Robofest - Ideation

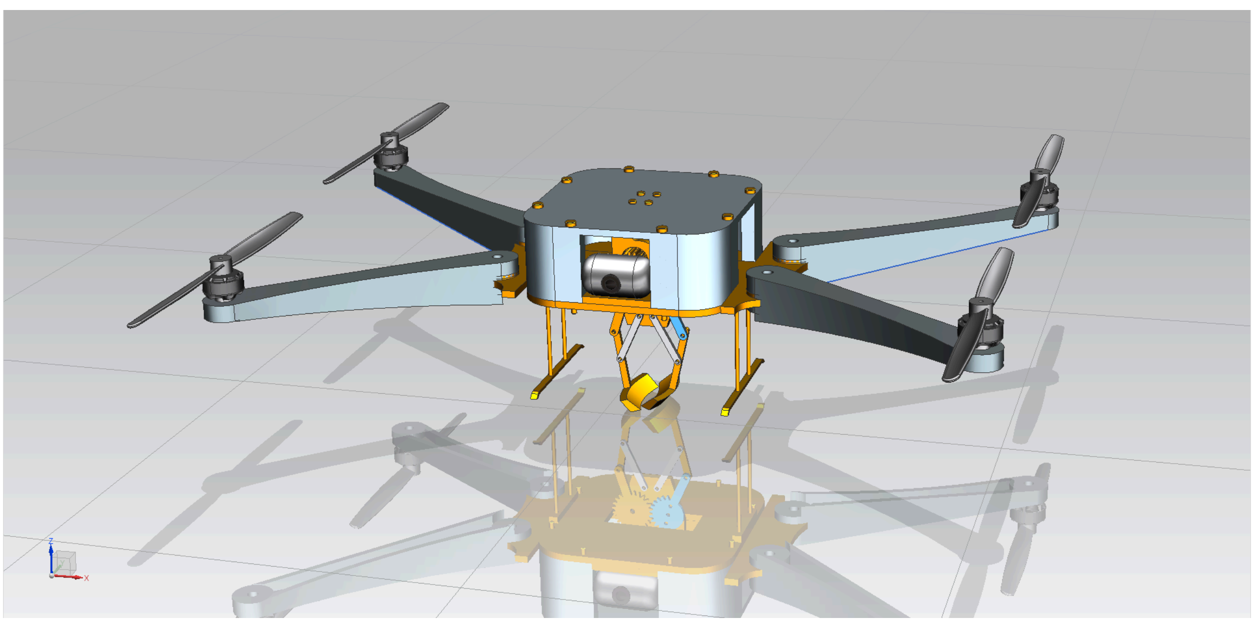
1. Type of Drone

Swarm drones:

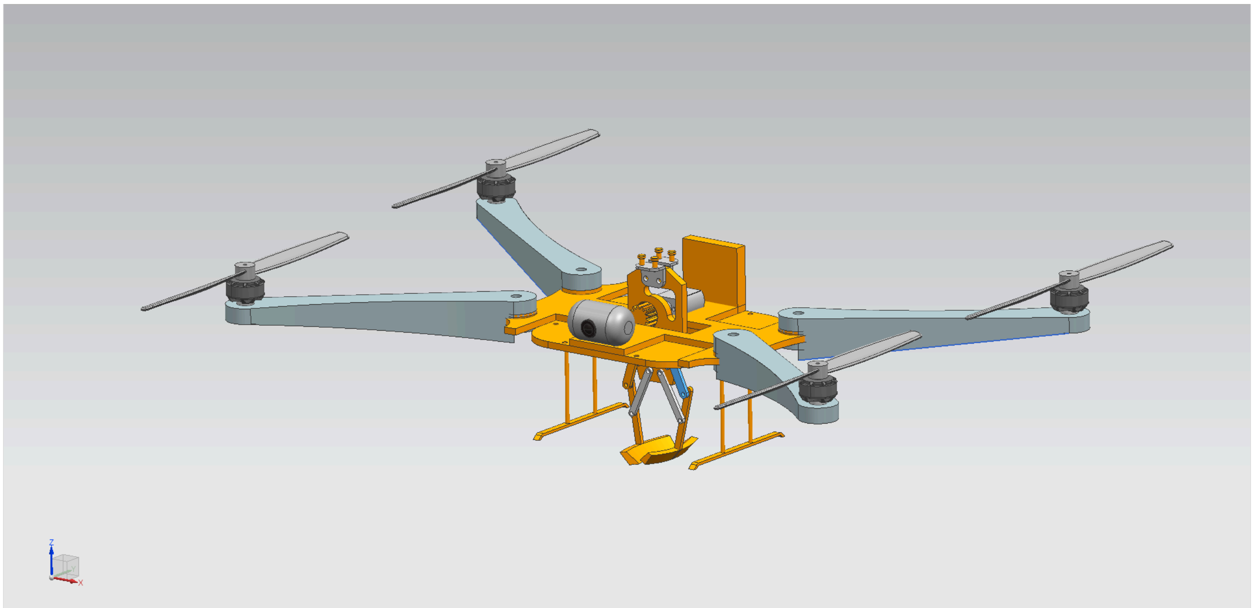
Primary Objective: A group of 4-6 aerial vehicles, with only one control unit. To have coordinated motion by moving together forward, backward, left and right (100m each direction). No external controls are allowed.

Grand finale Objectives: Ability to form 3 different shapes (circle, square, triangle) starting from a straight line, making one shape and going back to a straight line. Should be able to pick plastic balls of a given color, fly to a given destination and drop the ball in the cart. Needs to be battery operated only.

