:

- **Not being able to have a full-scale field for testing purposes**

Pre-Meeting Tasks

Date: 9/12/22
Time: 5:10
Location: Ideaventions Academy

Meeting Goals:

We've just received our shipment for all our components and we've made sure it contains everything we need

- Start construction and calibration of side vehicles.
- Start working on the main AVR drone.

Post-Meeting Tasks

Accomplishments:

- Partially completed objectives on the website
- Candid shots
- Started working on the tello and got basic code and calibration down.
- Began working with the Spheros and started doing incline tests
    - Figuring out how to get them up the ramps
- Began construction of the main AVR drone.
- Uploaded all of the parts for the landing gear for the drone. Printing time is roughly 12 hours.

Issues:

- **The Main AVR Drone kit wasn't shipped correctly; part missing. We can't start working on the AVR drone until we've gotten a new shipment**

Pre-Meeting Tasks

Date: 9/14/22
Time: 4:15-5:15
Location: Ideaventions Academy

Meeting Goals:

- Ari and Hunter are working on Apriltag recognition with the main AVR drone's stereoscopic camera
    - Start working on IR imaging to pick up heating up building
- Avi for creating flow chart with every possible Phase 1 starting condition
- Shivam and Vasishta are working on Sphero Mini software for getting more detailed controls, and eventually working on calibration of the RVR
- Conall and Matthew will start
    - Making a Tello board
    - design of team t-shirt design
        - Our number is team 76122A
- Logan will start 3d printed design of main AVR drone landing gear
- Avi and Arya will start working on an overall schedule for build objectives until the competition date

Post-Meeting Tasks

Accomplishments:

- Started work on a mock schedule for build dates.
    - Made a list of objectives, down to specific vehicle objectives
    - Still planning the dates
- April Tags software now set up on linux Started working on stereoscopic camera
- Shirt design near complete. Some pricing
- Trello started and shared.
- Worked with RVR software (installed and test program)
    - Will test soon
- Calibrating 3D printer (will start printing drone parts tomorrow)

Issues:

- **Had to change computers (mac doesnt work) windows or ubuntu**
- **RVR battery taking very long to charge (need to check to see if working or not)**

Pre-Meeting Tasks

Date: 9/17/22
Time: 2:00 PM - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Review Game manual revisions and new strategies
- Avi for creating flow chart with every possible Phase 1 starting condition
- Finish basic build for main AVR drone
- Start designing 3d water dropping mechanism for AVR drone
- Hunter is doing PCC code
- Shivam is working on learning the Sphero RVR code since we can't use it yet because the battery doesn't work
- Conall and Vasishta sketching 3d sketches

Post-Meeting Tasks

Accomplishments:

- Finished preliminary flow chart for AVR gameplay path during phase 1, needs a lot of improvement to incorporate more scenarios and will be subject to change after more updates on the game manual.
- Finished Team T-Shirt Design
- Started on RVR Code
- Tested Driving Sphero Minis
- Started working on Jetson Nano
- Got Apriltag pose detection working
- Got VMC working
- Finished soldering PCC
- Finished Basic Drone Assembly
    - Basic calibration done, ready for testing next meeting
- Printed brackets to mount the AVR drone landing gear
- Printed housing for battery
- Field Assembly
    - Built ¼ of the field base
    - Built 3 buildings, 2 short 1 tall
    - Built most of fire control tower

Design decisions:

- Started design on RVR bean bag pushers

Game Strategy Planning:

- Finished preliminary flow chart for AVR gameplay path during phase 1, needs a lot of improvement to incorporate more scenarios and will be subject to change after more updates on the game manual.

