MITS

TERABOT

CONTENT

*click the requires content to follow the link

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ACKNOWLEDGEMENT

Primary we would like to thank GOD without whose grace this project would not have been completed successfully. We are also extremely grateful to our parents for their support and guidance.

We would also to like take this opportunity to express our intuition of gratitude to our principal Dr. Neelakandan P.C.

We convey our earnest gratefulness to Dr. Manoj Kumar K, (HOD)/Department of Mechanical Engineering, for his awakening leadership.

We are also grateful to our Vice Principal, Dr. Chikku Abraham, for his constant moral support. We would also like to thank Dr. Kurian Antony for all his guidance and mentorship.

Lastly, we would like to thank all the technical staff and students who have constantly supported and encouraged us in completing this project.

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ABSTRACT

A quadcopter can achieve vertical flight in a stable manner and can be used in various applications in different sectors like agriculture, health, defense and transportation. Technical advances have reduced the cost and increased the performance of the low power microcontrollers that allowed the general public to develop their own quadcopters. The goal of this project is to make a drone which could transport a payload with the help of additive manufacturing.

In this report we have included the CAD files of all the drone parts and our design have illustrated how we implemented the pickup mechanism we have also included the iterations which we have made on our design. We have also included simulation reports along with performance analysis of our quadcopter.

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INTRODUCTION

A drone has the potential for performing many tasks where humans cannot enter, for example, high temperature and high-altitude surveillance in many industries, rescue missions. A drone has four propellers with motors that generate the thrust for lifting the aircraft.

The drone which we have made is a quadcopter. The basic principle behind the quadcopter is that two motors will rotate in the clockwise direction and the other two will rotate in the anticlockwise direction allowing the aircraft to vertically ascend. With the help of a camera and FPV Goggles we can control the drone.

In our drone most of the part are 3D printed and we have a pickup mechanism which uses a servo motor and magnet mechanism to lift and drop payload. We have designed our drone after many iterations based on the guidelines of DFAM, DFMA, the 3D printing material we have chosen is ABS.

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GROUP INFO

COLLEGE	Muthoot Institute of Technology and Science Varikoli P.O, Puthencruz- 682308 info@mgits.ac.in | 0484-2732100/111
Chapter Advisor	Dr. Kurian Antony
Phone No.	9544827944
Email Id	kuriananantony@mgits.ac.in
Chapter President	Mathews Jain
Phone Number	9526262200
Email Id	17me125@mgits.ac.in
Team Captain	Joshua Thomas
Phone Number	9048015571
Email Id	joshuathomas2000@gmail.com
Address	Villa no 27, Countryside Bungalows, Sastham ughal, kochi, Kerala, Pincode-682305
Number of students that intend to participate at E-Fest from our Team	5

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LIST OF COMPONENTS

SL NO.	COMPONENT NAME	MODEL DESCRIPTION	PRICE	REFERENCE PICTURE
1	FRAME	3D PRINTED		
2	PROPELLER	HQProp DP6X4X3V1S Durable 6040 6x4 6 Inch 3-Blade	**₹355.60**	
3	MOTOR	inflight XING X2207	**₹1,780.93**	
4	ESC	SKYSTARS 50A Blheli_32 bit 3-6S Dshot1200 Brushless ESC	**₹1,328.22**	
5	BATTERY	URUAV 14.8V 2200mAh 70C 4S Lipo Battery XT60	₹1641.50	

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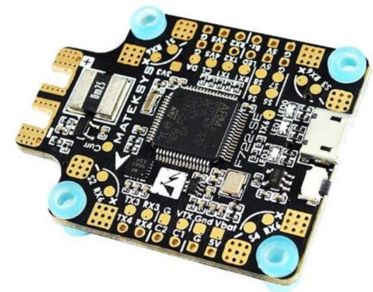
7	FLIGHT CONTROLLER + POWER DISTRIBUTION BOARD	Matek System F722-SE F7 Dual Gryo Flight Controller	**₹ 4,000**	
8	TRANSMITTER/RECEIVER	FlySky FS-i6 2.4G 6CH AFHDS RC Radion Transmitter With FS-iA6B Receiver	**₹4,097.10**	
10	FPV CAMERA	RunCam Phoenix Oscar Edition 1000tvl 1/3 Super 120dB WDR Mini FPV Camera	**₹3,384.43**	
11	FPV GOGGLES	Eachine1 EV800D 5.8G 40CH Diversity FPV Goggles 5 Inch 800*480 Video Headset HD DVR	**₹5,840.79**	
12	VTX	Runcam TX200U 5.8G 48CH 25mW/200mW Video FPV Transmitter VTX Support	**₹1,505.65**	

COST ESTIMATION

COMPONENTS

COMPONENT		COST
Remote controller Receiver	1	4100
Flight controller	1	2700
Battery	2	4000
FPV Camera	1	3400
FPV Goggles	1	6520
Motors	4	7170
Props	7	2500
VTX	1	1520
ESC	4	5347
Pick up Mechanism	1	820
3D printing cost	-	5000
TOTAL		43077

ACCESSORIES

COMPONENTS	PRICE
Allen key	210
screwdriver set	500
m3 screw assortment	500
Zip ties	100
MicroSD card	640
Battery non-slip matt	125
Wires	680
Rubber grommets	192
Double sided Foam tape	240
Heat shrinks	245
Fsi6 simulator cable	760
Capacitor	230
Safety glasses	700
Battery strap	430
Battery charger	4020
Battery Monitor alarm	223
Lipo safety bag	820
TOTAL	10615

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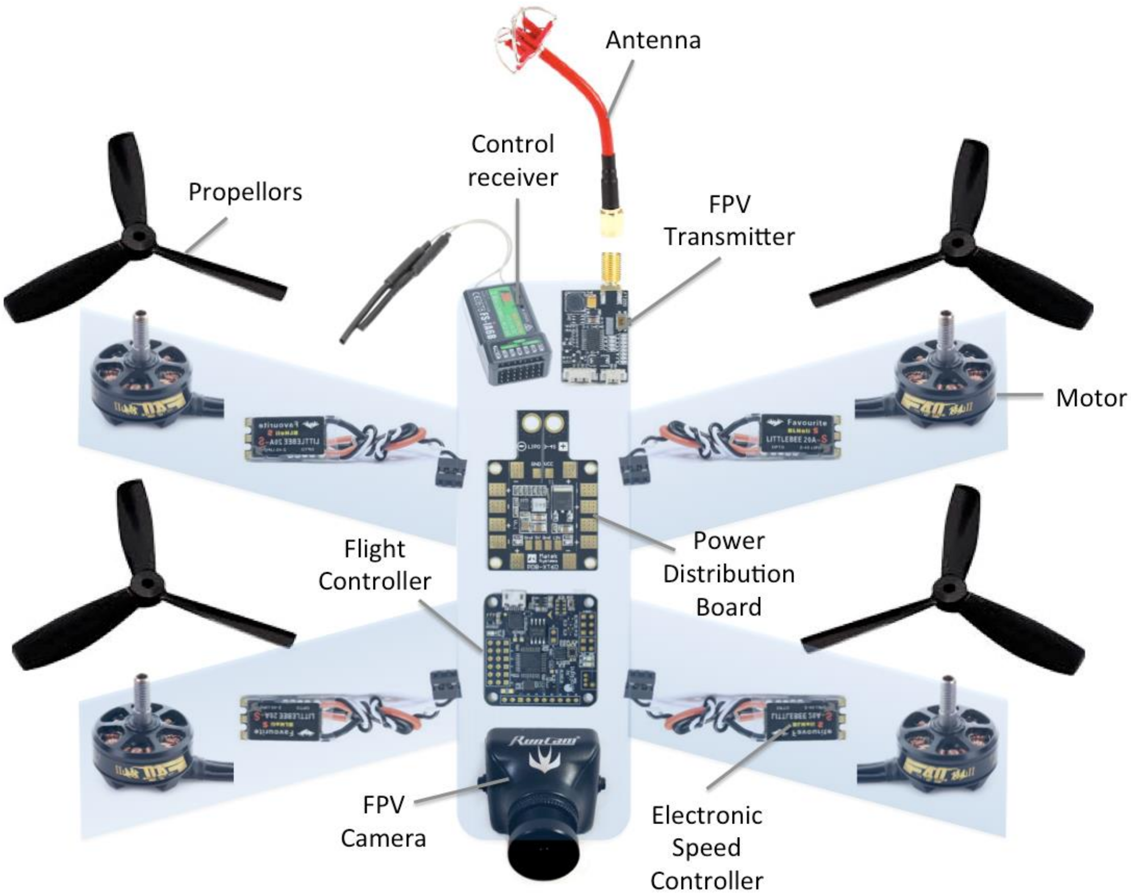
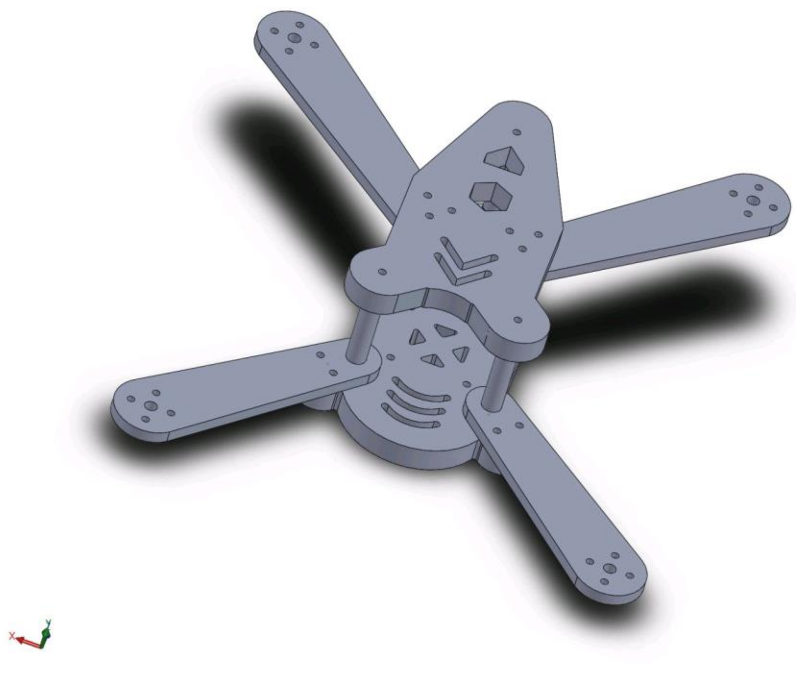
SYSTEM OVERVIEW