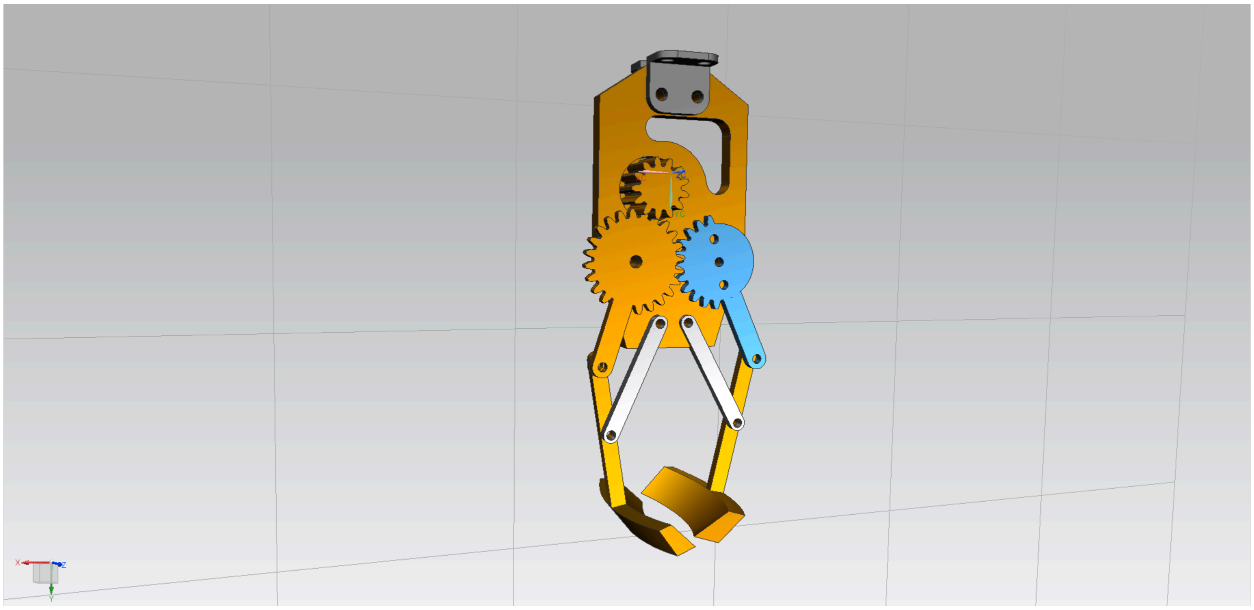
2. Drone Assembly Design (Proposed Diagram)