Event and Presentation Discussions:

Issues:

- **Propellers need to be replaced, really hard to get on and off**
- **Need to replace RVR battery, can only work with code.**

Pre-Meeting Tasks

Date: 9/19/22
Time: 4:05
Location: Ideaventions Academy

Meeting Goals:

- First Test of Drone
- Continue work on support elements

Post-Meeting Tasks

Accomplishments:

- Finished first test of the drone,
    - Got footage
- Finished calibration of CSI camera
    - Close to getting it to work
- Battery for RVR was shipped, coming in Saturday
- Printed the feet for landing gear of AVR drone
- Reprinted tray for battery
- Sliced CAD for gimbal
- Continuing work on team shirts
- First iteration of 3D design of beanbag pusher
- Website is nearing completion,
    - Need About page and contact page
- First iteration of full phase 1 for the AVR drone
    - Considers all starting scenarios and time scenarios

Issues:

- **May need to buy a new IR sensor due to low resolution**
- **First iteration of the battery tray failed, (now fixed)**
- **Need to fix the main AVR drone propellor issue,**
- **The propellor is fitted on wrong**

Pre-Meeting Tasks

Date: 9/21/22
Time: 4:15 PM -5:15 PM
Location: Ideaventions Academy

Meeting Goals:

- Get some parts ready for laser cutting for the RVR
- Start printing 3D designs LWC target pieces and design

Post-Meeting Tasks

Accomplishments:

- Started printing for Gimbal and LWC holder
- Finished the shirt design
- Finished website besides “About” section
    - Each member has to write a little about themselves
    - Need contact information for “Contact”
- Finished 3D Sketch of bean bag pusher V2
- Almost done creating laser cutting sketch for the bean bag pusher V1
- Started sketching bean bag pusher V3
- Started testing mission pads with Tello
- Worked on Telemetry with Jetson Nano

Design decisions:

- Revised Phase 1 Gameplan for AVR and found a better solution, but it requires faster times from the AVR in doing actions

Issues:

- **Still need to learn more about Jetson Nano and Telemetry with it**
- **Tello Software is extremely ‘young.’ Hard to use**

Pre-Meeting Tasks

Date: 9/24/22
Time: 2:00-6:00
Location: Ideaventions Academy

Meeting Goals:

- Finish Team Shirts
- Finish ⅓ scale field
- Assembly Jetson and PCC on drone
- Start building RVR pusher part
- Continue to work on Tello
- Email Bell to get correct RVR battery
- Start a twitter account

Post-Meeting Tasks

Accomplishments:

- Finished assembly of the top plate of drone with Jetson Nano and PCC
- Troubleshooting drone motors and props
- 2nd AVR Drone flight test (went well)
- Made storage space for our field components
- Sent shirt design to buy
- The first iteration of RVR pusher almost complete
- ⅓ model of field is mostly complete + water collection reservoir
- Started 3d printing the gimbal stand
- Sliced 3d pieces for camera mount
- Fixed one broken 3d printer
- Took some photos and videos

Design decisions:

- Began making RVR pushing part
-

Game Strategy Planning:

- N/A

Event and Presentation Discussions:

- Began talking about it

Issues:

- **People were sick today**
- **Lack of RVR battery - Emailed Bell AVR**

Pre-Meeting Tasks

Date: 9/26/22
Time: 4:15-5:15
Location: Ideaventions Academy

Meeting Goals:

- Updating Strategy, exploring into phase 2 for AVR and updating scoring calculator
- Update schedule for each team, and make sure we can do a full game test in 3 and ½ weeks.
- Make shirt revisions
- Set up four computers

Post-Meeting Tasks

Accomplishments:

- Power distribution board mounted to AVR
- Top plate mounted
- BEC board mounted
- Y cable shortened and installed
- Camera streams working
- Virtual Environment Setup for Jetson
- Computers organized and started installing software
- List of parts to order made
- First revision of RVR pusher is mounted onto RVR
- CAD for bottom plate has been acquired, can start designing water dropper
-

Design decisions:

- First revision of RVR pusher is mounted onto RVR

Game Strategy Planning:

- Made point scoring models for RVR autonomous point scoring

Issues:

- First gimbal parts weren't working
- Computers were slow, will be hard to setup

Pre-Meeting Tasks

Date: 9/28/22
Time: 4:15-5:15
Location: Ideaventions

Meeting Goals:

- Continue Design of the water dropper
- Print last gimbal piece
- Continue configuring the computers for the drones
- Continue game point total over all game
- Break down strategy tasks on the Trello board
- Continue advanced drone assembly
- Finish PDB assembly
- Working on design for the water picker upper
    - Couple designs first
- Finish getting the video streamed (definitely before Saturday)
- Finish wiring everything to the jetson

Post-Meeting Tasks

Accomplishments:

- First design done for water dropping module
- Finished mounting power distribution board
- Rerouted regulator wire and did cable management
- Continued progress on setting up computers

Game Strategy Planning:

- Worked on scheduling and updated tasks needed to finish key game components, such as being able to do an LWC building.

Pre-Meeting Tasks

Date: 10/1/2022
Time: 3:00 PM - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Finish Phase 2 and 3 gameplan for AVR
- Come up with test plan for what we can do with the portion of the field we have (and plan on what else needs to be added)
- Attach ZED Camera
- Assemble Gimbal
- **laser cut last gimbal piece ?
- Test CSI Camera and FPV Camera (not putting them on gimbal)
- If time allows, attach LED lights and ring to main AVR
- Stabilized test and position test flight (for AVR)
- Group review T-shirt designs and CAD designed water dropping mechanism
- Test possible heat plate
- Start working with RVR (got new battery)
- Work on Heating Up spot identification
- Test MavSDK after main drone test

Post-Meeting Tasks

Accomplishments:

- Both LED Strips mounted onto RVR
- Finished routing power cables for Jetson and PCC
- Full assembly of propellor guards
- Installed everything onto VMC
- Soldered wires for thermal camera
- First proof of concept for water dispenser/picker upper
- Gimbal part and camera mount printing
- Almost finished installing software on computers
- RVR can recognize colors (color sensor works)
- Started assembling LWC targets
- Finished Score Calculator
- Finished AVR Gameplan for Phase 1 & 2

Game Strategy Planning:

- Finished Score Calculator
- Finished AVR Gameplan for Phase 1 & 2

Pre-Meeting Tasks

Date: 10/3/22
Time: 4:15-6:00
Location: Ideaventions Academy

Meeting Goals:

- Build Gimbal
    - Once done, can start working on simple software to control, then move onto more advanced functions
- Make 1 LWC target
- RVR recognition testing, hopefully increase recognition success rate
- Send out shirt design
- Twitter is setup, make first post
- Mount ZED Camera and Gimbal
- Planning/Design session for water picker-upper, pitch a couple new ideas and hopefully come up with our first prototype
- Start working on contingency plans for Phase 1

Post-Meeting Tasks

Accomplishments:

- Started working on a new AVR drone game strategy based on a different style of water dropping/picking up in which we aim for speed and not accuracy.
    - Accuracy becomes less important if we can just dump all the water we have in the tank
- 5 ideas for water dropping/picking up system made
    - 1 prototype/proof of concept created
- Started getting color recognition accurate for the RVR
- 1 LWC target complete and tested
    - Second has the mechanism tested, but not finished building
- Half-way assembled with the gimbal
    - Need to rebuild some gimbal parts
    - Plan to finish and test on Wednesday
- PCC software installed and almost running
    - Didn't set the serial port

Issues:

- RVR is not too reliable connection-wise (with the computer)
- Gimbal was a bit too weak in some areas

Pre-Meeting Tasks

Date: 10/5/22
Time: 4:15 PM -6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Assemble gimbal and test
- Zip tie on stereoscopic camera and test
- Wire BEC to PCC
- Connect PCC and be able to control through app
- Continue work on color sensor
- Continue work on ball picker upper mechanism and test physical prototypes/proof of concepts

Post-Meeting Tasks

Accomplishments:

- PCC working
    - Figured out the serial port
    - Fixed to go the full range it's supposed to
- Gimbal's completely working; not mounted yet (70%)
- Stereoscopic Camera Mounted
- BEC to PCC wired
- Prototype almost finished for water ball picker upper
- Got half of a Tello mission working, going to wait for new Droneblocks update to continue working.