CAD DRAWINGS



DRONE EMBODIMENT DRAWING

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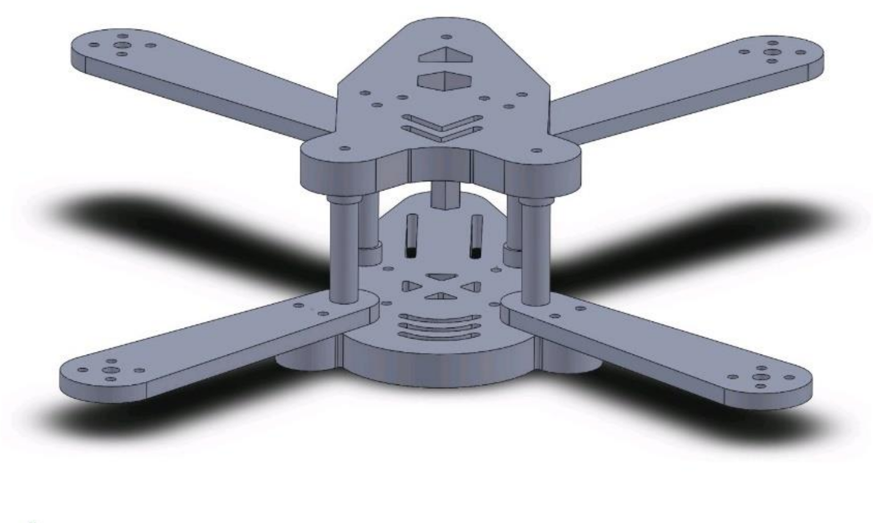
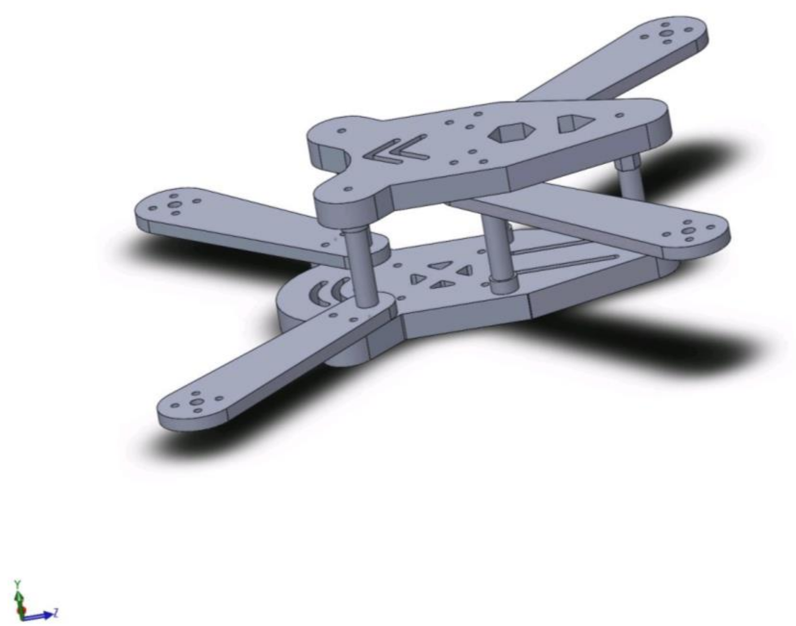


DRONE FRONT VIEW



DRONE LEFT SIDE VIEW

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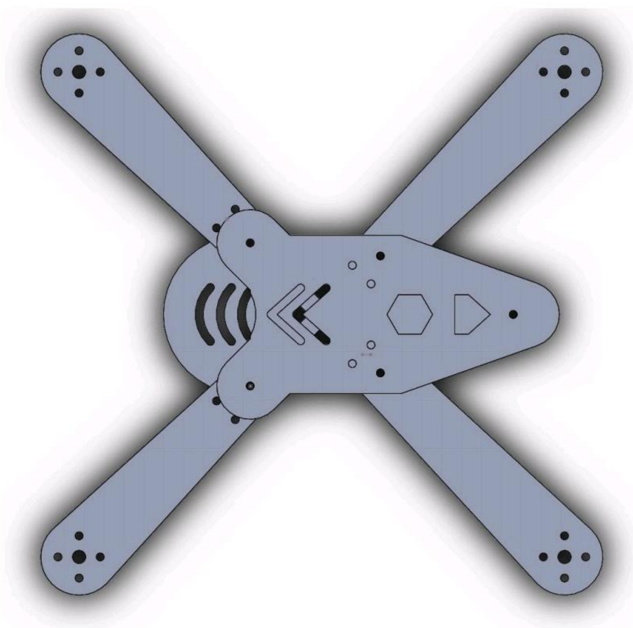
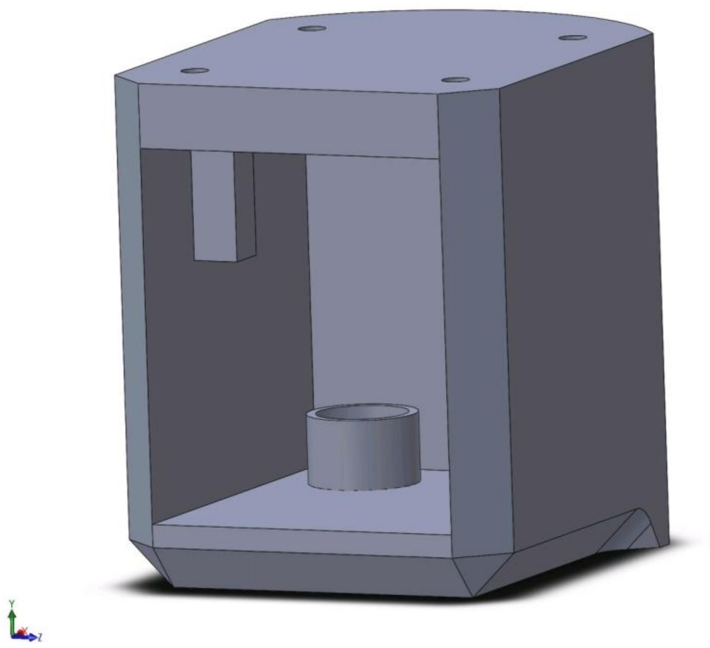


DRONE TOP VIEW



ISOMETRIC VIEW (PICKING MECHANISM)

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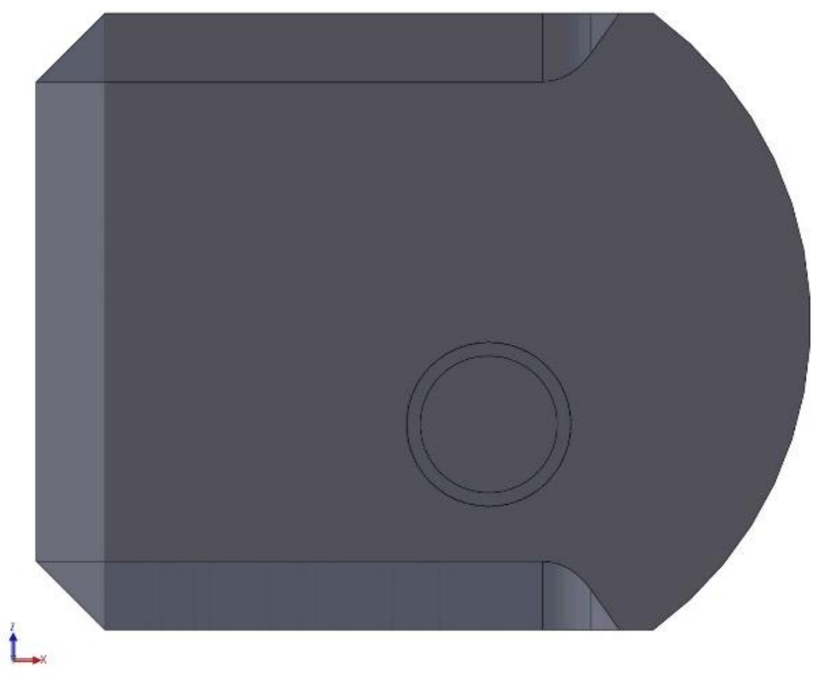
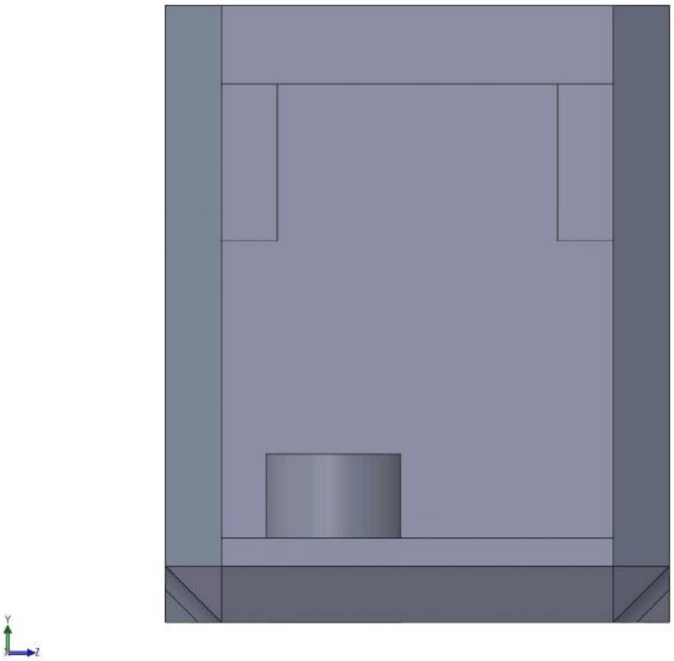


BASE VIEW (PICK UP MECHANISM)



PICKUP MECHANISM (FRONT VIEW)

