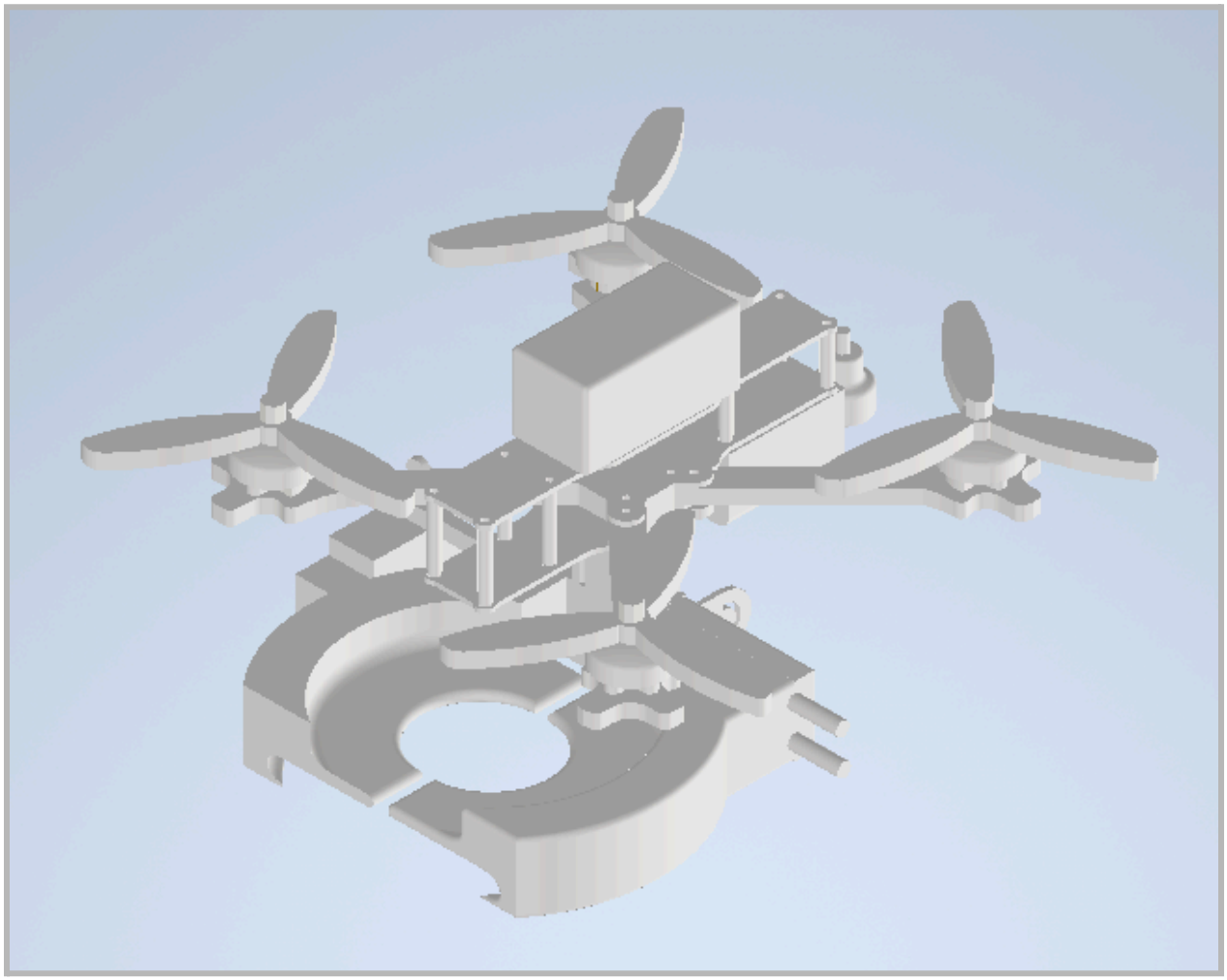
TSA Technosphere 2024

Location: Hampton, Virginia



Drone Challenge (UAV)