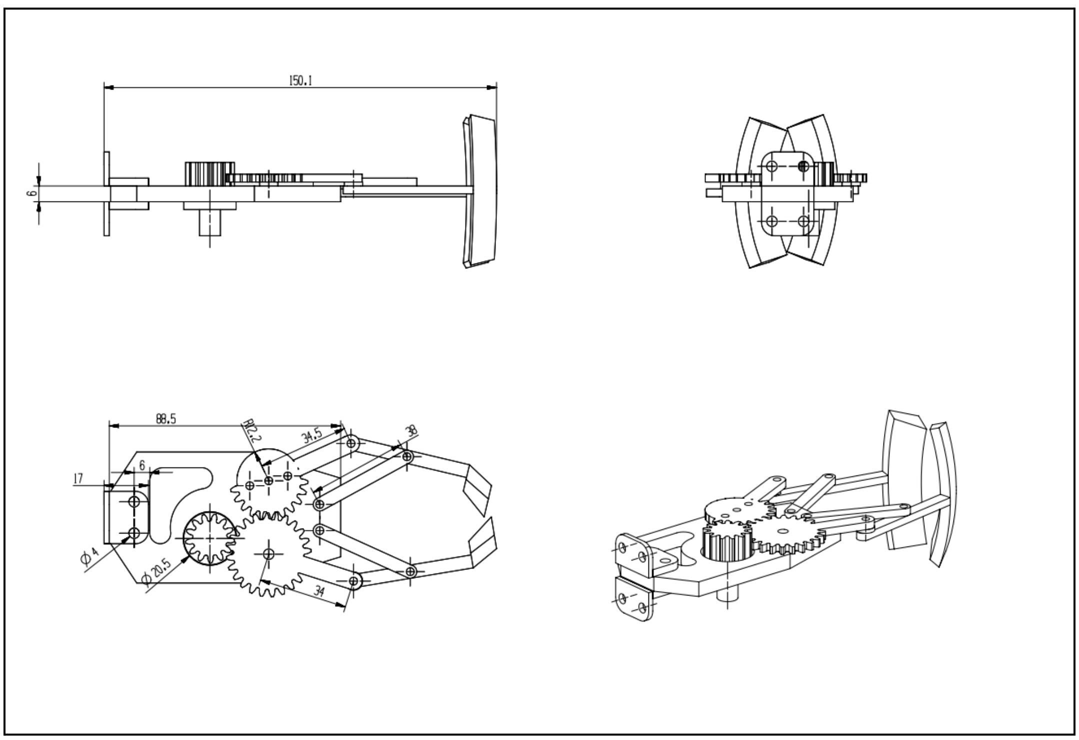


Isometric Open view

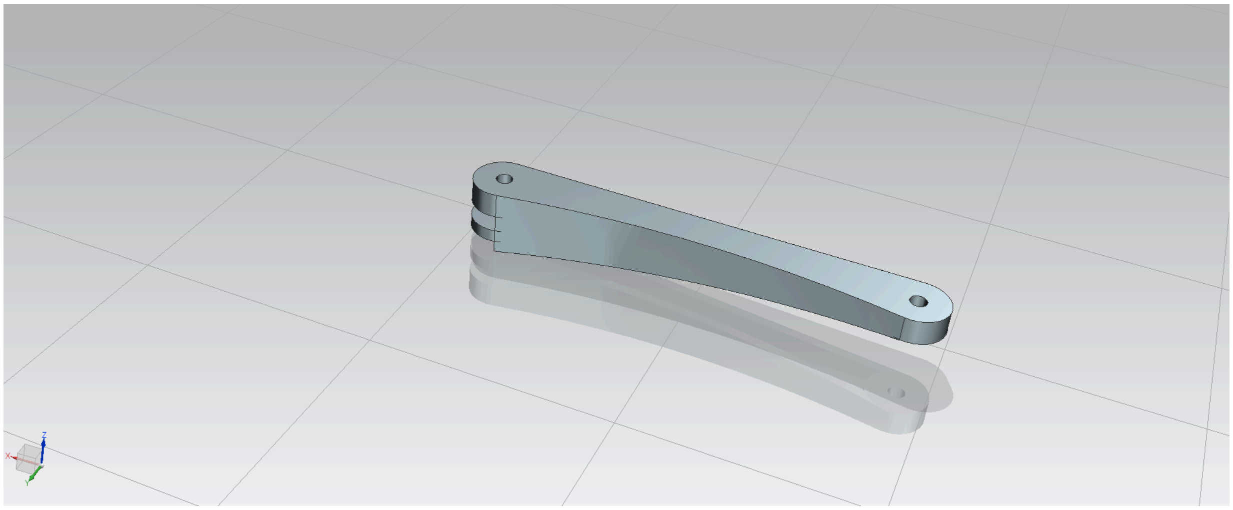


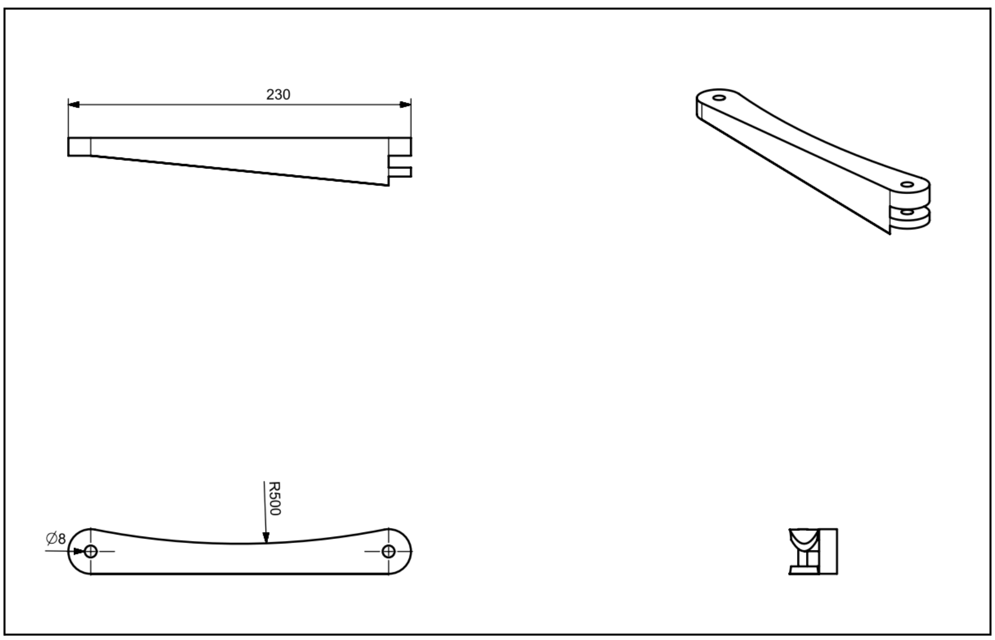
Picking mechanism



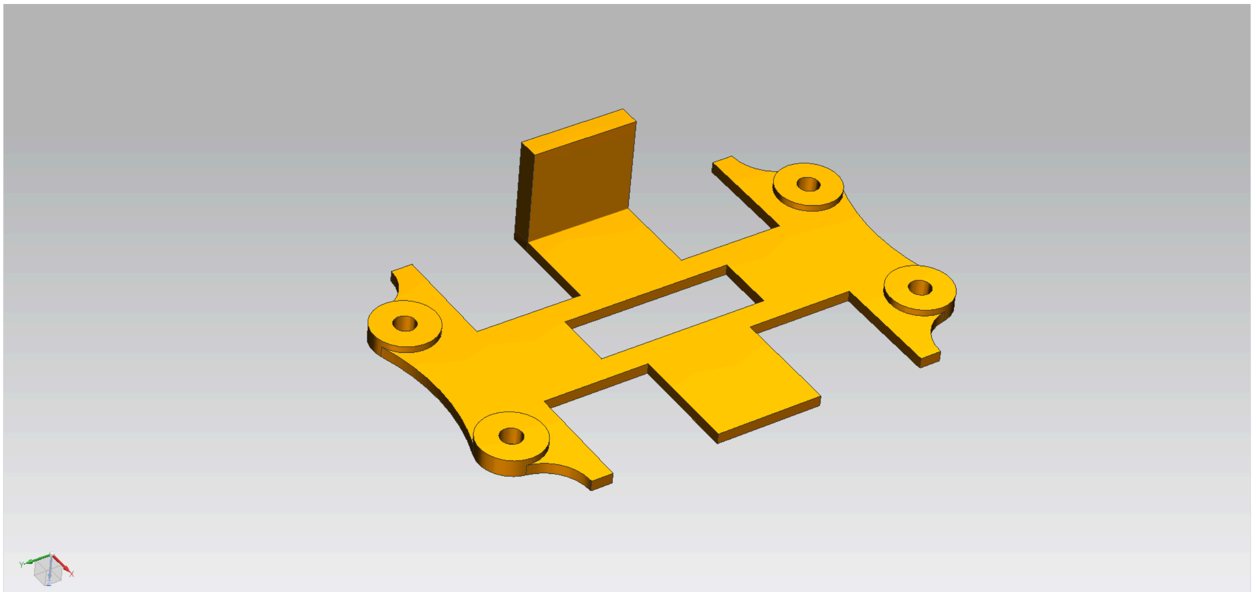


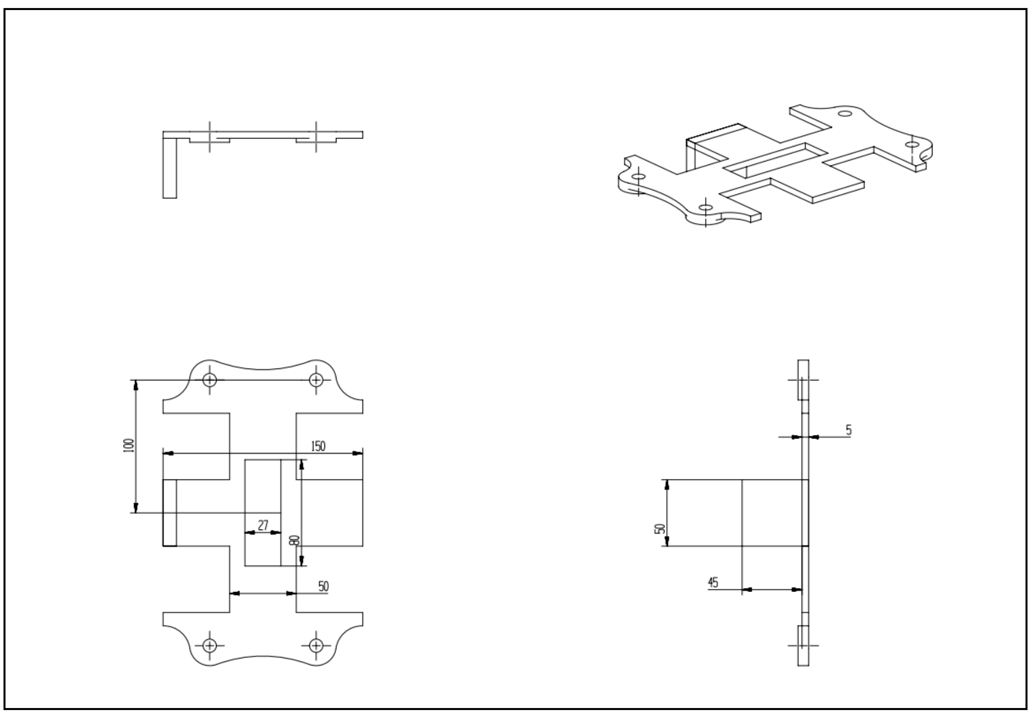
Drone Wing



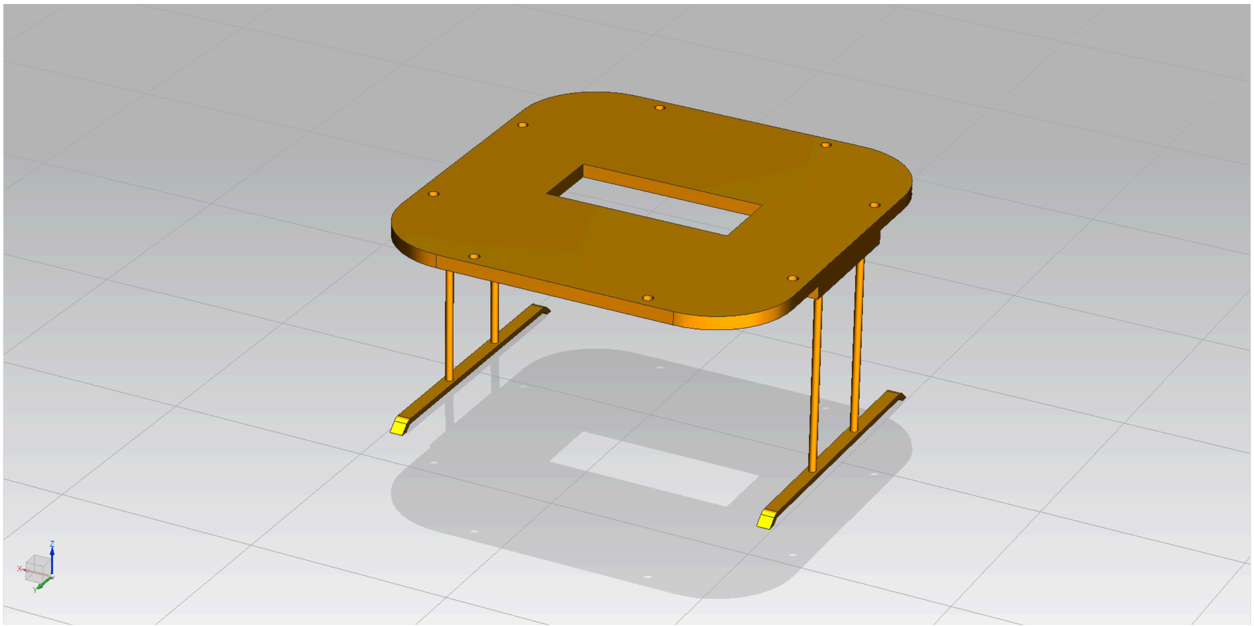


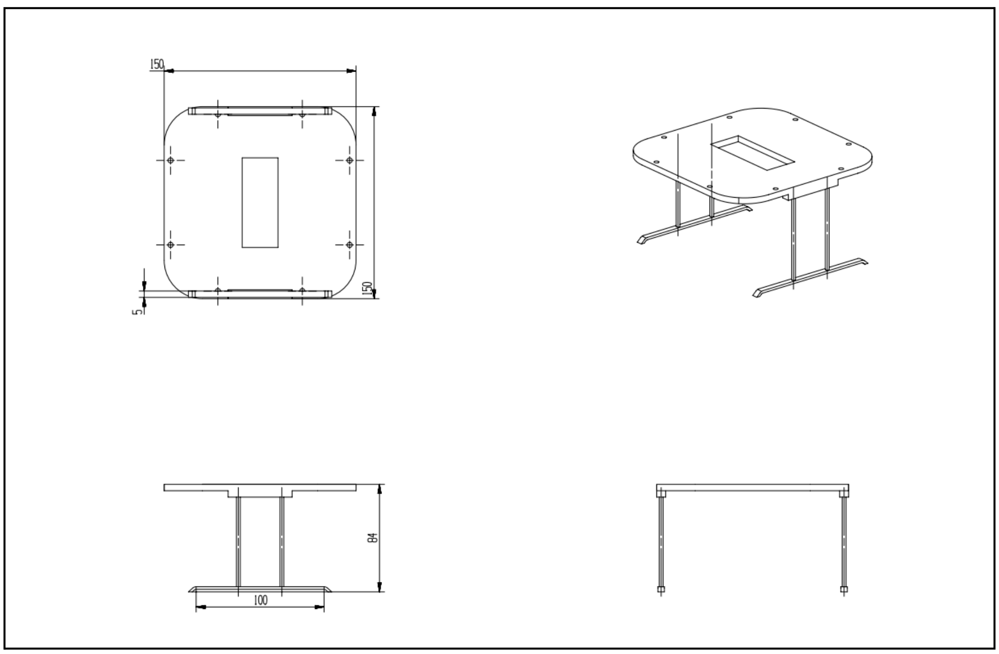
Wings Mounting plate

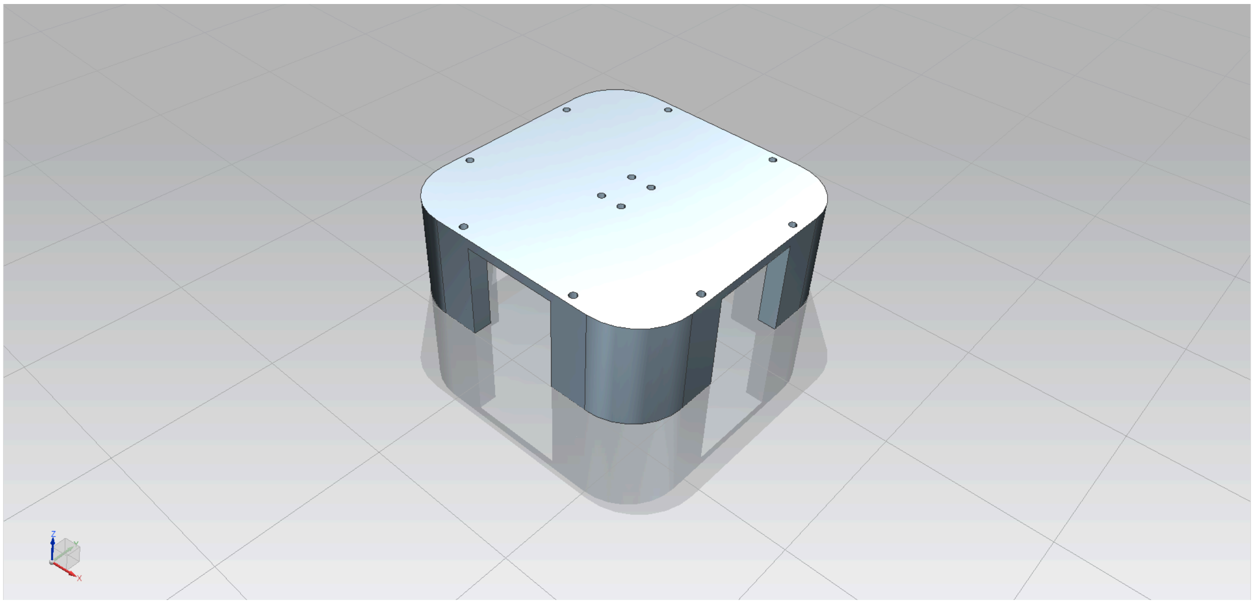


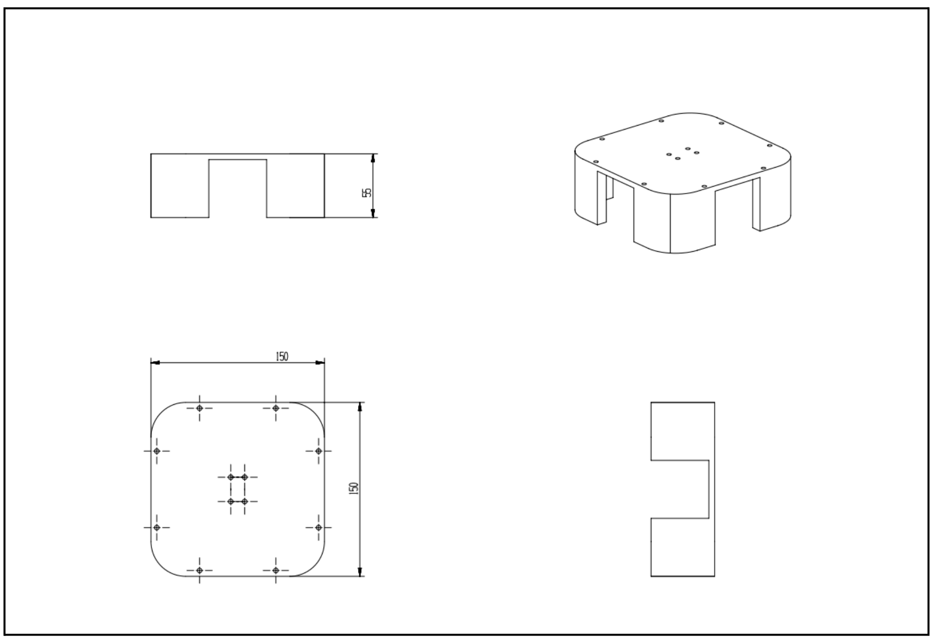


Drone Casing