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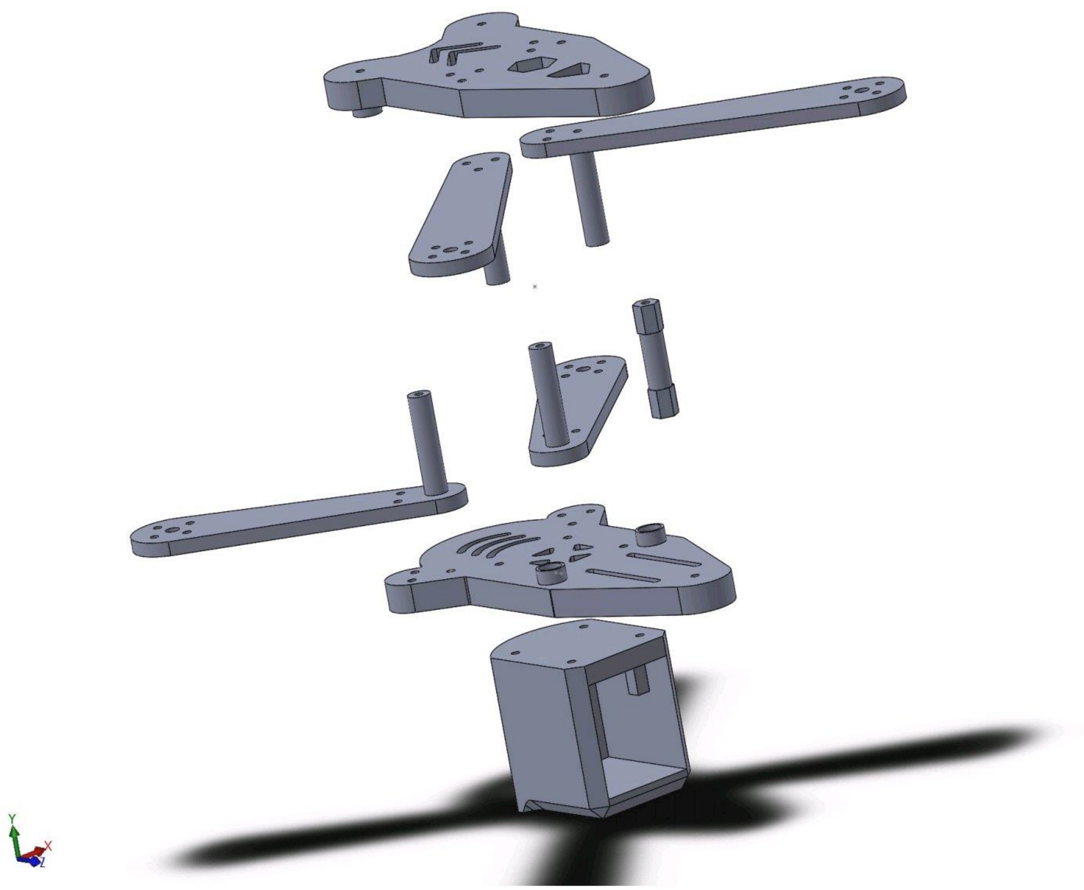
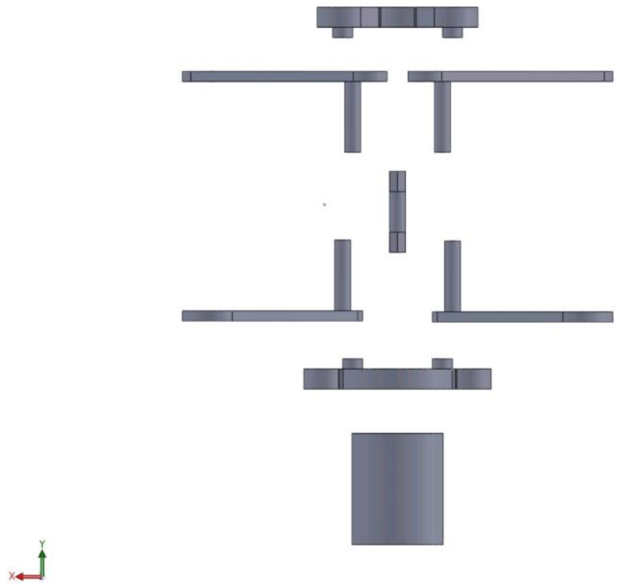
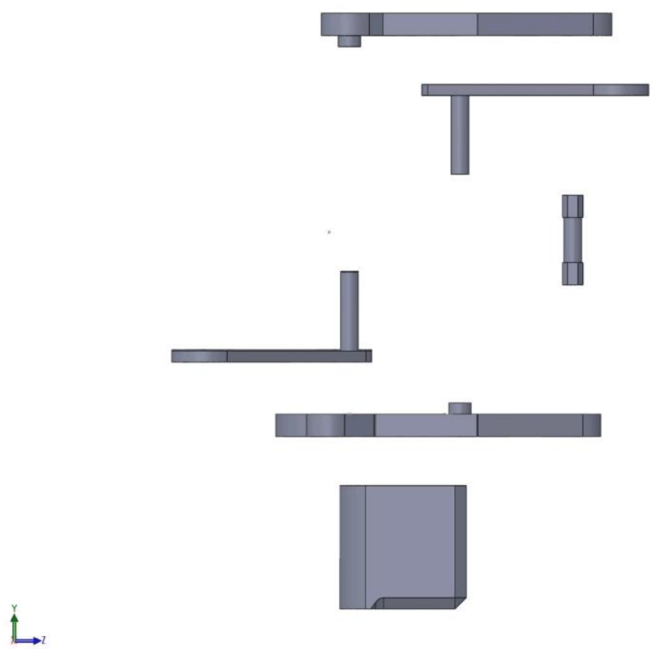
EXPLODED VIEW