Team ID: #21790-1

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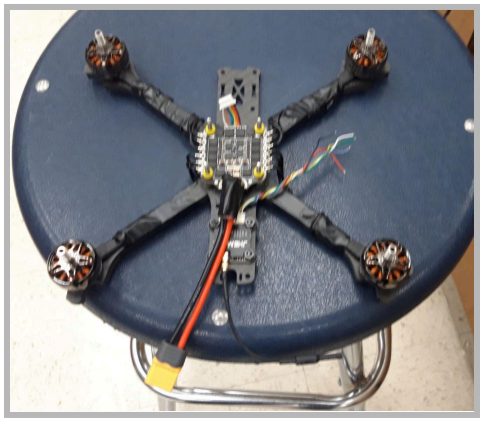
Full In-depth Photo Log with Captions

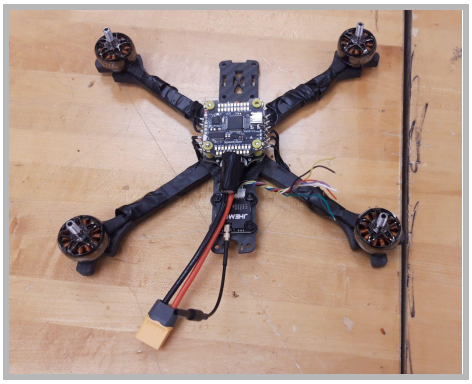
All individual pieces of drone assembly are ready for assembly

The bottom frame and the four motors of the drone are assembled.

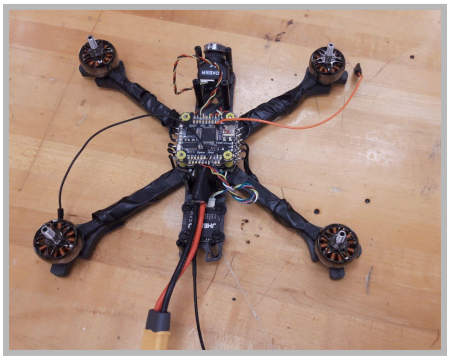
Note. M3 screws are sequential screwed in a star pattern



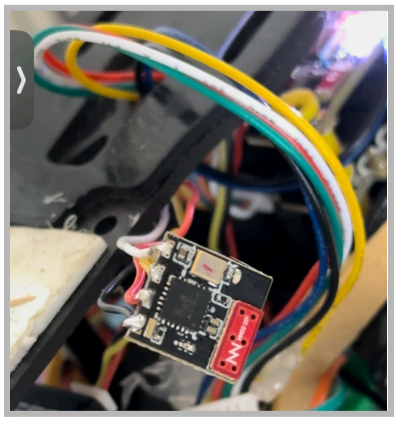
Main XT60 power cable, 100 picofarad capacitor, and brushless motors have been soldered to the Electronic Speed Controller 'ESC.'



The Speedy Bee Flight Controller and Video Transmitter ‘VTX’ has been assembled to the ESC.



The First Person View ‘FPV’ camera has been installed and soldered to the flight controller. The VTX has been soldered to the flight controller.

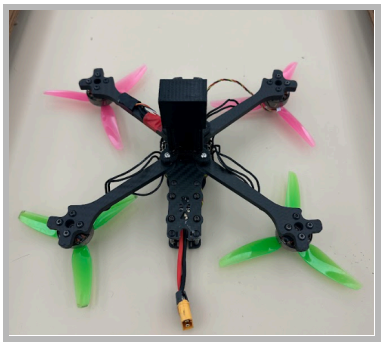


The ELRS receiver has been soldered to the flight controller.

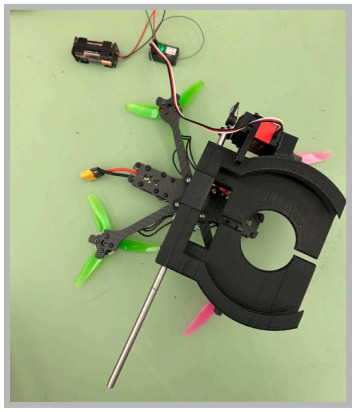
Construction of the drone is finished. Triple blades and software has been installed; betaflight software is being programmed.

Prototype gripper has been modeled in CAD and printed in MakerBot.

Final gripper piece has been modeled and CAD and printed. a 20 kilogram servo is attached to the mechanism as an opening unit.



Final gripper mechanism attachment has been assembled on a drone.