Issues:

- RVR color sensor is hopeless; asking on forum and thinking of ways to fix it

Pre-Meeting Tasks

Date: 10/8/22
Time: 2:00 PM - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Finishing gimbal and testing all sensors
- Position Hold Test for AVR
- Troubleshoot RVR color sensor
    - Hard-code mission if it doesn't work
- Finish building proof of concepts (BPU, Ball Picker Upper)
    - Select a vacuum to buy
    - Select balls to buy

Post-Meeting Tasks

Accomplishments:

- Got color sensor to start working correctly using JavaScript
- ¼ of the hard-coded mission for RVR completed
- Tested the RVR to make sure it could get up the hill with the set speed
- Finished power wiring for Jetson, PCC
- Finished adding MOSFET for laser
- Gimbal Calibrated
- Got marks set up on our ⅓ sized field and can easily set up the towers on our next test. (ready for scale Tello testing)

Design decisions:

- BPU/BDU System
    - Prong Proof of Concept done
        - Prototype finished
            - Need to incorporate servo to allow balls to be dropped
    - Box Proof of Concept done
    - Found water droplet ball for purchase
    - Found Archimedes screw to purchase

Issues:

- Prong plate was too stiff, Will pick up less stiff plate
- FPV Camera is not working properly. Will email Bell AVR for replacement.
- We are behind on our BPU/BDU system timeline
- Attempted Position-Hold test; software issues, but will try again Wednesday

Pre-Meeting Tasks

Date: 10/12/22
Time: 4:15 PM -6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Position Hold Test AVR
- Thermal Camera
    - LWC after
- RVR Coding
    - Modify Code if time then implement response to colors
- Lots of hands on deck working on getting a full prototype for the BPU/BDU

Post-Meeting Tasks

Accomplishments:

- Partway through creating our prong BPU/BDU design
    - Need to create more prongs and still need to create a dropper mechanism
    - Need to figure out how to mount to drone as well
- Soft coding for RVR is near completion.
    - On track for our first test
- Tello should be able to do full test

Issues:

- Couldn't complete the position hold test for the AVR because a debugging issue between the MAVP2P and FCC
    - Behind schedule with our first full game test.
- Sent out email for broken FPV camera
- Questions have not been answered on the forum or by email yet

Pre-Meeting Tasks

Date: 10/15/22
Time: 3:00 PM - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Full position hold test
    - Put props on
    - Just need to actually test; code works according to GPS coordinates
- AVR Aiming for gimbal laser
- Manual flight test
- Need to finish the BDU.
    - Arm
    - Mounting to the drone (legs directly)
    - Servo code
        - Debugging (after)
- Finish the other half of the hardcoding for RVR.
- Setup course and work on the Tello pathing

Post-Meeting Tasks

Accomplishments:

- BPU Prototype finished.
- MAVLINK communicating with PCC
    - FCC communicating with fusion module
- Position hold test works!!!!!
- Metal supports for the BPU/BDU is set up
    - Next step is integration with the actual prong module (Monday)
- L-Brackets for the BDU Servo is made and ready to be put on
    - Servo arm is also complete.
- RVR:
    - 75% of the competition code is working
    - Goes into and comes out of a trench and can continue moving
    - Fixed a lot of code issues
    - Should be done by Monday
- Tello
    - Test halfway running on the setup field
    - Code expected to be fully complete when stands to simulate buildings are complete (by next Saturday hopefully)
    - Droneblocks software is more stable and usable, makes coding easier
- Simulated trees and water towers (according to forum post reply) are made.