Isometric Exploded View



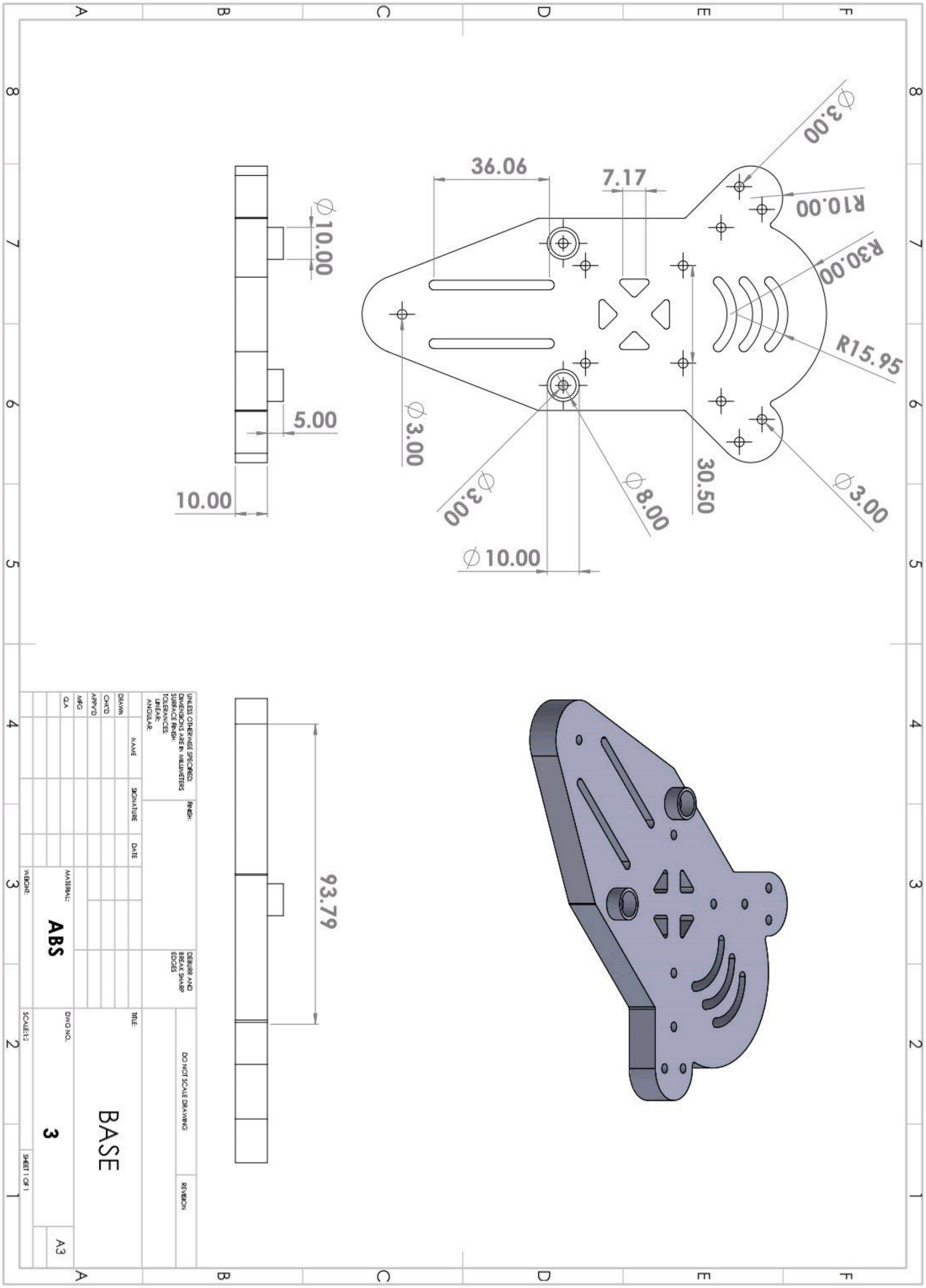
Front Exploded View



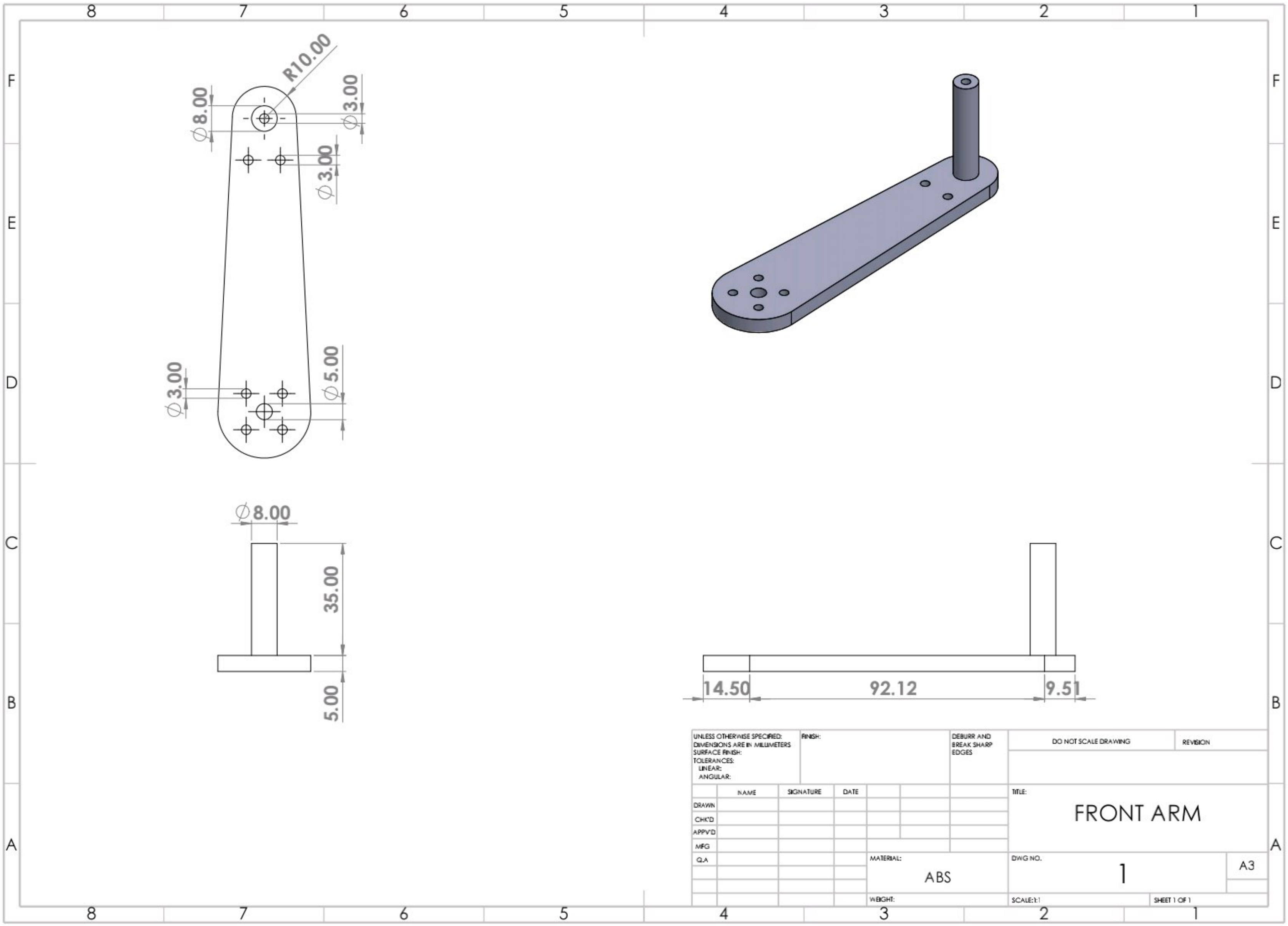
Science

Exploded Right Side View

INDIVIDUAL CAD DRAWINGS



BASE PLATE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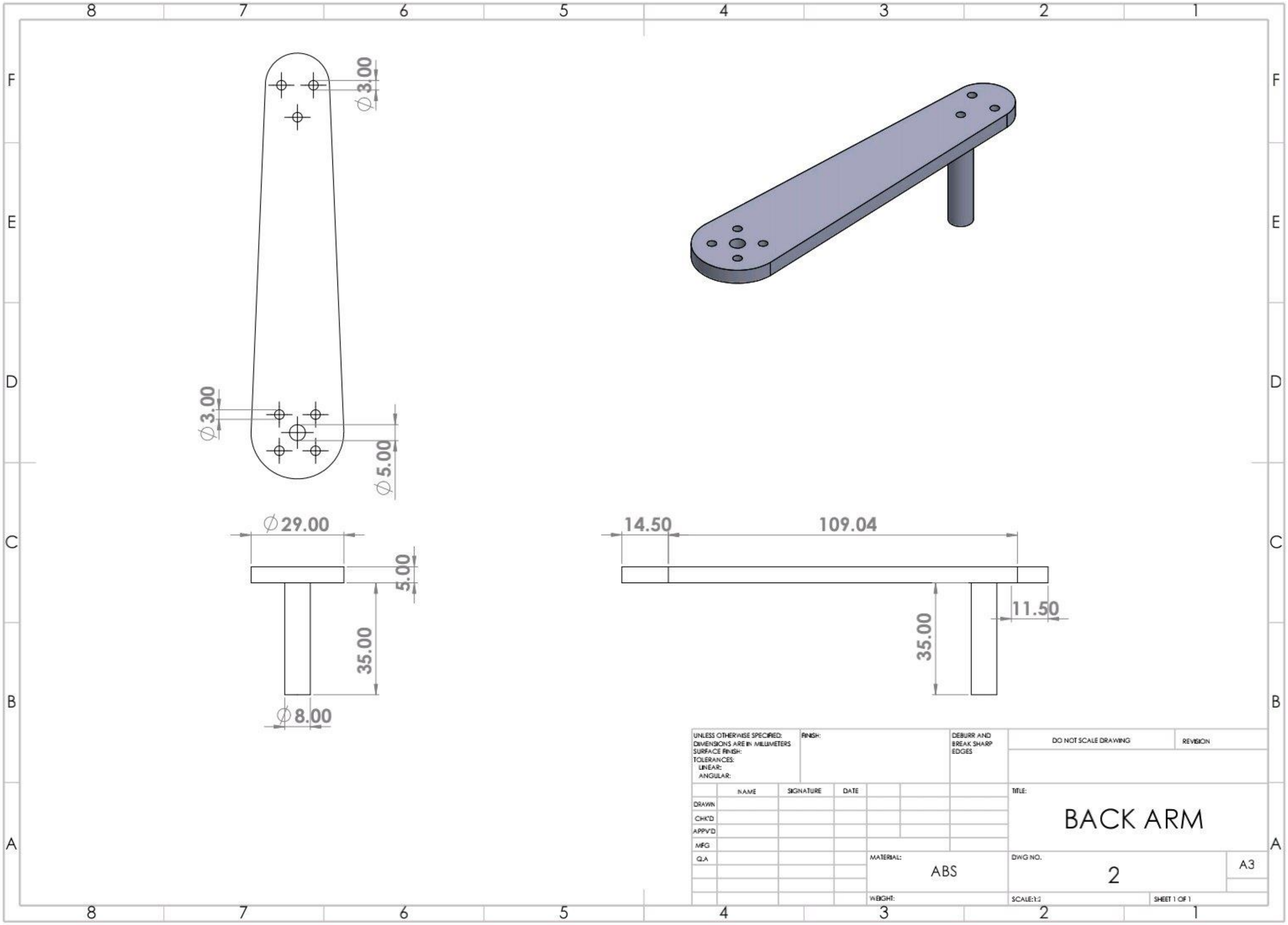
SHEET 1 OF 1

FRONT ARM



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BACK ARM
DWG NO.
2
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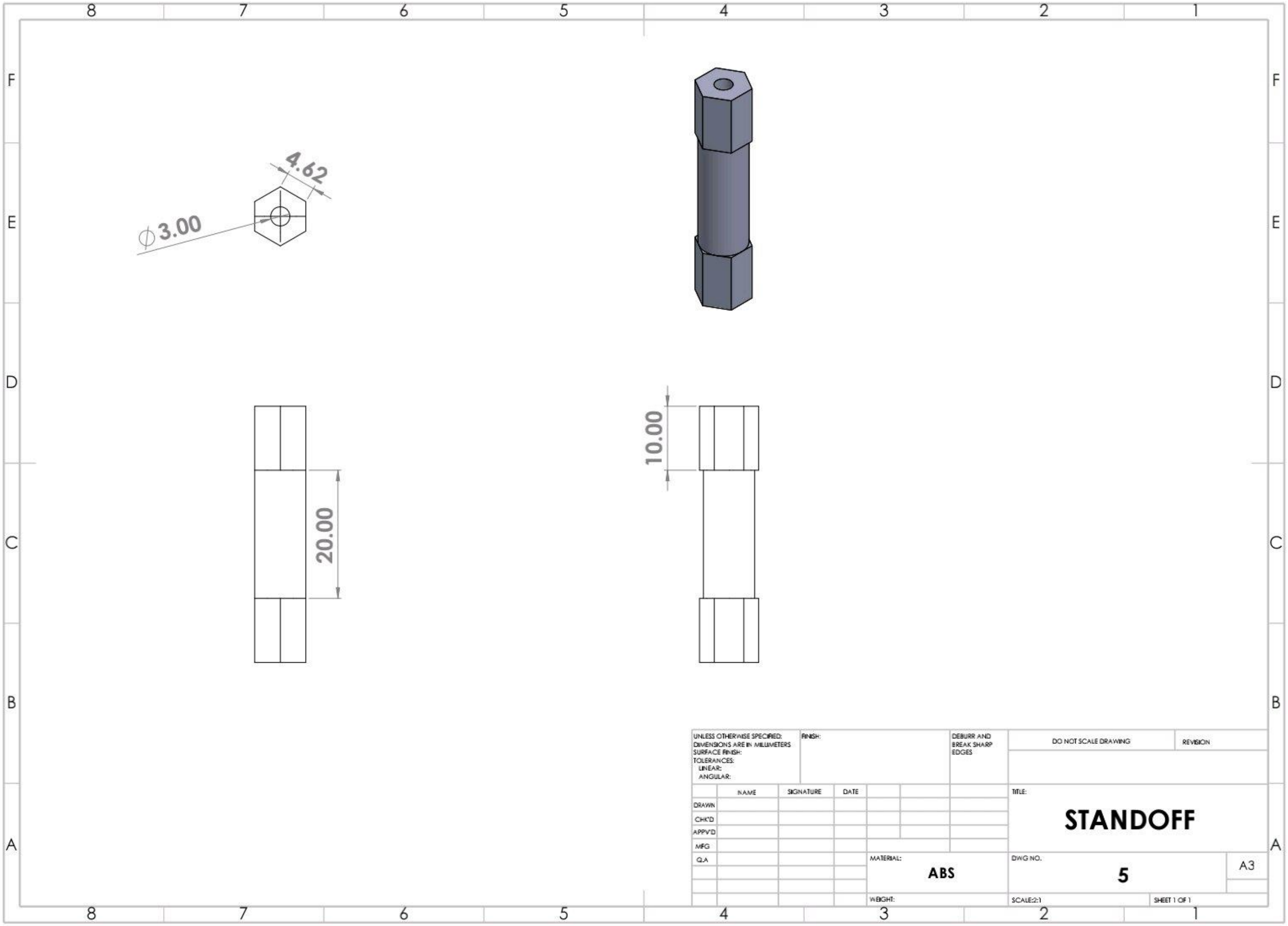
SCALE:1:2
SHEET 1 OF 1

BACK ARM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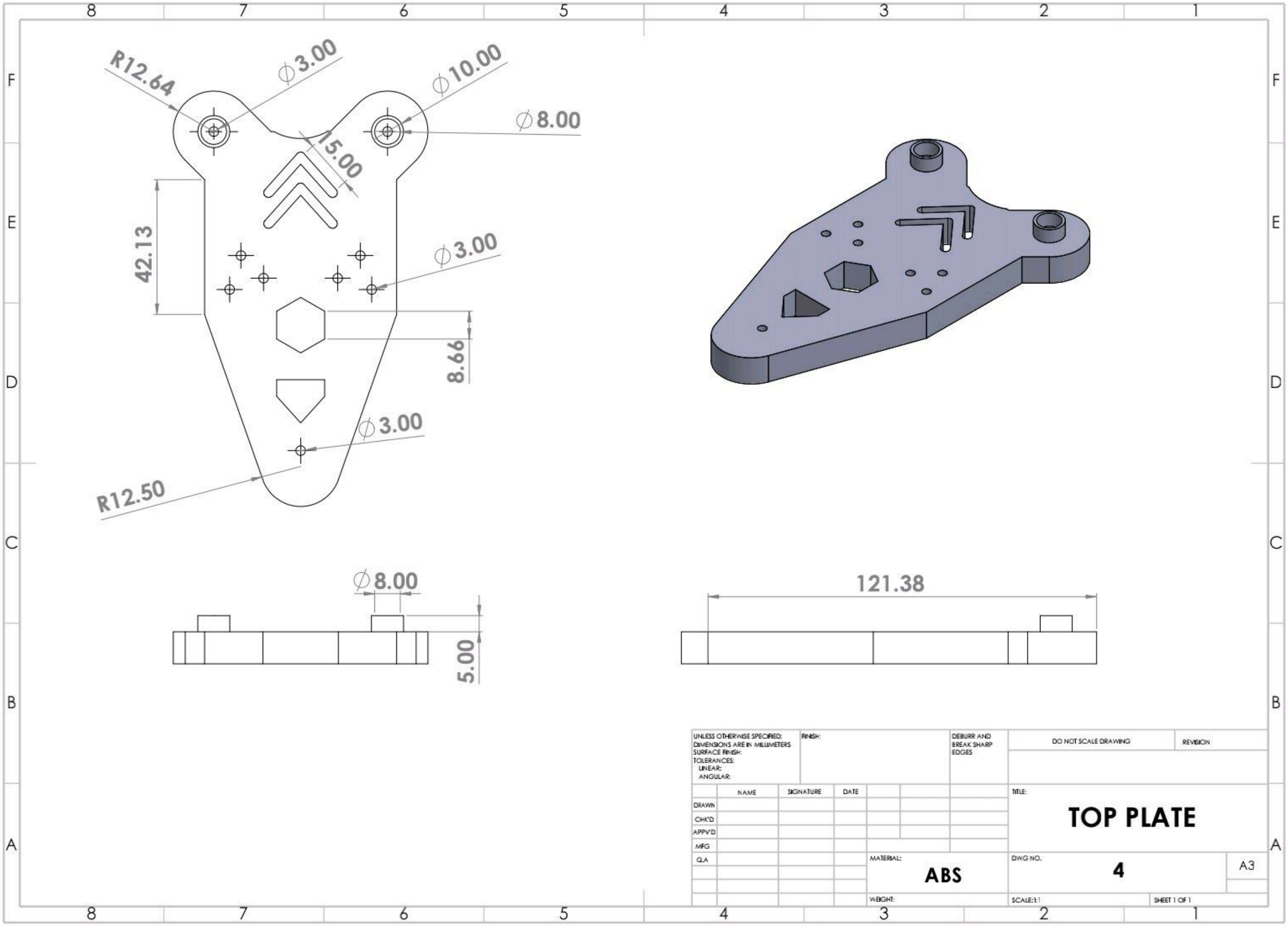
SHEET 1 OF 1

