

TA201A
Manufacturing Processes-I

Final Presentation
Section: W2 Group: 2

PROJECT TITLE: QUADRUPEd ROBOT

Course Instructor: **Dr. Shashank Shekhar**

Tutor: **Shikhar Jha**

TAs: **Sushrita Dash** and **Md Redad Mehdi**

Lab-in-charge: **I.P. Singh**

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GROUP MEMBERS

ROLL NO.	NAME
200760	RAJ VARDHAN SINGH
201025	SURYANSHU KUMAR JAISWAL
200658	P R ANAND MAHESH
200240	AYUSH DHINGRA
201011	SUHANI
200665	PARAMVEER SINGH CHOUDHARY
200007	AASTIK GURU
200529	KULDEEP GUPTA
200838	SAHIL SINGH

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to our Tutor - Shikhar Jha sir and our Lab Technical Personnel Mr. I.P. Singh for their support and instruction in this project. Their support and guidance were instrumental throughout the execution of our project.

We would also like to thank Professor Shashank Shekhar, Course instructor, for providing us with this opportunity to explore our creativity and design the whole process of manufacturing something through lab manufacturing processes.

We thank our TAs, Ms. Sushrita Dash and Mr. Md Redad Mehdi for their valuable guidance.

Any omission in this brief acknowledgement does not imply lack of gratitude.

WORK DISTRIBUTION

S.NO.	NAME	WORK CONTRIBUTION
1	RAJ VARDHAN SINGH	Fusion-cooling fan and its orthographic sketch;Contribution in Lab Report
2	SURYANSHU KUMAR JAISWAL	Fusion - the top outer part covering ,orthographic view of components, research ,contribution in Lab Report
3	P R ANAND MANEESH	Fusion- Design of the Motor, Orthographic and isometric views of components,research and contribution in Lab Report .
4	AYUSH DHINGRA	Fusion: the front part and its orthographic sketch,Contribution in Lab Report
5	SUHANI	Fusion:- Upper leg, Joint of Upper leg, Orthographic Views of these two + lower leg, joining disc, Contribution in Lab Report
6	PARAMVEER SINGH CHOUDHARY	Fusion:- Bottom leg, Bottom jeg joint ,Bottom leg joining disk,Leg Battery and Battery Joint , Assembly of Leg.Orthographic view of assembled leg.
7	AASTIK GURU	Fusion:-Middle plate of Inner Chamber and its orthographic sketch, Contribution in Lab report
8	KULDEEP GUPTA	Research on manufacturing materials,cost reduction technique and hardware description
9	SAHIL SINGH	Fusion and Orthographic views: Bottom Plate, Back Cover, Headlight, Side Covering, Battery Case; Assembly of the bot; Contribution in Lab Report

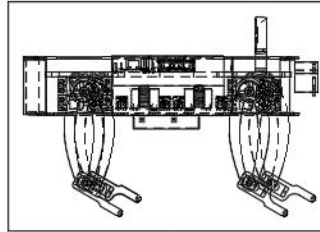
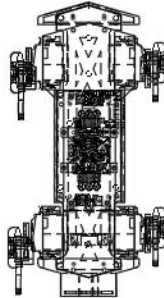
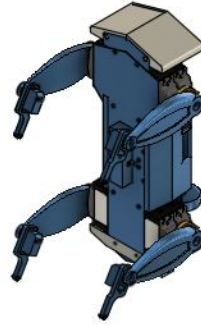
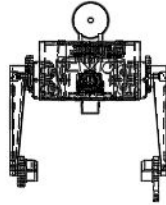
TIMELINE OF THE PROJECT

WEEK NO.	WORK DONE
Week 1	Discussion for project proposal
Week 2	Suggested 6 project ideas and finalization of idea after discussion with tutor, TAs and lab incharge
Week 3	List of parts and research on manufacturing processes for each of them. Started work on drawings
Week 4	Made orthographic and isometric drawings of each part and full assembly. Prepared 1st draft of the project report
Week 5	Final project report, Animation and Video presentation