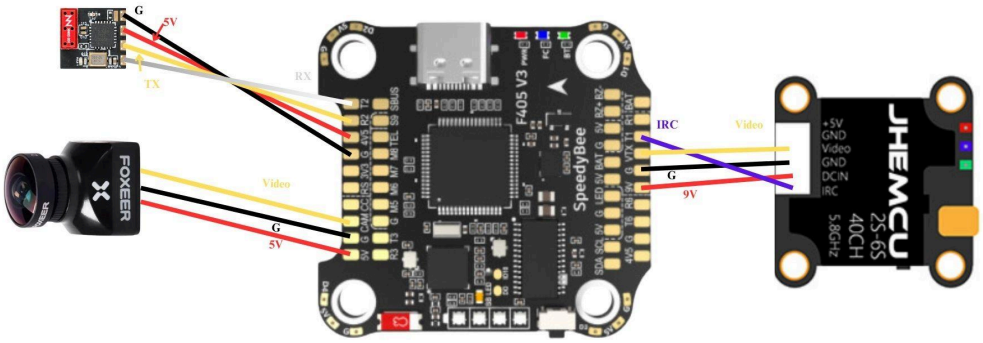
The complete gripper mechanism has been assembled and wired using a secondary circuit. Following, it is attached to the drone.

The VTX antenna has been replaced due to computing error. The metal structural rods have been shortened as well as the bean bag gripper for optimal performance. The laser has been attached to a secondary circuit as well as the FPV camera drone mounted to the mechanism, for precision dropping.

The drone is at its final stage. This stage includes the addition of the 1500 milliampere lithium polymer battery. Fully assembled UAV drone equipped with gripper and precision dropping instruments.