STAND OFF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MATERIAL:
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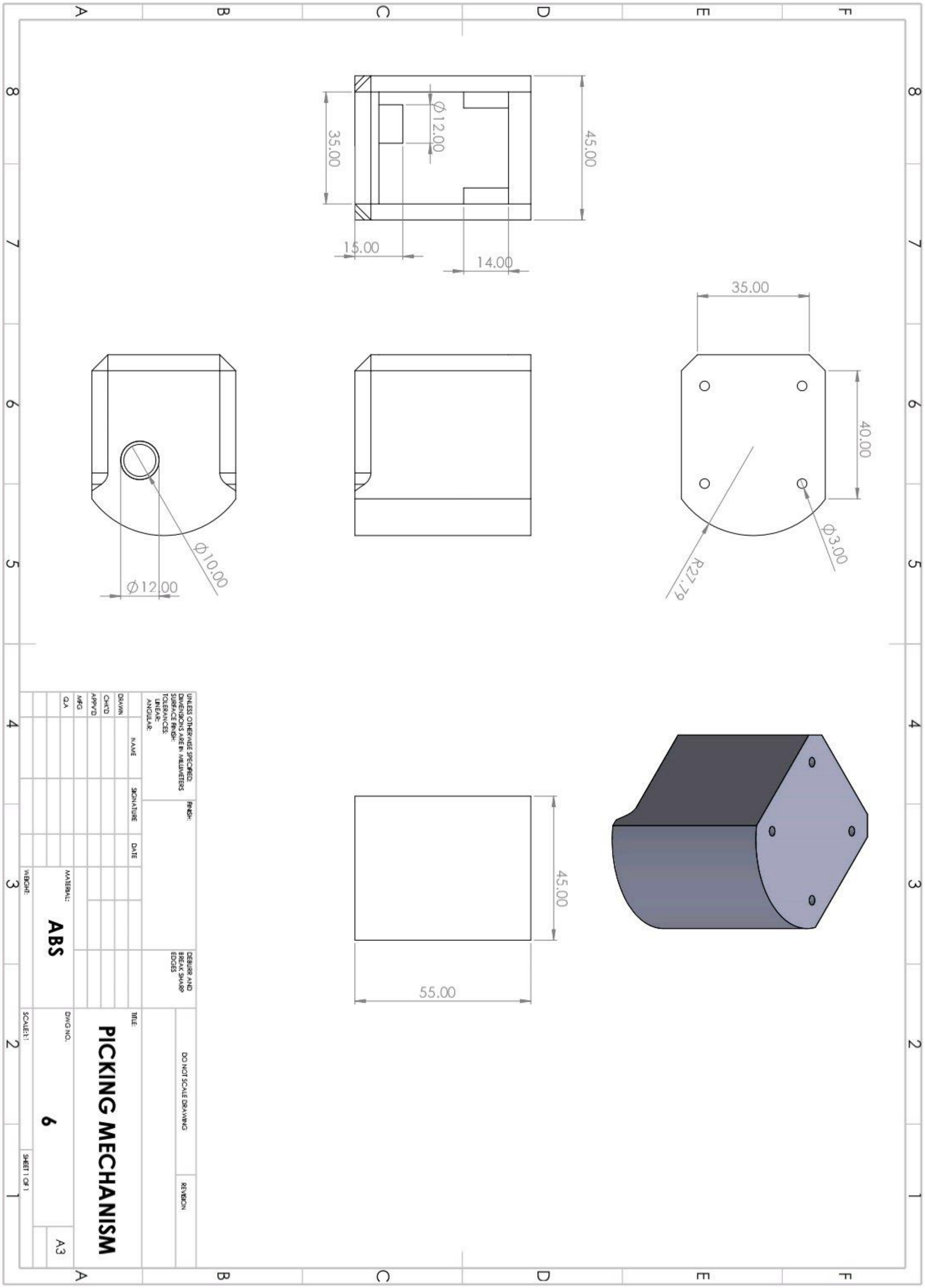
WEIGHT:
TITLE:
TOP PLATE
DWG NO.
4
A3
SCALE:1:1
SHEET 1 OF 1

TOP PLATE

PICK UP MECHANISM



PARTS DESCRIPTION

PROPELLER

The purpose of our quadcopter propellers is to generate thrust and torque to keep your drone flying, and to maneuver.
The upward thrust force generated by the propellers is usually measured in pounds or grams. To keep our drone flying at a hover, the upward thrust needs to equal the weight of the drone. The thrust to weight ratio TWR (thrusts divided by weight), indicates how much thrust our drone generates relative to its weight. A good rule of thumb is to design the TWR to be at least a value of two.

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About Our Propellers: -

Brand Name	HQProp
Quantity	2 CW & 2CCW
Propeller Diameter	6 inches
Pitch	40
Blades	3
Material	Poly Carbonate
Hub Diameter	13.2mm
Hub Thickness	7.1mm
Shaft	5mm
Weight	5.7g

MOTOR

Mostly, brushless motors are used for drones, for following advantages over brushed ones:

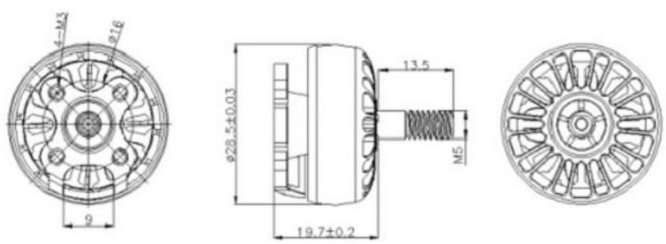
1. Due to absence of brushes, wear and tear is very less, thus making them more reliable and durable.
2. High RPM are possible without much heating.
3. More power to weight ratio.
4. They respond more quickly to variations in speed than brushed motors, making them ideal for drones, since continuous variations in speed are required for maneuver of drones.
5. Less heating and noise. Thus, more efficient.

About Our Motor: -

Brand name	iFlight
Item name:	XING X2207 Motor
KV	2450KV
Configuration	12N14P
Stator Diameter	22mm
Stator Length:	7mm
Shaft Diameter	4mm
No. of Cells (Lipo)	4S
Weight	31.5g

iFlight Xing X2207 2450KV

Technical Datas	
KV	2450
Configu-ration	12N14P
Stator Diamter	22mm
Stator Length	7mm
Shaft Diameter	4mm
Motor Dimension(Dia.*Len)	Φ28.5*19.7mm
Weight(g)	34.6
Idle current(10)@10V(A)	<2.0
No.of Cells(Lipo)	2~4S
Max Continuous Power(W)180S	682.1
Internal Resistance	46.8mΩ
Max Current(180S)	42.63A
Max.Effciency Current	(9.33-26.08A)>81%



Prop (inch)	Voltages (V)	Throttle (%)	Load Currency (A)	Pull(g)	Power(W)	Efficiency (g/W)	Temperature(in full throttle load 10min)
5050	16	50%	7.93	495	126.9	3.901	60C°
		60%	12.33	655	197.3	3.320	
		70%	17.08	821	273.3	3.004	
		80%	24.22	1036	387.5	2.673	
		90%	31.48	1223	503.7	2.428	
		100%	39.56	1498	633.0	2.367	
5.1x3.1x3	16	50%	7.33	483	117.3	4.118	57C°
		60%	10.93	622	174.9	3.557	
		70%	15.35	799	245.6	3.253	
		80%	21.35	1051	341.6	3.077	
		90%	27.75	1189	444.0	2.678	
		100%	35.68	1391	570.9	2.437	
5045	16	50%	6.8	476	108.8	4.375	55C°
		60%	10.27	636	164.3	3.870	
		70%	14.47	792	231.5	3.421	
		80%	19.55	1008	312.8	3.223	
		90%	25.22	1207	403.5	2.991	
		100%	32.02	1465	512.3	2.860	
5043	16	50%	7.67	457	122.7	3.724	58C°
		60%	10.93	619	174.9	3.540	
		70%	15.28	765	244.5	3.129	
		80%	21.35	982	341.6	2.875	
		90%	27.68	1195	442.9	2.698	
		100%	35.48	1398	567.7	2.463	
6045	16	50%	9.33	648	149.3	4.341	63C°
		60%	13.87	798	221.9	3.596	
		70%	19.42	1042	310.7	3.354	
		80%	26.08	1315	417.3	3.151	
		90%	34.15	1496	546.4	2.738	
		100%	42.63	1679	682.1	2.462	
■Airplane			□Helicopter			■Vtol	

cience

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Thrust Tables

ESC

The FPV Drone Electronic Speed Controller is a crucial component, situated between the flight controller, battery and motor. There are many choices of ESC to meet the needs of many types of drones, from small 2-inch drones, to power-hungry racing drones, to longer range camera drones. It is important to match the ESC with the style of flying and intended application. However, it is better to get an ESC capable of handling greater amps and voltage than you may plan to use, as you may give yourself room to grow, along with a margin of safety.

About Our ESC: -

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Brand name	SKYATARS
Item name	50A Blheli_32 brushless ESC
Firmware	Blheli_32 bit
Input	3-6S
BEC	NO
Continuous current	50A
Burst current	60A >=10S
Weight	7.4g(include cables)
Size	26X15X6MM

FLIGHT CONTROLLER

An FPV Drone Flight Controller, or FC, is the heart of a quadcopter and controls most onboard electrical components with the assistance on an arduino-like microprocessor and an array of sensors.

As the name implies, and FPV Drone Power Distribution Board (PDB) is a printed circuit board that is used to distribute the power from your flight battery to all different components of the multirotor. Prior to PDB’s becoming common it was necessary to connect all the different components using wire and the result often resembled an octopus and weighed a considerable amount due to the amount of copper and solder joints in the wires.

In our drone we have used a Hybrid board with power distribution board and flight controller in a single board so that the overall weight and space consumption get reduced compared to conventional drone designs.

About our Flight Controller:

Specification:

Brand Name:	Matek System
Model:	F722-SE
Item Name:	F7 Dual Gyro / ACC Flight Controller Board
MCU:	STM32F722RET6 216MHz
IMU:	MPU6000 & ICM20602, Dual Gyros built-in (SPI)
Baro:	BMP280 (I2C)
OSD:	AT7456E (SPI)
Blackbox:	MicroSD card slot (SPI)
Firmware:	BetaFlight / INAV
Target:	MATEKF722SE
Size:	36x46mm
Mounting Hole:	30.5x30.5mm
Weight:	10g

PDB Specifications

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Input:	6~36V (3~8S LiPo) w/TVS protection
PDB:	4x35A (Max.4x46A)
BEC:	5V 2A cont. (Max.3A)
LDO 3.3V:	Max.200mA
Current Sensor	184A (Scale 179)
Battery Voltage Sensor:	1:10 (Scale 110)

BATTERY

An FPV Drone Battery is the foundational component of a quadcopter and must be selected to achieve an ideal balance between performance and flight time. Lithium batteries are the most common battery chemistry used to power quadcopters due to their high energy densities and high discharge capabilities.

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About Our battery: -

Battery parameter:	URUAV 14.8V 2200mAh 70C
Capacity:	2200mAh
Size:	33*34*105mm
Plug:	XT60 Plug
Continuous Discharge Rate:	70C
Weight	251g
Colors:	Standard Colors

TRANSMITTER AND RECEIVER

A radio control system is made up of two elements, the transmitter we hold in our hands and the receiver we put inside our drone. Dramatically simplifying things here, our drone transmitter will read our stick inputs and send them through the air to our receiver in near real time. Once the receiver has this information it passes it on to our drone’s flight controller which makes the drone move accordingly. A radio will have four separate channels for each direction on the sticks along with some extra ones for any auxiliary switches it may have.