3. List of components (for proof of concept, 1 drone)

a. List of structure components:

Sr. No.	Name of component	Quantity	Material
1.	3D printed body	1	PLA
2.	Wing(propeller Support)	4	PLA
3.	Mounting plate	1	PLA
4.	Legs	2	PLA
5.	Spur Gears	3	PLA

b. List of motion components:

Sr, No.	Name of component	Quantity	Cost (inr)
1.	Propellers	4	1000
2.	Links	2	250
3.	Spur gears	3	800
4.	Arms	2	250

c. List of electronics components:

Sr. No.	Name of component	Quantity	Cost (inr)
1.	Raspberry Pi 3	1	10, 743
2.	Flight controller - Navio2	1	23, 184
3.	BLDC Motor	4	350X4

4.	GSM module	1	
5.	Li-Po Battery	1	
6.	Electronic speed controller	4	450X4
7.	GPS Module	1	
8.	RF module	1	
9.	Battery Management System	1	
10.	UBEC	1	

4. The methodology of Making Drone:

1. For swarm drone building we need a master drone which is controlled directly by the user, and other slave drones which fly with respect to the instructions given from the master drone.
2. For all the drones, the microcomputer used will be Raspberry Pi which will perform all the computation tasks required. This microcomputer will interact with flight controller Navio2 and GSM module to control the drone flight and instruction transmission and receiving respectively. The main advantage of using the GSM module is its large communication range and support for various types of data transfer.

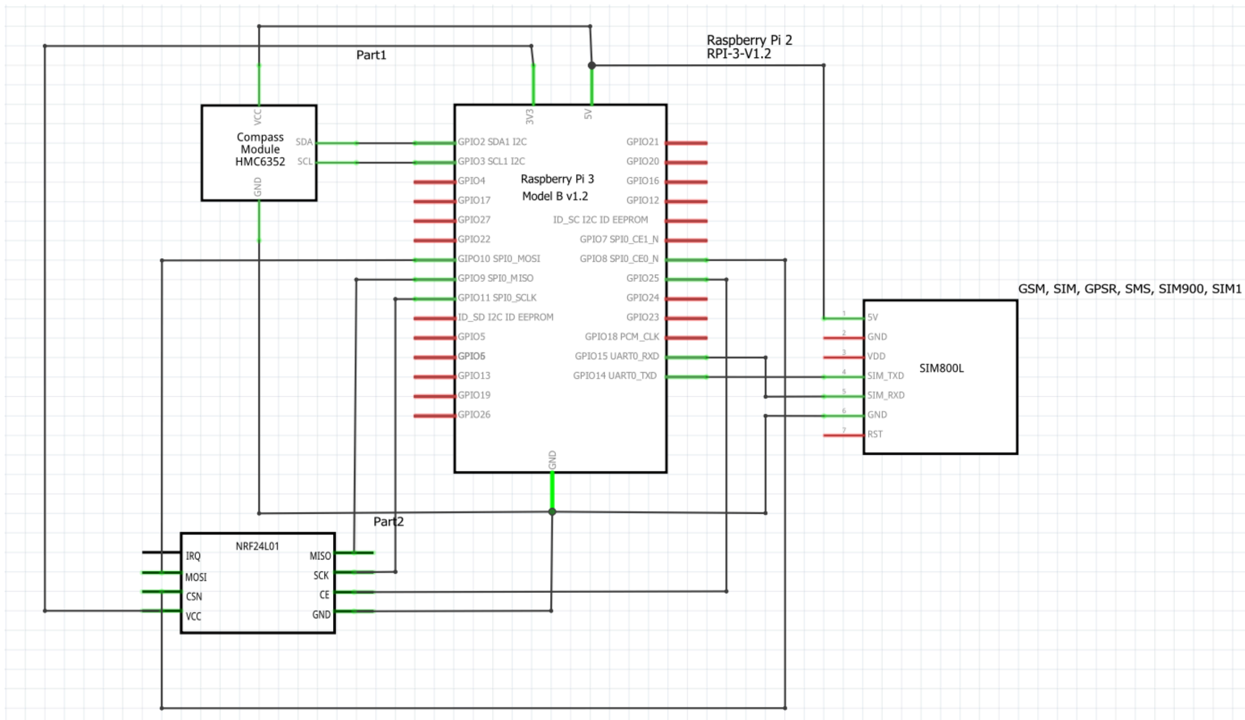
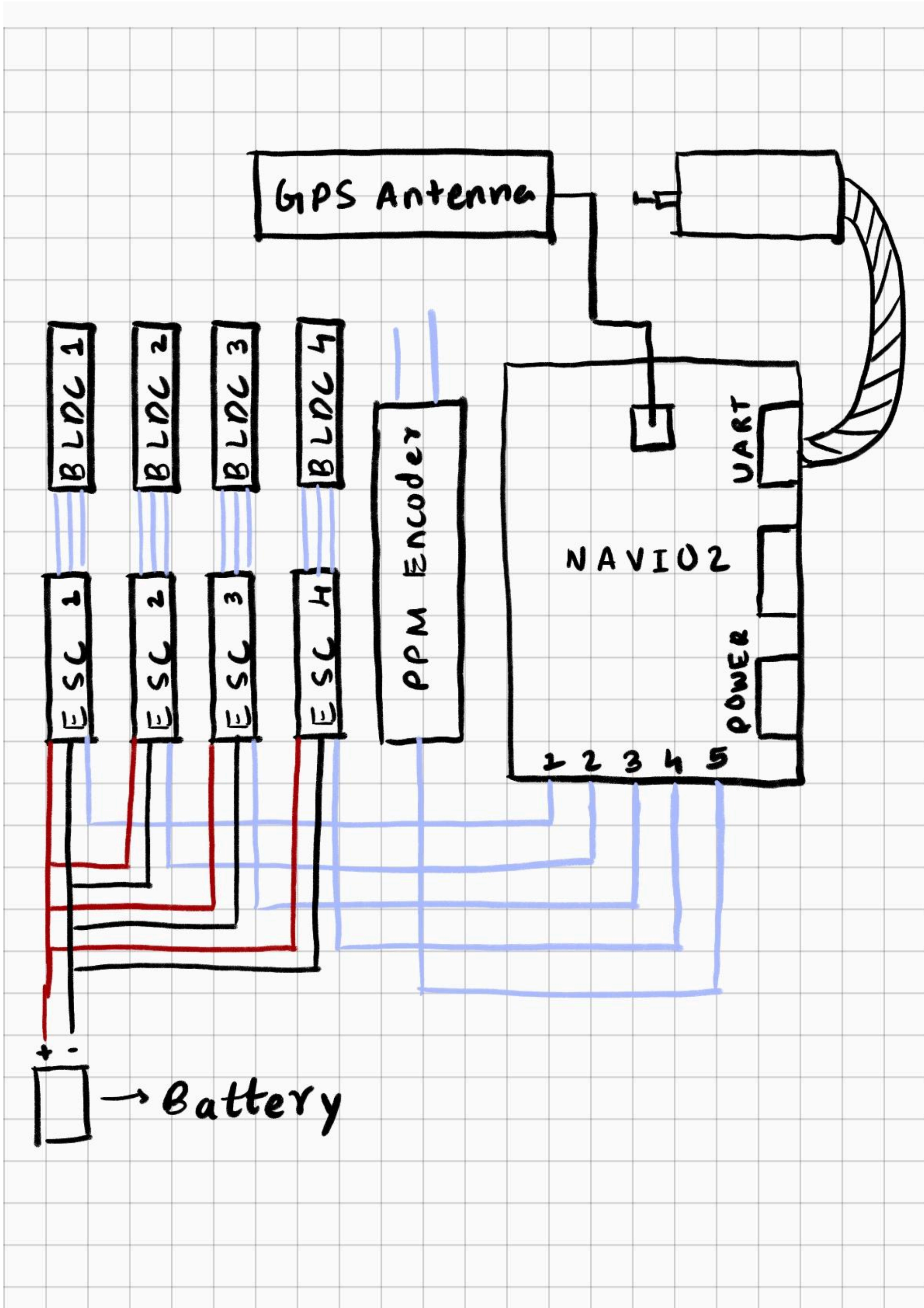