Issues:

- AVR: MQTT Messages weren't working, fixed it and finally finished a position hold test.
- AVR: ground isn't flat, ZED camera updates too fast and mulch moving around makes the drone adjust accordingly
- Will need to calibrate RVR color sensor
- Thinking about creating a backup for the BPU in case the model doesn't work as well as we hope it does. (Vacuum Idea)
- Need to have backup 3D prints, like for the gimbal

Pre-Meeting Tasks

Date: 10/17/22
Time: 4:15 PM - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Get Jetson connected to Wi-Fi to update
- Aim gimbal/laser and IR camera
- Finish BPU/BDU(servo) and integrate into AVR drone
- Test driving w/ RVR attachment up ramp
- Make design for RVR attachment to hold minis

Post-Meeting Tasks

Accomplishments:

- All the AVR software is running
    - Math for position averaging code is complete, and we need to communicate with the PCC to apply it.
- Tested RVR on incline with the pusher, works
- Need to redesign the front pusher because it can't really push the bean bags effectively
- Driving Stabilization code is complete
- Notches for BDU/BPU done
    - Need to create mounting onto AVR
- Mounted and tested the servo
    - Need to fix the code for it
- LWC target on building (for the test)

Issues:

- Possible Issue: One of the prop motors started smoking but still works, just a little slower

Pre-Meeting Tasks

Date: 10/19/22
Time: 4:15-5:15
Location: Ideaventions Academy

Meeting Goals:

- Get the Laser Pointing
- Fix FCC and VMC mounting
- Hopefully get our Over Concrete test done
- RVR: Finish Water Tower part of code

Post-Meeting Tasks

Accomplishments:

- Remounted Jetson, FCC, and First BEC
- Almost done with original RVR full path
    - Working on contingencies after
- Found RVR contingency paths for when we have a pinch of time.

Pre-Meeting Tasks

Date: 10/24/22
Time: 4:10
Location: Ideaventions Academy

Meeting Goals:

- Reviewing the video of the prop wash demo
- Test runs through the game
    - As realistic as possible
- Plan the rest of the season based on the results

- Mounting BPU/BDU onto the drone
    - Full test w/ it

- AVR: Getting laser pointer to work
    - Test shooting LWC laser at closed roof building

Post-Meeting Tasks

Accomplishments:

- Successful single trench RVR test
    - Need to make test more reliable and troubleshooting.
    - Have the code reviewed by a few people on the team.
- Servo moved on drone
    - Troubleshooting done,
        - Servo had to be moved because the legs wouldn't line up with it (??)
        - Need to adjust again to get it completely centered over BDU
    - BDU is also attached on
        - Need to troubleshoot the integration
        - BDU slides down the legs when pushed down on
            - Need to have a better solution than
                - Thinking of making a 3d design for brackets on the leg
            - Can be ready for a test with a quick and dirty taping solution,
    - Got the whole program for AVR running as a service
        - Need to troubleshoot so that there are less error messages coming out
        -

Issues:

- We are behind schedule

Pre-Meeting Tasks

Date: 10/26/22
Time: 4:15-6:00
Location: Ideaventions Academy

Meeting Goals:

- Got aiming to work,
    - Need to increase update rate & troubleshoot code
- Need to get Apriltag detection working

Post-Meeting Tasks

Accomplishments:

- Started working on 3d design for RVR pusher arm
- Found the optimal size restriction on our reservoir
    - We only have 300 out of the 1500 balls in the actual game
    - Little bit more than 20x20in,
- RVR: code allows for entering two trenches and water tower, and code is partially done for the reverse trip
- BDU Servo is mounted and is able to move
    - Tested with arm, metal is restricting arm movement,
        - Can notch the metal
    - Broke the landing gear (just need to print some extras)
    - Tested picking up and dropping with the current range of motion
        - Good results, must go all the way in to pick up a substantial amount of ball
        - Even with the restricted range of arm motion, the BPU/BDU dropped a good number of balls when it was mostly full.