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About Our Transmitter and receiver: -

Brand Name	FlySky
Channels:	6 Channels
Model Type:	Heli/Airplane
RF Range:	2.40-2.48GHz
Bandwidth:	500KHz
Band:	142
RF Power:	Less Than 20dBm
2.4ghz System:	AFHDS 2A and AFHDS
Code Type:	GFSK
Sensitivity:	1024
Low Voltage Warning:	less than 4.2V
DSC Port: PS2; Output:	PPM

Charger Port:	No
ANT length:	26mm*2(dual antenna)
Power:	6V 1.5AA*4
Display mode:	Transflective STN positive type, 128*64 dot matrix VA73*39mm, white backlight.
On-line update:	yes
Color:	Black
Certificate:	CE0678, FCC
Model Memories:	20
Control Range:	500m

FS-iA6B Specifications:

Item Name	FS-iA6B
Channel:	6
Frequency Range:	2.4055--2.475GHZ
Band Width Number	140
Transmitting Power	≤ 20dBm
RF Receiver Sensitivity: -	105dbm
2.4G Mode	The second generation of an enhanced version of the automatic FM digital system
Antenna Length:	26mm * 2 (dual antenna)
Input Power	4.0-6.5V DC
Dimension:	47 x 26.2 x 15mm
Weight:	14.9g
Package	Weight
Color:	Black
i-Bus Interface:	Yes
Data Acquisition Interface:	Yes
Encoding:	GFSK

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Features:

Works in the frequency range of 2.405 to 2. 475GHz.This band has been divided into 142 independent channels, each radio system uses 16 different channels and 160 different types of hopping algorithm.

- This radio system uses a high gain and high quality multi directional antenna; it covers the whole frequency band. Associated with a high sensitivity receiver, this radio system guarantees a jamming free long-range radio transmission
- Each transmitter has a unique ID, when binding with a receiver, the receiver saves that unique ID and can accepts only data from the unique transmitter. This avoids picking another transmitter signal and dramatically increases interference immunity and safety.
- This radio system uses low power electronic components and sensitive receiver chip. The RF modulation uses intermittent signal thus reducing even more power consumption.
- AFHDS2A system has the automatic identification function, which can switch automatically current mode between single-way communication mode and two-way communication mode according to the customer needs.
- AFHDS2A has built-in multiple channel coding and error-correction, which improve the stability of the communication, reduce the error ratio and extend the reliable transmission distance.

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PICK-UP MECHANISM

The picking mechanism that we have designed uses the help of a permanent magnet to pick up and drop the specified payload, i.e. the 1-inch cube. The mechanism is directly attached at the bottom of the drone base and all the components required are enclosed in a specially designed 3d printed housing.

The picking mechanism consists of a servo motor, neodymium magnets, steel pin, shielding case and a custom 3d printed housing.

The picking mechanism picks up the load when the servo motor is in the 90-degree position. The servo motor is connected to a steel pin which is connected to a casing in which the magnet is enclosed. When the servo motor is in this condition the magnet and the ferromagnetic washer is in contact. Therefore, the payload is picked.

The payload is dropped when the servo motor returns to its original state which is at zero degrees. Due to this the magnet is lifted higher. There is a fixed layer between the magnet and payload therefore as the magnet rises there is an increase in the distance between the magnet and payload and hence the magnetic power reduces. This causes the payload to drop.

The advantages of this mechanism are that it eliminates the need of continuous supply of power, hence significantly increasing the battery life of the drone. Also, since we are using a permanent magnet, a sudden power failure will not cause the payload to drop. In other word the payload is secured.

FPV CAMERA

The Drone FPV Camera in your multirotor is the key component that allows you to enjoy that ‘First Person View’. It makes sense to take some time and ensure that you choose the camera that will best suit the type of multirotor that you own and flying that you would like to do.

There are 5 main points to consider when choosing a camera for your multirotor:

1. Size
2. Aspect ratio
3. Sensor Type
4. Lens Field of View
5. Additional Features

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About Our Camera: -

Model	RunCam Phoenix Oscar Edition
Image Sensor	1/3" 120dB WDR Sensor
Horizontal Resolution	1000TVL
Lens	2.5mm (M12) FOV140° (4:3)
Signal System	4:3 / 16:9 switchable
Mirror/Flip	Available
Signal System	PAL / NTSC Switchable
Integrated OSD	Yes
S/N Ratio	>50dB (AGC OFF)
Electronic Shutter Speed	Auto
Auto Gain Control (AGC)	Auto
Min. Illumination	0.01Lux@1.2F

WDR	D-WDR
Day/Night	Color/Auto/B&W
Menu Control	Cable Control / Remote Control Switchable
Power	DC 5-36V
Current	220mA@5V 120mA@12V
Housing Material	ABS
Net Weight	9g
Dimensions	19mm*19mm*20mm

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FPV GOGGLES

Flying using FPV drone goggles is a terrific experience. To have the best flying experience, it is important to choose the best FPV glasses, which are correct for you.

It is important to fly using the correct drone goggles for your eyes. If you choose an incorrect fitting FPV headset, then you won't enjoy the experience as much as you should. Most drone goggles on the market now have many adjustable settings and are very comfortable.

About Our FPV goggles: -

Brand Name: EACHINE
Item Name: EV800D

Appearance	Dimension: 180*145*82mm Weight: 362g without antenna Belt: three-way adjustable belt
Specification	Build in DVR Record up to 720*576px full frame rate video, no frame lost (C10 card required) Re play in MENU Require C10 card to record full frame rate
Diversity	-90dB Super sensitiveness in 2pcs RX5808 PRO modules Great performance when two types (Linear and Omni) antennas are used
Display	Screen size: 5.0 inch Screen resolution: 800*480(No blur after enlarging by the lens) Screen brightness: 600cd/m2 with special high brightness backlight LED for outdoor FPV Ratio: 16:9, 4:3 View Angle: 140/120 degree (Horizontal/Vertical)

Lens	3x boost of the video to acquire intense feel-in-there video; 92% transparent rate distorts if light;
Battery	Built-in 7.4V/1200mAh battery; Each battery circle offers around 2hr working time; 10-22V wide range recharging voltage range, typical recharging voltage is 12V Charger: 12V,2A, DC 2.5mm 2S (7.4 V) /3S (11.1V) battery as back-up power t to have long working time.

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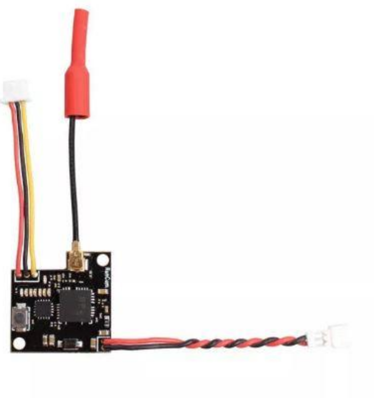
VTX



VTX stands for video transmitter, it's an essential part of an FPV system. It's a device that sends the video from FPV camera to a video receiver, which can then display it on a monitor or FPV Goggles. **VTX** can use many different frequencies, such as 1.2Ghz, 2.4Ghz etc.

About Our VTX: -

Model	RunCam TX200U
Frequency Channel	5.8G 48CH
Output Power	25mW / 200mW
Working Current	5V@150~400mA
Voltage out	5V@max 250mA
Voltage in	1S 3.5-5.5V
Video Input Impedance	75 Ohm
Antenna	U. FL 5.8G 2dB Omni antenna
Weight	2.5g (with antenna)
PCB Size	19mm*19mm

DRONE PERFORMANCE

- FPV camera with a horizontal resolution of 1000TVL
- The video from the FPV camera is directly stored in the FPV goggles on an SD card for future playback.
- The Blackbox built into the flight controller stores flight logs for troubleshooting
- Transmitter with a range of 500m
- Power to weight ratio is 4:1
- Maximum pick up load is 500g
- Flight time of 5-8 minutes
- The drone can survive a drop of 13 feet while maintaining structural integrity.

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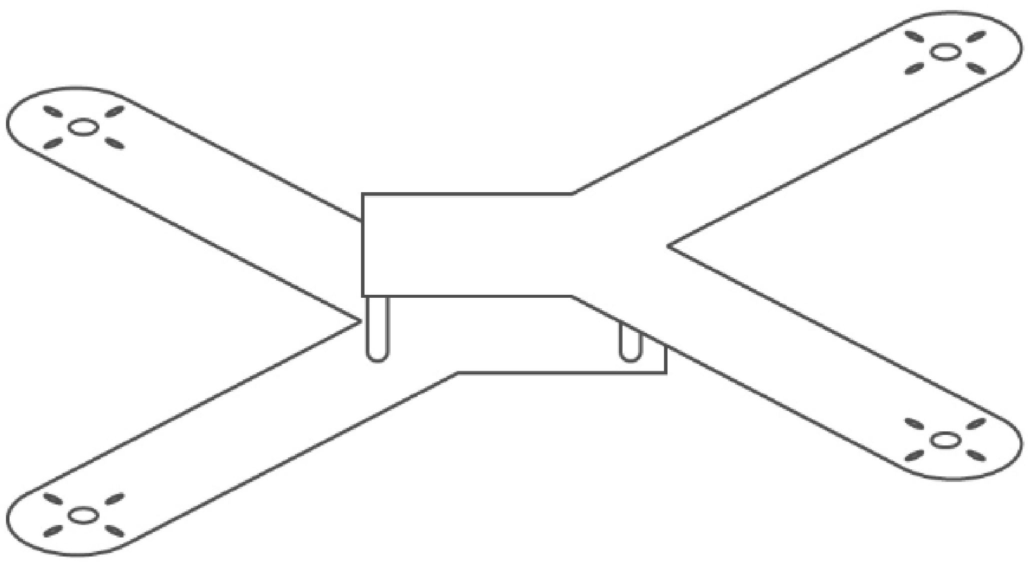
Z-Type Frame



Z

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A Z quad uses two similar base plates mounted on top of each other to produce a stepped geometry between the front and rear motors. Mounting the motors on different planes improves the prop wash handling of the quadcopter, as less turbulent air is directed towards the rear motors during forward flight.

DFMA (Design for Manufacturing and Assembly)

DFMA stands for Design for Manufacture and Assembly. DFMA is the combination of two methodologies; Design for Manufacture, which means the design for ease of manufacture of the parts that will form a product, and Design for Assembly, which means the design of the product for ease of assembly.

Usage

DFMA is used as the basis for concurrent engineering studies to provide guidance to the design team in simplifying the product structure, to reduce manufacturing and assembly costs, and to quantify improvements. The practice of applying DFMA is to identify, quantify and eliminate waste or inefficiency in a product design. DFMA is therefore a component of Lean Manufacturing DFMA is also used as a benchmarking tool to study competitors' products, and as a should cost tool to assist in supplier negotiations.

How our design aids ease of manufacturing: -

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- Process Independence: Each manufacturing process of each module has fewer dependencies on the processes of external components. This requires that the manufacturing processes (including all tasks) that a module undergoes are independent of the processes undergone by external components and modules. Once again, any dependencies that do exist are minimized in number and criticality. Processes independence allows for the redesign of a module in isolation in the manufacturing process of a product should change.
- Minimized number of sharp corners: This reduces the stress concentration and chances of injury from sharp corners.
- Standard holes: - Standard holes were drilled so that we won't need to design custom fasteners.
- Integrated parts: - The parts were chosen in such a way that it helps in reducing material cost and saves time in design phase, like hybrid boards.