Image X.X Circuit depicting connection of Raspberry Pi 3 to GSM and radio module

3. All the communication between the operator and master drone and the master drone and the slave drones will happen with the help of GSM module which uses GSM mobile technology to provide a wireless data link to a network.
4. The microcontrollers through the instructions received will control the working of BLDC motors and control flights.



5. Camera modules will also be connected to the drones, in order to perform the next set of tasks which is to identify plastic balls of a particular color, and pick and place them as required.
6. For the pick and place mechanism, we have used a gear mechanism. The DC motor will rotate the driving gear, which rotates the base gear which is in turn attached to another half gear. These gears will hence move the arm attached to the ends. To restrict the motion of arms, we have added a link. The entire

mechanism will be boarded on the drone. We have maintained the weight ratio by making the entire mechanism by 3D printing.

5. Application of proposed Drone in a societal context:

- **Geospatial mapping: Search and Rescue**

  Swarm drones can be used as an airborne platform for more efficient collection of geospatial data. By using “Divide and Conquer” algorithms, they can map the region more quickly. By this concept, a geographical area can be divided into zones and scanned individually by a Swarm of drones to collect images. These images can be passed on to the “Master” drone which sends the same for further analysis and Cartography. Softwares like QGIS can be used to make photo-mosaics to map the area. An efficient “Divide and Conquer” algorithm to divide regions can further help in disaster management and rescue operations.

6. Size of Drone proposed for Proof of Concept (Small version):

a. Length in cm: 49.5 (including wingspan) , body length: 15
b. Width in cm: 6, 28.4(considering foremost point of front wing to rearmost point of rear wing)
c. Height in cm: body height: 6, including legs:14