Pre-Meeting Tasks

Date: 10/31/22 *Halloween… spooky*
Time: 4:15-6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Order Shirts
- Get software for camera tracking working
- Thinking of a new design for the servo pusher mechanism
    - Push down in more of a vertical fashion.

Post-Meeting Tasks

Accomplishments:

- CSI Camera Working
- Water Drop Page done in AVR GUI
- Tested a Revision for BPU/BDU
- Remaking actuator for BDU
    - Began work on new model
- Started Acrylic plate CAD design
- Reviewed RVR Code
    - Working on cleaning up code
- Comprehensive Schedule for the next 3 weeks is done.
    - Going to be handed out tomorrow

Pre-Meeting Tasks

Date: 11/5/22
Time: 2:00
Location: Ideaventions

Meeting Goals:

- Finish building and installing the final version of the ball dropper/picker upper
- Finish Apriltag detection software + test
- Review RVR Code and improve

Post-Meeting Tasks

Accomplishments:

- BPU/BDU
    - CAD design for BPU/BDU plate
    - Laser cut the plate
    - Assembled fully
    - Mounted on drone
- Laser cut team nameplate and mounted on the drone
- Began reprinting replacement 3d parts for backups
- Finished master schedule up till the competition
- RVR
    - Cleaned up code
    - Converted a lot of processes into functions
    - Troubleshoot turning and successfully completed one trench
- AVR Drone
    - Sped up MQTT messaging to optimize the drone software

Design decisions:

- BPU/BDU
- Nameplate

Issues:

- 3d printed leg bracket broke on the drone. We need to reprint

Pre-Meeting Tasks

Date: 11/7/22
Time: 8:00-6:00
Location: Ideaventions

Meeting Goals:

- Test AVR Software
    - Improve
- RVR test on half the field
    - Take data on success rate and attempt to improve
- Tello
    - Finish coding all three paths
    - Ask questions on the forum

Post-Meeting Tasks

Accomplishments:

- RVR
    - Finally accomplished repeatable RVR Trench run test
    - Figured out possible solution for added weight from Sphero mini test
    - Successfully completed half run
- Tello
    - Finished Pseudo Code for all three missions
    - Coded the reverse direction files
- AVR Drone
    - Finished building BDU/BPU unit
    - Tested BDU/BPU unit
        - Works well but bolts tend to rattle off
    - Cleaned up a lot of code, still need to create a run file
    - Fixed some bugs
- Sphero Minis
    - Practiced Driving the challenge

Design decisions:

- BDU/BPU built
- Sphero Mini Cage designed, and prototype built
- AVR Drone camera moved
-

Game Strategy Planning:

- We want to use only one Sphero mini to complete the mini challenge

Issues:

- BPU/BDU reliability
- Position Hold is inconsistent (might be because we weren't testing on a flat surface)
- RVR run is inconsistent
- Not sure how Beanbags are placed, conflicting information about Velcro

Pre-Meeting Tasks

Date: 11/8/22
Time: 8:30 AM - 4:30 PM
Location: Ideaventions

Meeting Goals:

- AVR
    - Test/troubleshoot position hold
    - Reposition camera and test April tags
    - Test LWC on the building with the target
    - Test Accuracy Manual BDU/BPU
    - Automate BDU/BPU
- RVR
    - Improve accuracy on half-field run
    - Account for mini carriage
    - Work on full field homing function
- Tello
    - Finish coding function
    - Put pseudo code into real code (Droneblocks).