How our design aids ease of assembly: -

- Standers parts (fasteners) were used and minimized the different sizes in screws so that there will be no confusions in selecting screws for different parts.
- Integrated components were used, in our drone we use a flight controller which functions as a power distribution board too, this scan save a lot of time in the assembling process
- No partial holes were drilled for the ease of combining different modules and to avoid possible vibrations

DFAM: - Design for Additive Manufacturing

It is a general type of design methods or tools whereby functional performance and/or other key product life-cycle considerations such as manufacturability, reliability, and cost can be optimized subjected to the capabilities of additive manufacturing technologies.

This concept emerges due to the enormous design freedom provided by AM technologies. To take full advantages of unique capabilities from AM processes, DFAM methods or tools are needed.

DFAM is implemented in our drone in the following ways: -

Topology Optimization

After simulation of our drone we redesigned the geometry in such a way to reduce material but maintain the required properties. This helped in reducing material required, cost and time for manufacture. In our drone we reduced the thickness of the base plate from 7.5mm to 5mm after simulation.

Design for Customization

Mass Customization refers to the possibility to evolve from already existing systems to the novel ones that can be personalized, without major increase in cost and causing the new technologies to emerge.

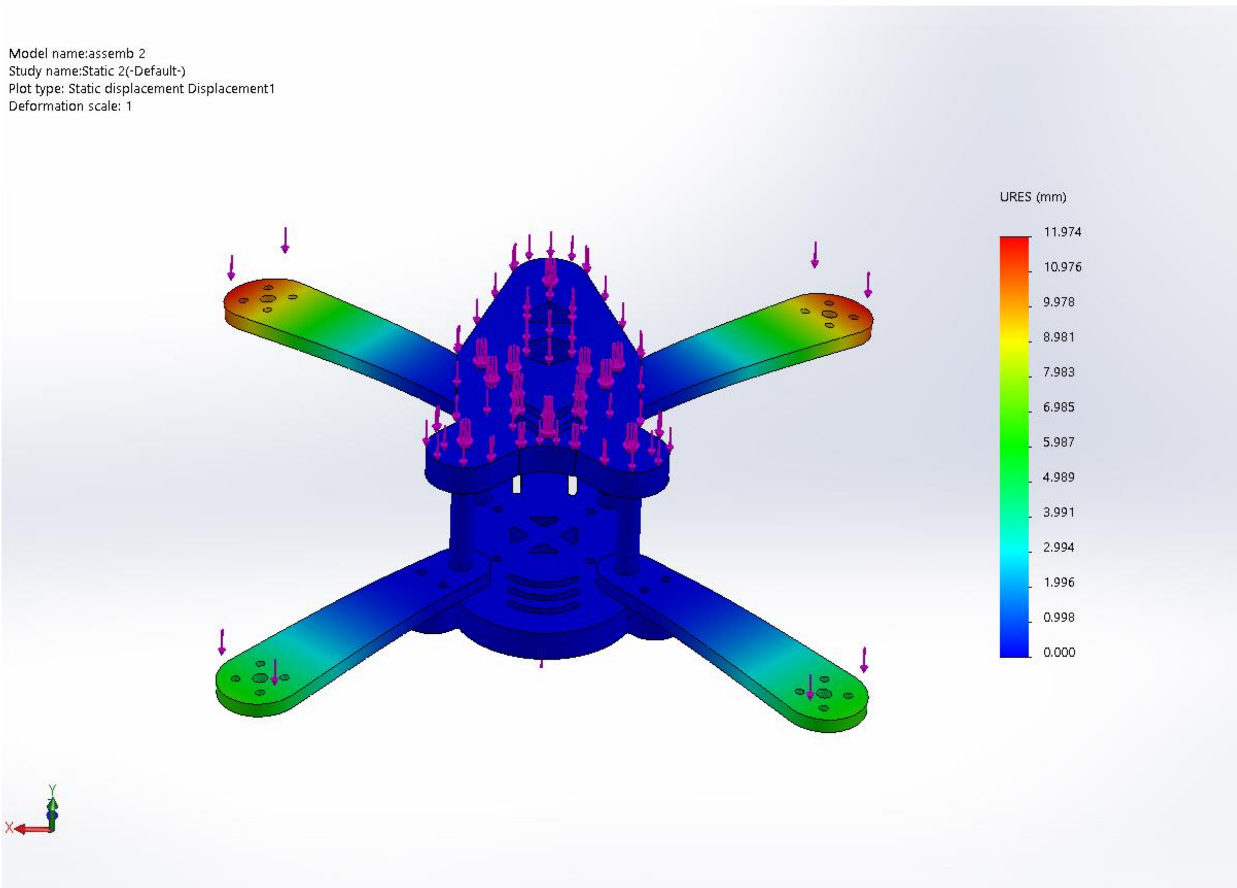
The drone arms are printed as modules so that we can customize the drone in future by making the arms foldable.

Parts consolidation

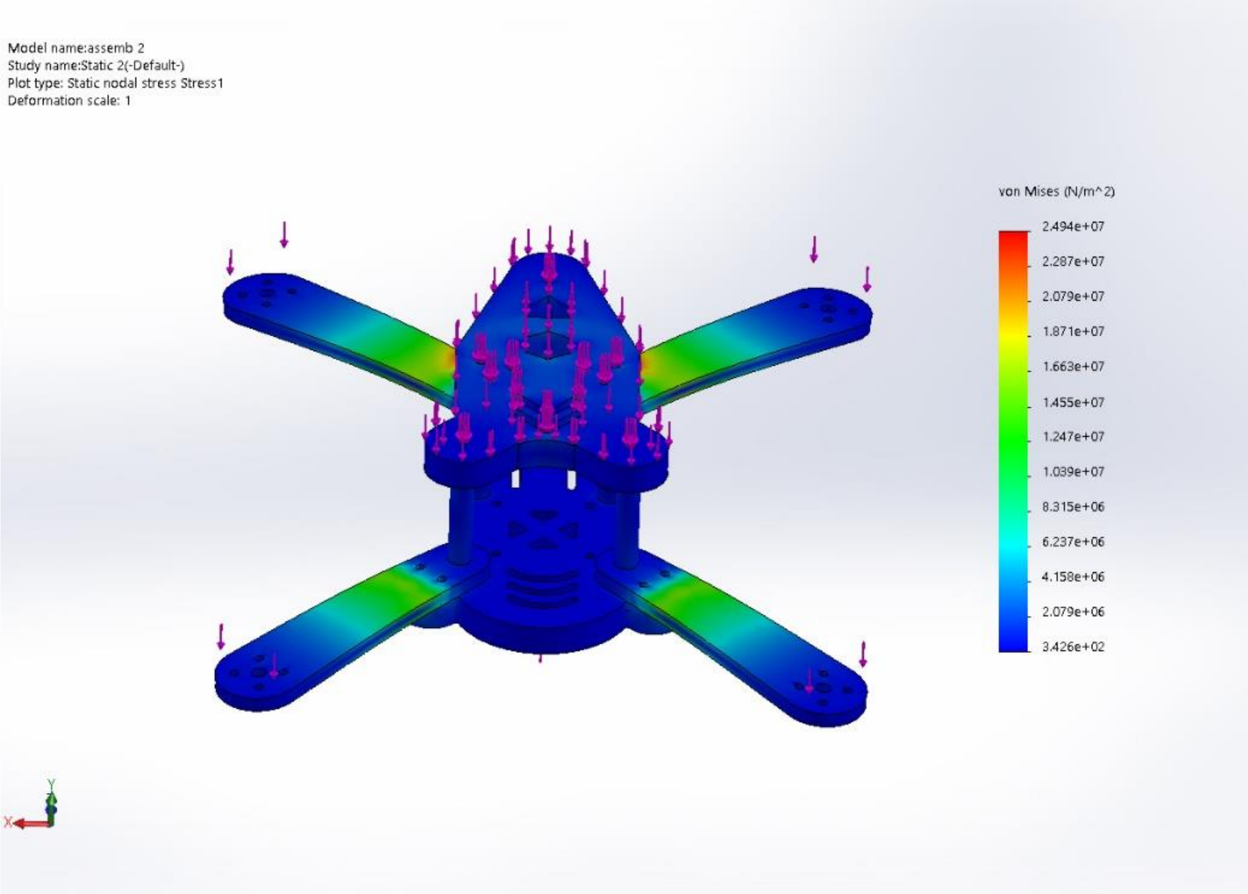
Parts consolidation offers numerous advantages as it reduces the number of parts that need to be designed and manufactured into the final assembly.

In our drone the arms and the supporting poles between the top and bottom plate are integrated into a single unit and thus we consolidated the number of parts which in turn helps in the ease of assembly.

STRUCTURAL SIMULATION



Static Displacement-Displacement



Static Stress-Stress

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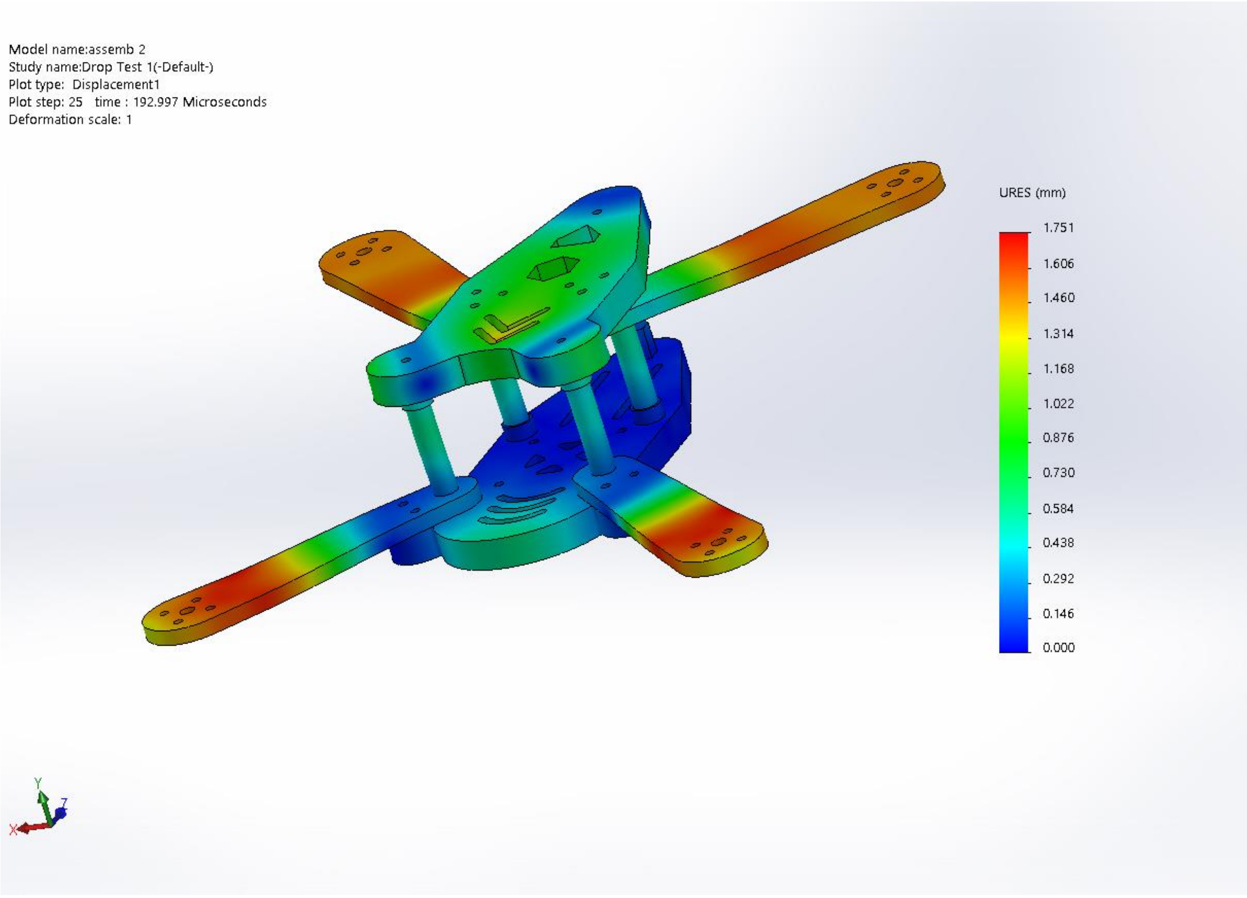
The above simulation is performed with the following forces

- 5kg(50N) force on each arm which indicates the maximum force that the arm may incur.
- 400g weight on the top plate which indicates the maximum force that the top plate may incur due to the battery
- 100g weight on the base plate which indicates the maximum force that the base plate may incur due to the components placed on it downwards (FC, PDB, Camera, etc.)
- 100g weights on the base plate which indicates the maximum force that the base plate may incur due to the payload and picking mechanism placed below it.