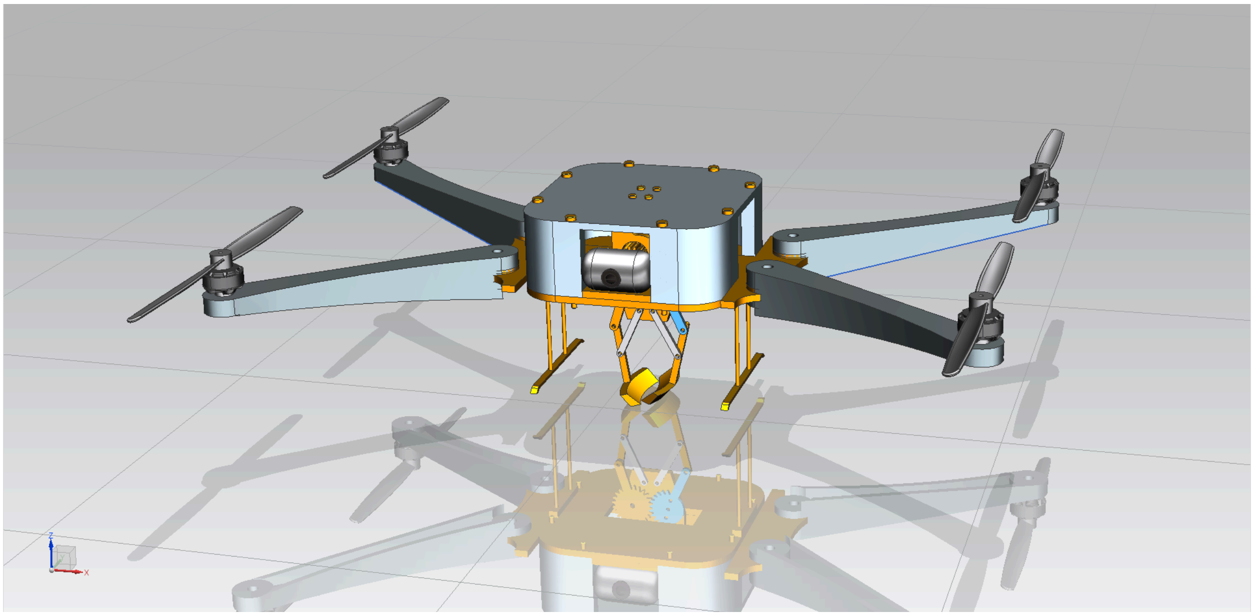
7. Size of Drone proposed as prototype (Actual Version):

a. Length in cm: 49.5 (including wingspan) , body length: 15
b. Width in cm: 6, 28.4(considering foremost point of front wing to rearmost point of rear wing)
c. Height in cm: body height: 6, including legs:14

8. Timeline of Drone making with milestones. (Divided in activities vs. no. of days)

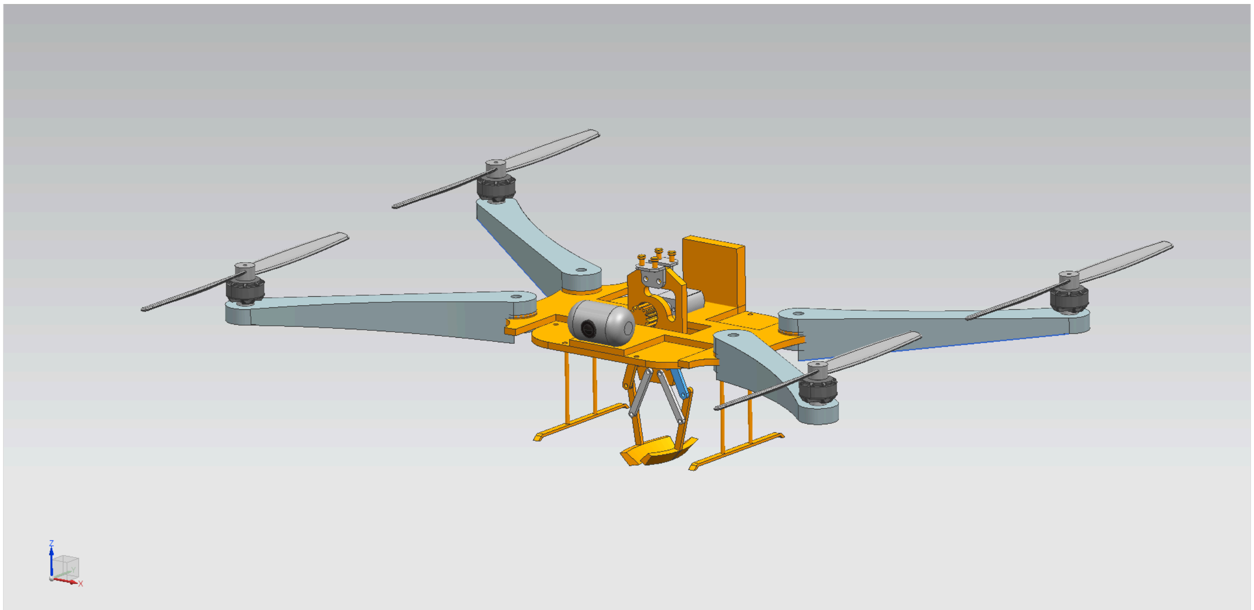
Value Added Activities	15 Nov	16 Nov	13 Dec	14 Dec	15 Dec	16 Dec	17 Dec	19 Dec	20 DEc	25 Dec	26 Dec	27 Dec	29 Dec	30 Dec	31 Dec		2 Jan	5 Jan	
Procurement	5 hrs																		
Materials decide			2	1															
Design					2	2	3												
Assembly						1	3												
Building the circuit								2	1										
Testing and Documentation										2	2	1							
Iterations														2	1		1	1	

9. Proposed outline (photography) for understanding.



The drone body is 150mm x 150mm. The wings are attached on a separate mounting plate; it serves to mount circuits of the drone as well. The four wings have ribs to give structural support to the propellers and motors. This drone includes two bladed propellers to increase the stability which are mounted on Bldc motors. For pick and place mechanism this drone includes 2 armed geared driven mechanisms designed by optimizing the weight. For image recognition we have added a Racecam mini camera which will rotate 90 degrees front front to bottom and vice versa.

Isometric Open view



Picking Mechanism