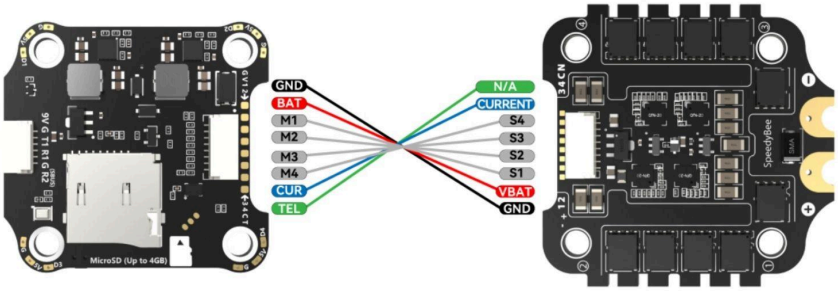
Schematics

Schematic 1 - Flight Controller

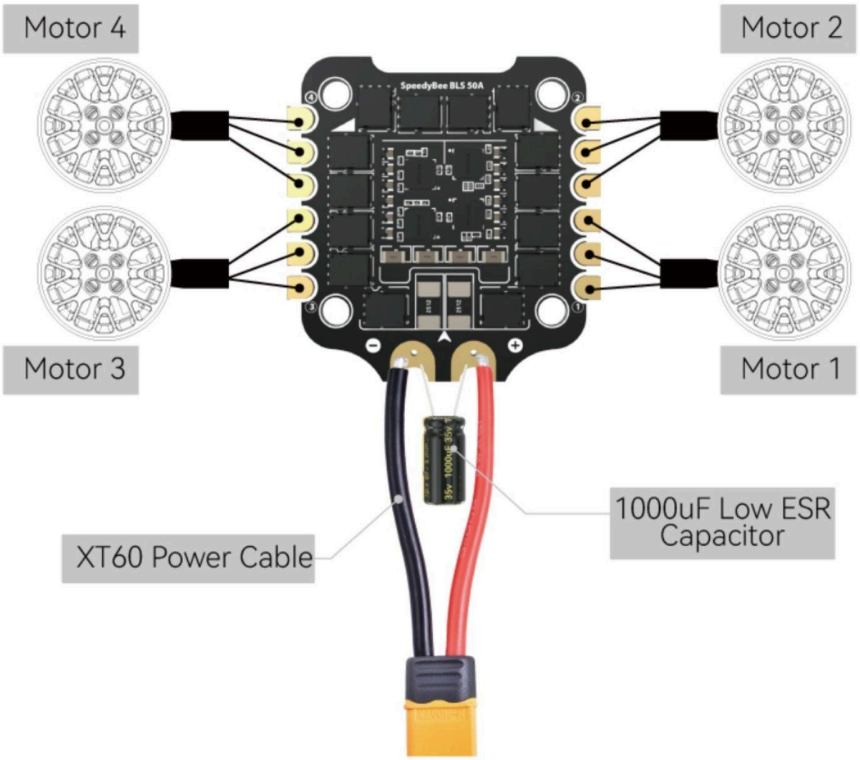


Note. Reference images are from Speedybee, Bangood, Betafpv, and