Post-Meeting Tasks

Accomplishments:

- Improved RVR code efficiency
    - Better shutting down code to avoid rebooting every time.
    - Also got service (to make everything run on boot) completely working
- First prototype of Mini Cage completed
    - Working on second prototype
- Tested RVR with Mini Cage on top
- Changed the RVR bean bag pusher design to be more efficient
- 80-90% of code (potentially) working.
- Most Team Bios completed
- Practiced using Sphero Minis
- Coding through all Tello missions.
    - #M1 is half-way
    - #M2 is half-way

Pre-Meeting Tasks

Date: 11/12/22
Time: 2:00 PM - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Get back on schedule

Post-Meeting Tasks

Accomplishments:

- Continued work on engineering notebook sections
    - Have content layed out for RVR Design Elements, need to format and insert pictures.
- Did a full game test
    - AVR timing is not good, have to rearrange some strategy blocks
    - Was pretty messy, but as expected as it was our first full integration
    -
- Changed surface of course to be more realistic representation of the actual course
- Ran several tests runs with the Sphero Minis
    - Figured out that the door of SMC was too small, have to modify
- RVR
    - Must recalibrate stopping protocol due to new surface

Pre-Meeting Tasks

Date: 11/14/22
Time: 4:15-6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Improvements to code

Post-Meeting Tasks

Accomplishments:

- Engineering Notebook needs one final review before it's completely finished
    - Need to paste and format one thing for strategy to be done.
- Did more RVR testing on the field
- Got Gimbal Working in Real Time
    - Was jerky, not smooth, and delayed before
- Cleaned up Jetson Nano
- Finished more team bios for the engineering notebook
- Recut out the SMC
- Worked on packaging our parts for competition

Pre-Meeting Tasks

Date: 11/15/22
Time: 4:15 - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Getting autonomous water-dropping code to work
- Sorting items into toolboxes for comp.
- Fix RVR pathing to match with actual field specifications (from the picture on the forum)
- RVR Code review
- 3D printing

Post-Meeting Tasks

Accomplishments:

- Improved RVR code to account for new data about field
- Moving Tello controls to Xbox controller to make manual use easier
- Finished downloading all necessary software into competition laptops
- Organized toolboxes with necessary equipment
- Framework for autonomous water drop done
- Coded that we know every Apriltag detected within the last minute
- Made improvements to SMC

Pre-Meeting Tasks

Date: 11/16/22
Time: 4:15 - 6:00 pm
Location: Ideaventions Academy

Meeting Goals:

- Finish Apriltag Autonomous Waterdrop
- Finish Tello code

Switch to python DJITelloPy

Post-Meeting Tasks

Accomplishments:

- Minis Training is in good shape
    - Need to make a decision on two main pilots
- RVR
    - Will have to make final adjustments on Friday Afternoon
    - Confidence Level
        - 50%
        - 70% if measurements go well on Friday

Pre-Meeting Tasks

Date: 11/17/22
Time: 4:15 - 8:30 PM
Location: Ideaventions Academy

Meeting Goals:

- Finish Apriltag Autonomous Waterdrop
- Finishing Touches on Engineering Notebook
- Finish And Practice Presentation

Post-Meeting Tasks

Accomplishments:

- Finished Engineering Notebook
- Close to Finishing Presentation
- Finished Packing Our Competition Supplies/Kit
- BIG Breakthrough in strategy
    - In 75% of possible game scenarios, it's a lot more

Pre-Meeting Tasks

Date: 11/26/22
Time: 10:00 - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Rebuilding entire drone and getting it working
    - Many new motors in (have extras too)
- Test Tello software
- Build accurate open-roof building for BDU testing
- Design and Test new version of BBA
- BDU/BPU Redesign
    - Test with airflow holes (stability test)
    - Test different spacings (ball drop test)

Post-Meeting Tasks

Accomplishments:

- RVR
    - Lots of Testing w/ slippery surfaces to simulate competition environment
        - On testing doc
    - Redesigned BBA
- AVR
    - Rebuilt Drone w/ new motor, BEC, capacitor
        - Flight test went very well
            - We think it flew worse before motor-change due to single motor problems
    - Started new BDU/BPU design in hopes of increasing stability and reducing the number of balls that fall outside.
        - Several concurrent versions
        - Side “scales” to direct propwash away from the BDU
        - Will test all new versions tomorrow
- Tello
    - Tested newest Tello software
    - Several bugs
    - Still need to add a button to run land routine
    - Working well otherwise though
- Built a new more accurate version of an open roof building for testing
    - Trying to recreate our ball bouncing out issue from competition to work on it
- Replanned Engineering Notebook and presentation

Issues:

- Our testing program has a bug where it doesn’t detect working April tags
- Tello software bugs need to be ironed out

Pre-Meeting Tasks

Date: 11/27/22
Time: 2:00 - 6:00 PM
Location: Ideaventions Academy

Meeting Goals:

- Continue testing the AVR drone via the Testing Spreadsheet metrics
- Design airflow shield design for BDU/BPU prototype

Post-Meeting Tasks

Accomplishments:

- Finished the new BPU/BDU model with airflow holes
    - Successfully works (not attached to drone)
- Tested ball dropping w/ feather BPU/BDU design (propwash shield)
    - Did well
- Finished spray painting new prop guards
- List of extra materials we need
- Organized pit box for AVR drone during competition
- Worked on updating engineering notebook and presentation
    - Overhaul strategy, more focused on testing and data analysis rather than theoretical rule analysis as it didn't apply as much anymore (rapid prototyped new strategy as well)
    - Hardware cutting down into one slide, only focusing on important bits
    - Cutting down BPU/BDU slide

Pre-Meeting Tasks

Date: 11/28/22
Time: 4:05 - 7:00 PM
Location: Ideaventions Academy

Meeting Goals:

- More testing with the AVR drone
    - Finish and test the feather shield BDU design
    - Test the Airflow holes BDU design
- Get autonomous water dropping to work

Post-Meeting Tasks

Accomplishments:

- The Airflow holes BDU design worked out great, reducing the weight on the bottom, and allowing the drone some more stability. There is a decrease in ball spread thanks to the airflow allowed by the holes. This design also makes the actuation of the ball drop much more fluid.
- Autonomous water-dropping works
    - We tested it and it works phenomenally. Combined with the better position hold we have; we can easily knock out buildings with autonomous water dropping
- Tested side feathers for BDU to control airflow getting in the way of the ball drop. It worked well and we will build the final versions tomorrow
- RVR
    - Worked on increasing grip
        - Few new ideas to test tomorrow
    - Finished new bean-bag arm
    - Finished new smaller SMC

Pre-Meeting Tasks

Date: 11/29/22
Time: 4:05 - 7:00 PM
Location: Ideaventions Academy

Meeting Goals:

Post-Meeting Tasks

Accomplishments:

- AVR Drone Rebuild
    - Cut new legs and assembled
    - New BDU design with airflow jointed on
- Tested RVR slippage using “brakes,” seems to work
    - Confidant for competition
- Final task list for comp
    - Longer bolts for BDU to make it easier to bend
    - Testing of Tello more
    - Try smaller BDU arm and test
    - Heads Up Display
    - Test Water dropper mods (start of club time tomorrow)
    - Presentation and Engineering Notebook
    - Packing

Pre-Meeting Tasks

Date: 11/30/22
Time: 4:05 - 7:00
Location: Ideaventions Academy

Meeting Goals:

- Pack our kit for the plane
- Practice Presentation
- Print Engineering Notebook
- Print Strategy Binder

Post-Meeting Tasks

Accomplishments:

- Final test of the drone before flight to Dallas
- Fully disassembled drone
- Packed entire kit for plane travel
- Worked on an engineering notebook and presentation.

Appendix A: GitHub Organization & Website

GitHub

https://github.com/Daedalus-Robotics

Website

https://daedalusavr.weebly.com/

Appendix B: Engineering Drawings

. **CAD drawings**