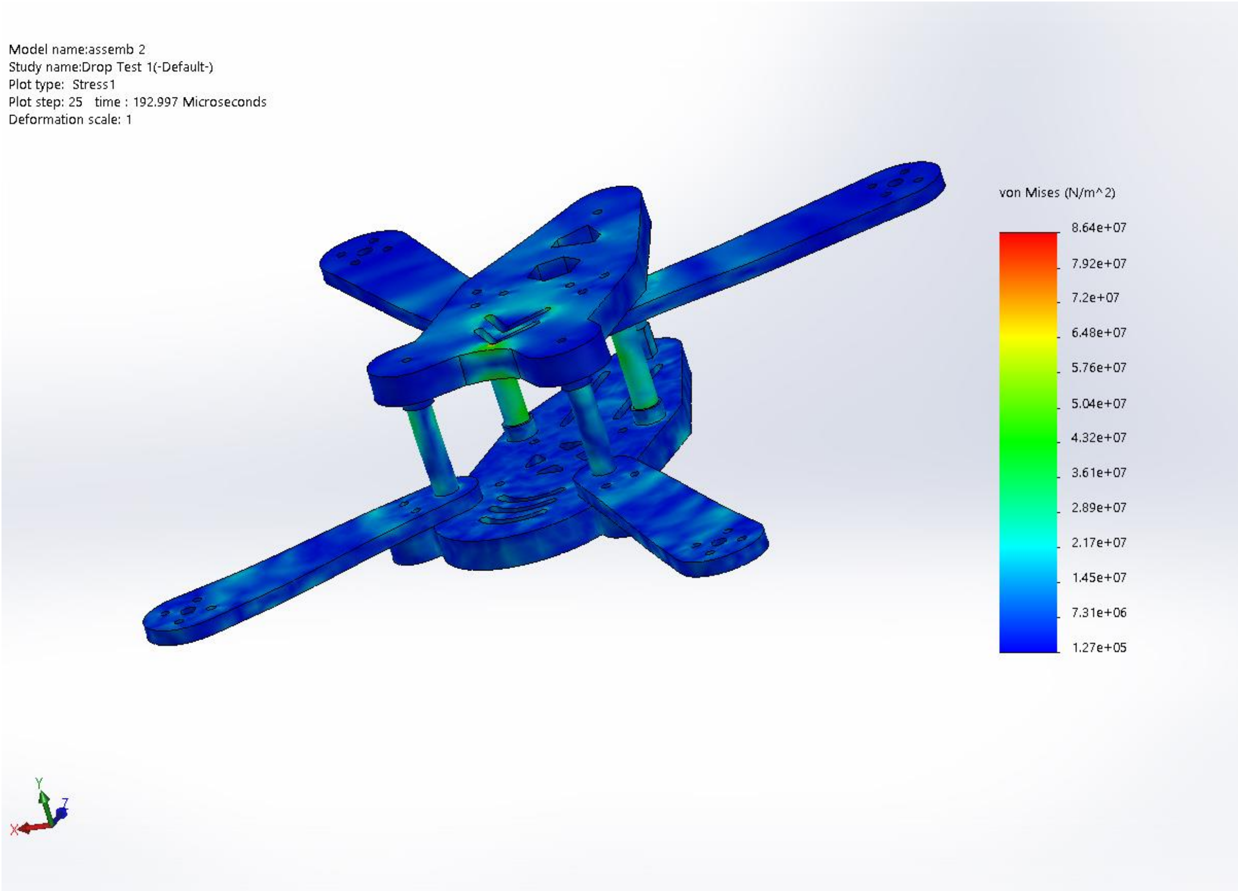
The following conclusions can be made from the following structural simulation:

- The drone arm is undergoing more than desired displacement and stress and therefore the thickness of arm is to be increased.
- The drone base has more mass than required and therefore should be reduced in order to get a factor of safety matching three.

DROP TEST



Drop test-Displacement



Drop Test - Stress

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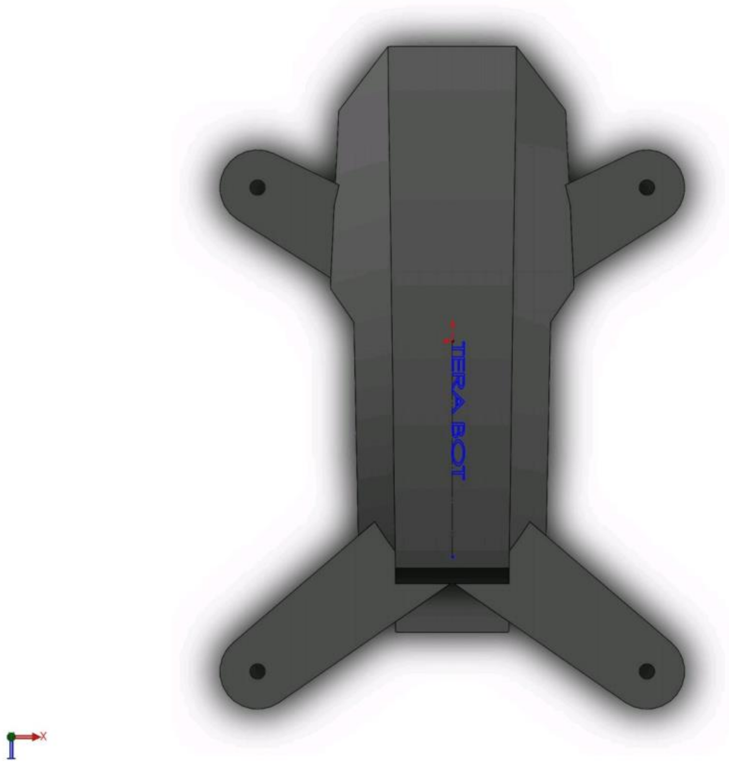
The drop test is performed in such a way that the drone is dropped from a height of 10 feet and it touches the ground at the lowest point of the base. The following conclusions can be made from this analysis

- The drone arm is undergoing more than desired displacement and stress and therefore the thickness of arm is to be increased.
- The drone base has more mass than required and therefore should be reduced in order to get a factor of safety matching three.
- The drone is able to successfully withstand a drop test of 10 feet with a maximum displacement of 1.75 mm displacement.

DESIGN ITERATIONS

ITERATION 1



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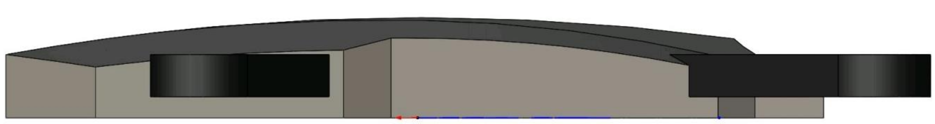
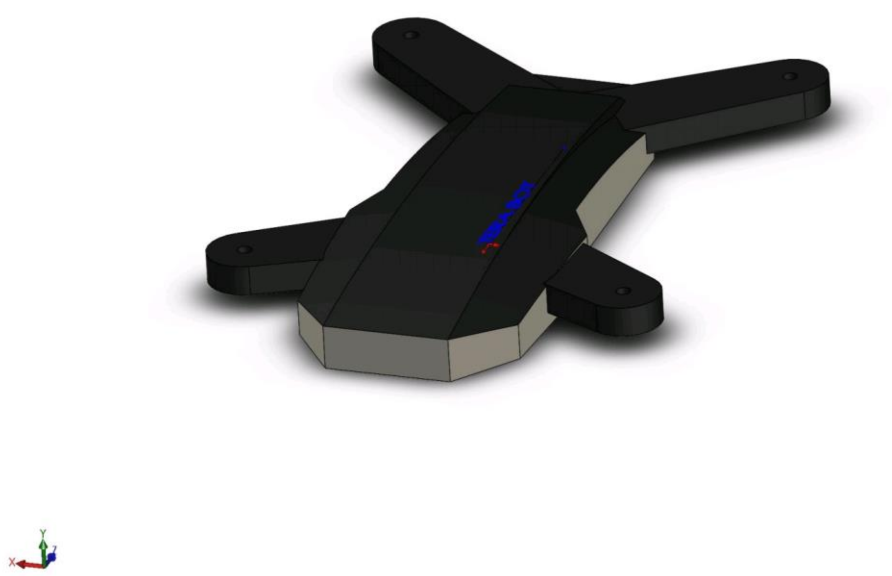
Iteration 1(Top View)

2



Iteration 1(left Side View)



Iteration 1(Isometric View)

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This design concept was created to get a greater understanding of Solidworks and was rather a minimalistic design but this design was not suitable for carrying payloads, moreover this design could not facilitate the FPV camera and a bigger battery. Hence, we decided to create a better design concept.

ITERATIONS 2

iteration 2(top view)

Iteration 2(folded arm)

Iteration 2(arms open)

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Iteration 2 had many exciting features like foldable arms but the design was not structurally strong especially at the joints of the foldable arm mechanism. This design also had a motor to motor distance of 370mm which exceeded the design constraints given in the ASME Rulebook.

Hence, we designed the current drone which takes into consideration the ASME Rule Book constraints as well as improves on the faults of the previous iterations.

PRECAUTIONS

- Before switching on the drone make sure the transmitter is on
- Do the receiver test (make sure the Aileron, Elevator, Rudder, Throttle, Aux pins are all set to zero)
- Check if all the motors are rotating with equal speed or not if you are increasing the throttle value
- Make sure that the Lipo battery is fully charged
- Lipo batteries are highly dangerous, there is a chance for it to explode if it is overcharged, so be careful while charging them.
- Make sure Lipo batteries are stored in safety bags.

CONCLUSIONS

Each component was tested and verified to be working as intended. Multiple simulations have been conducted and the results confirm that the quadcopter can fly in a stable manner.

We were successful in designing a quadcopter which can carry a payload with the aid of a unique pick up mechanism that we developed. We were able to successfully optimize the flight time of the drone by reducing the materials used, choosing the right parts, etc.; while following the ASME Rulebook.

In the process of completing this project, we were able to acquire many useful skills such as the ability to design and simulate in Solidworks. We learned important soldering and electric system fabrication skills including making a power harness and digital to analog motor control. We were also able to learn more about additive manufacturing and dive deeper into the world of FPV Drone Racing.

As a team we were able to successfully subdivide crucial tasks among team members to achieve the goals, keeping in mind the constrains and the time limits.

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