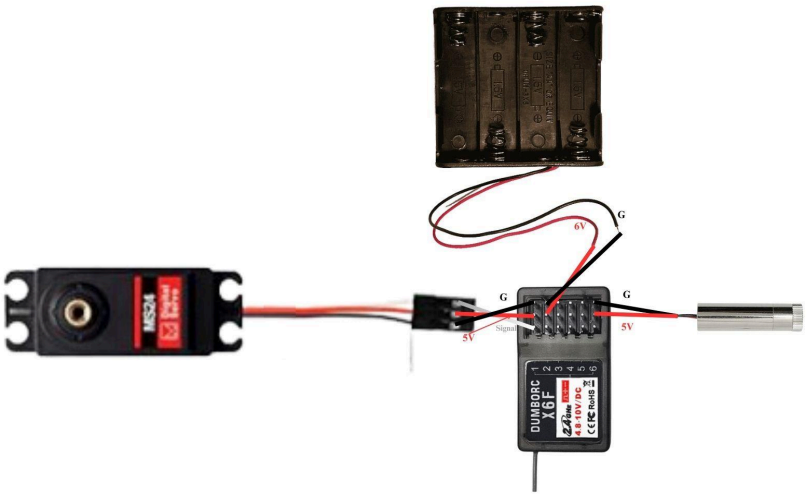
Schematic 2 - Flight Controller to ESC



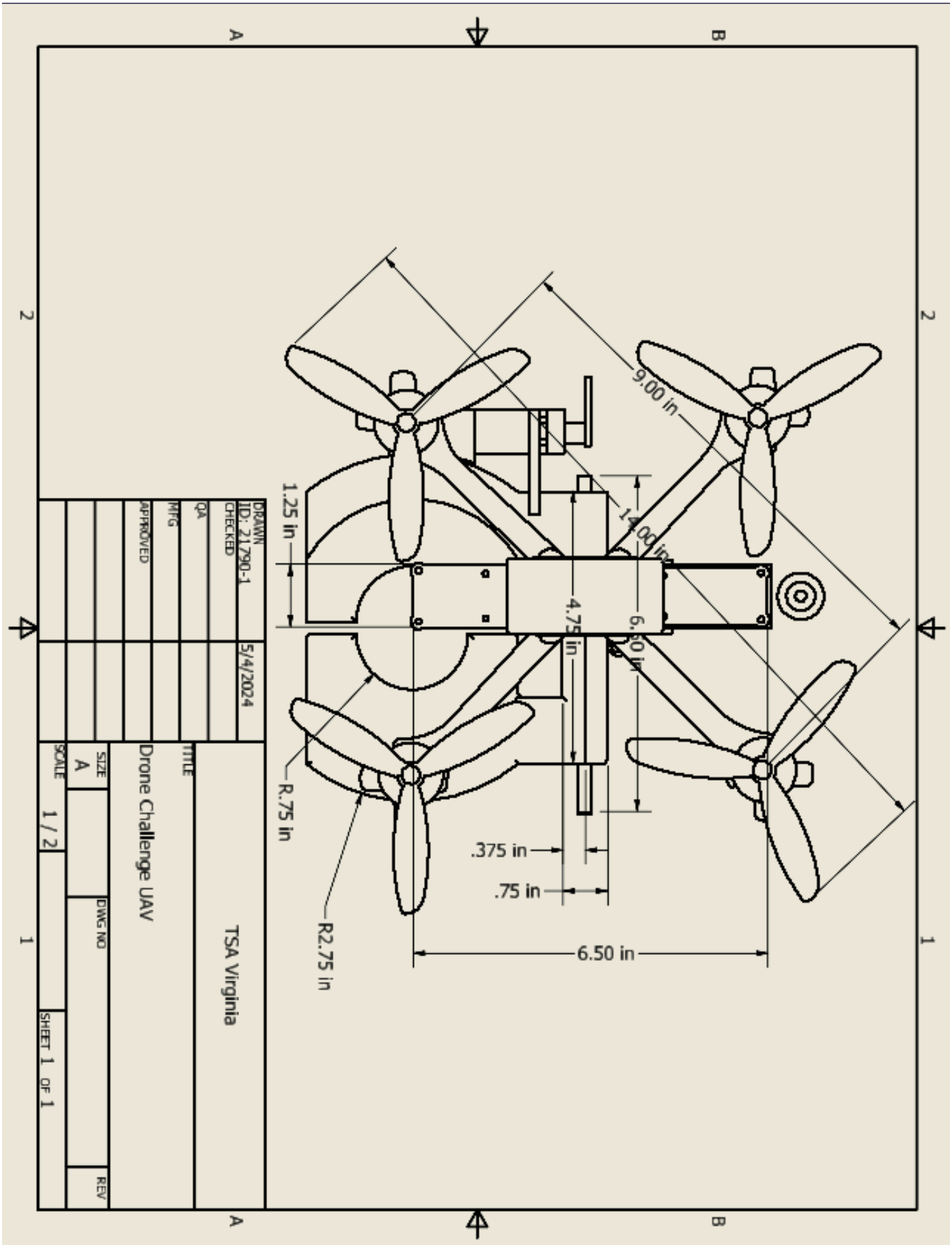
Schematic 3 - ESC

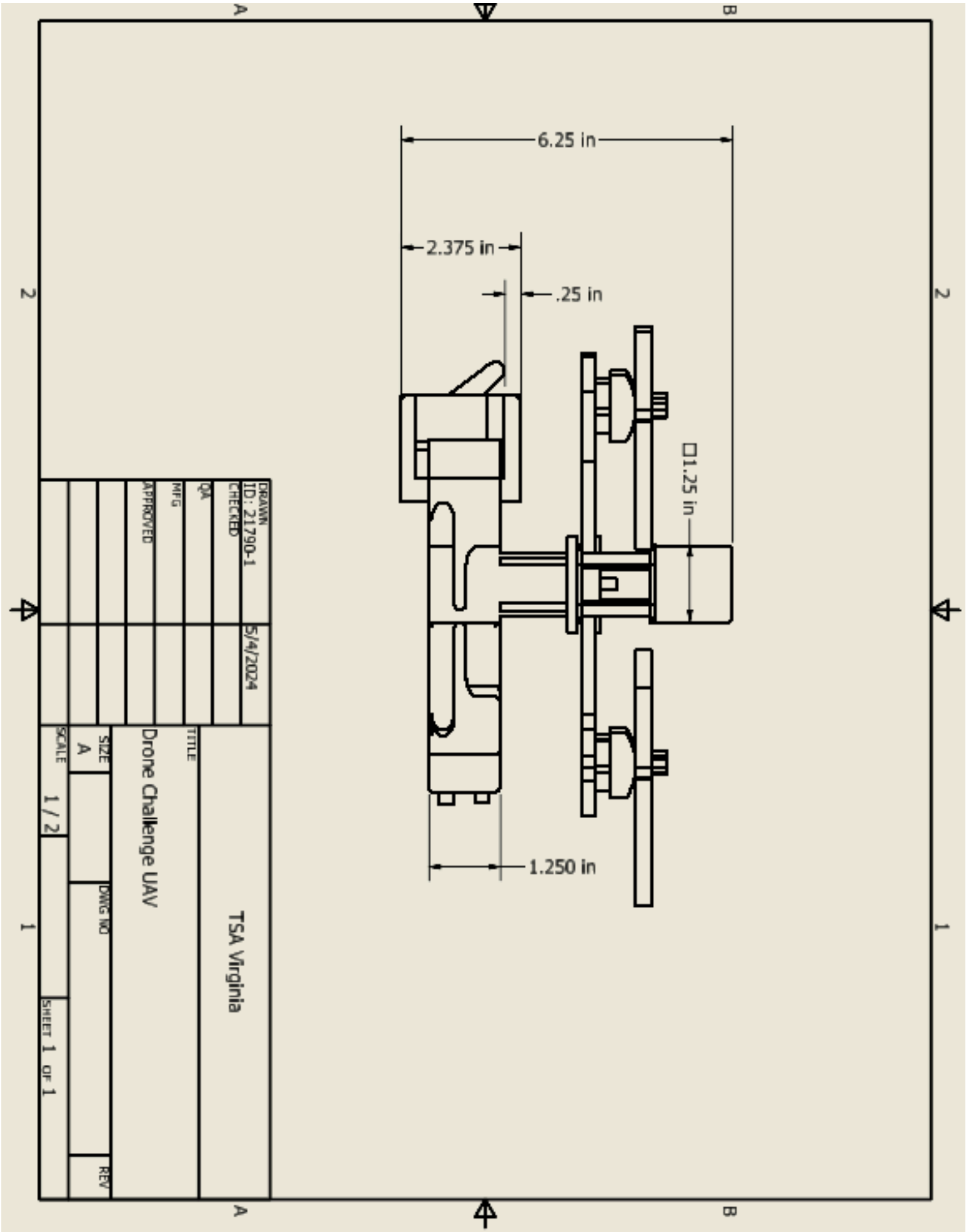


Schematic 4 - Secondary Circuit



Multi-view Drone Drawings

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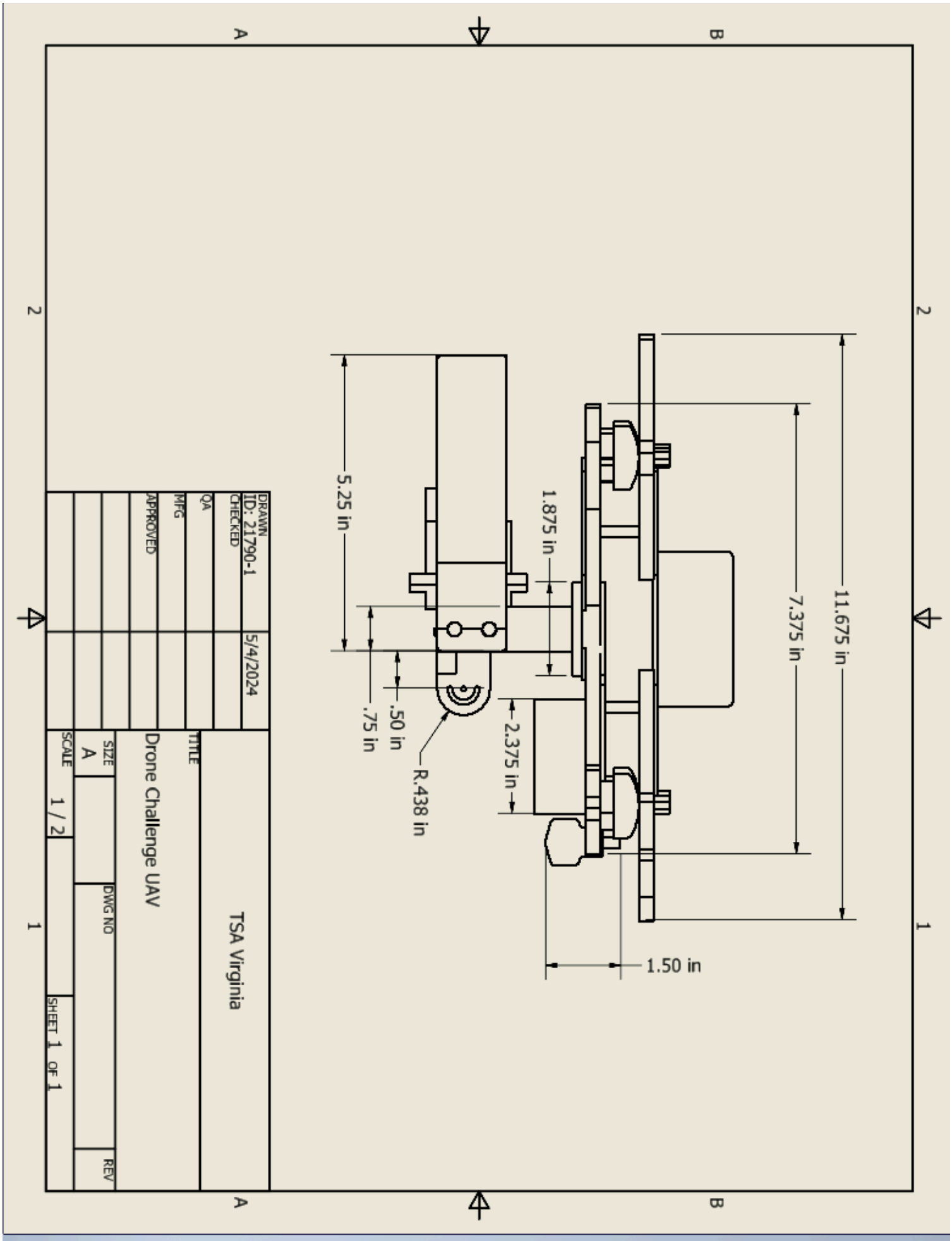
SHEET 1 OF 1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SHEET 1 OF 1

Software and Power Sources

BetaFlight Software Functions

BetaFlight is a free to use and open source software program that allows the drone to operate within parameters set by the users. Through the SpeedyBee flight controller which allows users to use the SpeedyBee app on the go to set and limit parameters. Such parameters can be set for ports, configurations, motors, battery, receiver, setup, modes, and On Screen Display ‘OSD.’ Setting and adjusting these perimeters through the app allows the user to efficiently operate the drone, FPV goggles, and main transmitter.

The FPV goggles interface gives a live feed from the camera in conjunction with multiple drone readings. These readings include voltage, compass, altitude, signal strength, drone speed, and flight duration. Along with the FPV goggles the user uses the radio transmitter to communicate with the drone’s receiver. Through input of the radio transmitter the drone will feel the experience of pitch, yaw, and roll which corresponds to the user's input.

Without BetaFlight these instructions from the user’s radio transmitter cannot be interpreted by the flight controller. BetaFlight uses the convenient SpeedyBee app to configure the drone’s components to systematically communicate with one another. To give an illustration, BetaFlight uses the ports tab in the app to structure the Universal Asynchronous Receiver/Transmitter ‘UART’ to identify the receiver as a component of the drone; the UART bridges the gap of communication between the component and the flight controller. These examples are some of many components that are able to communicate through each other by BetaFlight to properly carry out the users in-put.

BetaFlight uses a gyroscope and a barometer to balance the drone. These components communicate to each other through thousands of miniscule commands by the flight controller to

stabilize the drone. This system compensates for human input and allows for the drone to remain in a stable hover while in neutral position. The stabilization system is integrated into the flight controller and once programmed, the software calculates and configures responses of the drone from these instruments without human input.

Secondary Circuit

The secondary circuit's function is to separately power the mechanism servo and the laser. This secondary circuit is run on four AAA batteries that are mounted on the bottom back of the drone. In this challenge the team used resource skills and ingenuity by reusing a RC car transmitter and PPM receiver to fulfill the need of the gripper mechanism. Because of this the mechanism is able to be opened proportionally and can be tuned. The laser draws very modest current and therefore it was practical to put it on a separate power supply and also for the safety concerns of overcurrent.

Bill of Materials 1 - UAV Drone

	Part	Material	Quantity Total	Price
1	SpeedyBee F405 V3	Silicone	1	$34.99
2	SpeedyBee ESC	Silicone	1	$34.99
3	EMAX ECO II Motors	Metal	4	$63.96
4	TBS Source One Frame	Carbon Fiber	1	$39.59
5	JHEMCU VTX	Silicone	1	$18.99
6	Betaflight Receiver	Silicone	1	$8.99
7	Foxeer FPV Camera	Silicone	1	$19.89
8	HQ 5x3.1x3 Propellers	Plastic	4	$3.49
9	Uxcell MMCX Antenna	Copper	1	$6.99
10	FPV Drone 5.8ghz Stub	Brass	1	$13.99
11	Zeee 4S Lipo Battery	Lithium	4	$77.98
12	RadioMaster TX12 Transmitter	Plastic	1	$109.90
13	Emax Transporter FPV Goggles	Plastic	1	$98,99
14	800 mAH Lithium-ion Battery	Lithium	1	$9.99

Bill of Materials 2 - Gripper Mechanism

	Part	Material	Quantity Total	Price
1	DumboRC Transmitter	Plastic	1	$35.99
2	DumboRC Receiver	Silicone	1	$15.99
3	MakerBot PLA	Plastic	1	$10.50
4	Laser Diode	Metal	1	$5.95
5	Miuzei 20KG Servo	Metal	1	$13.99
6	Tynulox ¼ Steel Rods	Metal	2	$5.59
7	Melsan Velcro	Plastic	2	$1.32
8	Screws	Plastic	2	$0.10
9	Duracell AAA Batteries	Alkaline	4	$4.97
10	Duracell AA Batteries	Alkaline	4	$4.09
11	Battery Holder	Plastic	1	$6.11
	Total of all Materials:			$647.33

Rules and Reggulations

- Wear high visibility vest and safety glasses
- Only work on drone within designated area
- Two (2) welding blankets must be provided
- The drone and all parts and tools must be inspected in the pit
- All computers and software must be provided
- All tools with combustible fuel is prohibited
- All batteries must be placed on welding mats while charging
- Propellers must be off of drone when out of the competition tent area
- Only install battery when directed to do so in the competition tent area
- Remove the battery when not in the competition tent area
- The propellers must be inspected to ensure safe operation
- When a competition takes place or practice session starts, all other drones must be powered off
- All batteries must be inspected before competition or practice
- Drones must only fly within competition area
- All competing drones must have four motors and propeller blades
- The drone must be assembled from open sourced parts
- No commercial drones are allowed
- Drone frames may be made from wood, plastic, 3d printed materials, resin, and or metal combined plastic
- Battery packs must be commercially available, open sourced lithium-ion batteries

- Drone propellers can be anywhere from four inches to 8 inches in length
- The drone can be six inches to fourteen inches diagonally; excluding propellers
- Propeller guards are optional, but must fit in an 18”x18” box
- Magnets or grippers must be employed to complete this year’s theme
- Propellers must be removable for inspection
- The landing gear must be versatile to accommodate various missions and payloads
- The drone must be equipped with a camera

References

Student Taken Images

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Work Log

12/18/2023 - Drone Challenge (UAV) project started

1/11/2024 - Drone problem identified and ordered replacement *Note.* Drone was built last year

1/23/2024 - ESC arrived and replaced it for the drone to function correctly

2/6/2024 - Brainstorm of gripper mechanism and chose a option

2/20/2024 - Started designing the gripper in Inventor

3/5/2024 - Prototype of the gripper was created on Inventor

3/19/2024 - Redesigned the mechanism to accommodate the ring

4/8/2024 - Finalized the design and ready to 3D print

4/9/2024 - Finished the secondary circuit for gripper

4/10/2024 - Gripper pieces were 3D printed

4/11/2024 - Assembly of gripper was started

4/16/2024 - Gripper was attached to the drone

4/17/2024 - Laser and Camera were attached

4/23/2024 - Testing was Conducted

4/24/2024 - Testing was Conducted

4/25/2024 - Portfolio final touches

4/29/2024 - Drone and Gripper Mechanism final touches

4/30/2024 - Packed up for technosphere

5/2/2024 - Left for technosphere

5/16/2024 - working on drone improvement

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(for students to complete and advisors to verify)

1) **Does your solution to the competitive event integrate any music?** ☐ YES ◉ NO

If NO, go to question 2.

If YES, is the music copyrighted? ☐ YES ○ NO

If YES, move to question 1A. If NO, move to question 1B.

1A) Have you asked for author permission to use the music in your solution and included that permission (letter/form) in your documentation? If YES, move to question 2. If NO, ask for permission (OR use royalty free/your own original music) and if permission is granted, include the permission in your documentation.

1B) Is the music royalty free, or did you create the music yourself? If YES, cite the royalty free music OR your original music properly in your documentation.

CHAPTER ADVISOR: Sign below if your student has integrated any music into his/her competitive event solution.

I, Lyndsay Almarode (chapter advisor), have checked my student's solution and confirm that the use of music is done so with proper permission and is cited correctly in the student's documentation.

2) Does your solution to the competitive event integrate any graphics? ◉ YES ○ NO

If NO, go to question 3.

If YES, is the graphic copyrighted, registered and/or trademarked? ☐ YES ◉ NO

If YES, move to question 2A. If NO, move to question 2B.

2A) Have you asked for author permission to use the graphic in your solution and included that permission (letter/form) in your documentation? If YES, move to question 3. If NO, ask for permission (OR use royalty free/your own original graphic) and if permission is granted, include the permission in your documentation.

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3) Does your solution to the competitive event use another's thoughts or research? ☐ YES ◉ NO

If NO, this is the end of the checklist.

If YES, have you properly cited other's thoughts or research in your documentation? If YES, this is the end of the checklist.

If NO, properly cite the thoughts/research of others in your documentation.

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