O V E R V I E W

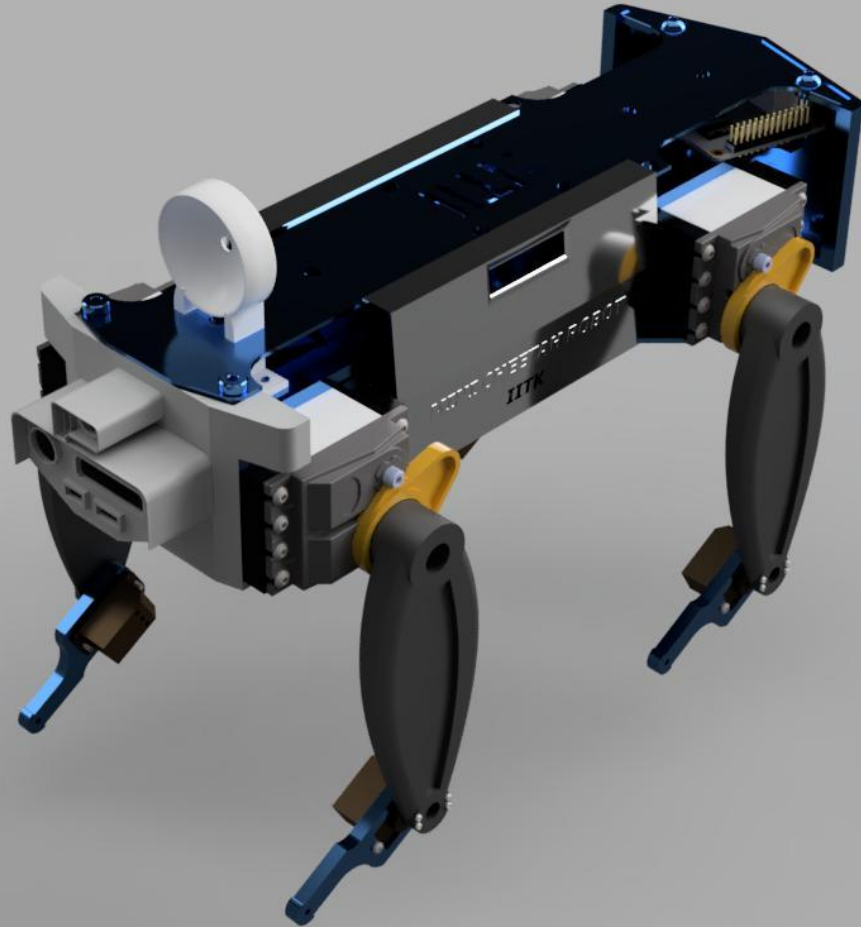
Drawing of the robot assembly

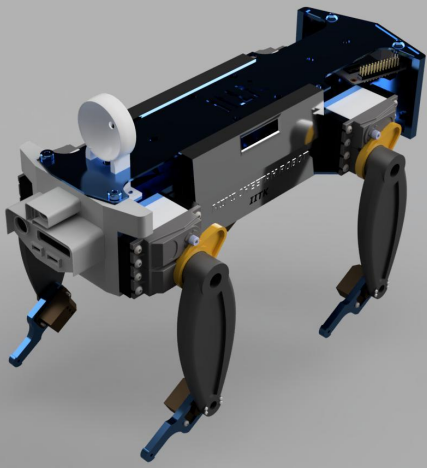
Overall dimensions of the bot = 321*165*175*mm



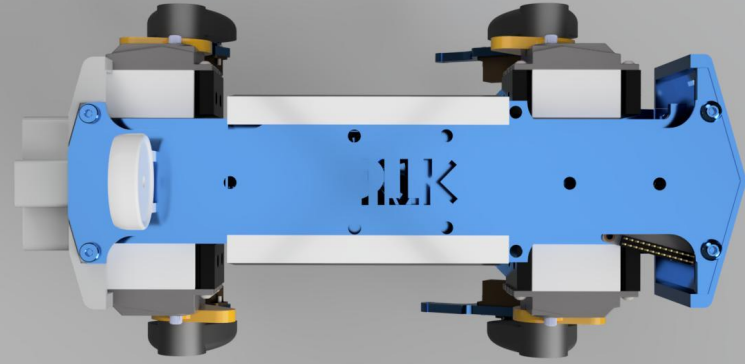
Dept.	Technical reference	Created by Sahil Singh	08-09-2021	Approved by
		Document type	Document status	
		Title inner chamber	DWG No.	
		Rev.	Date of issue	Sheet 1/1

RENDER



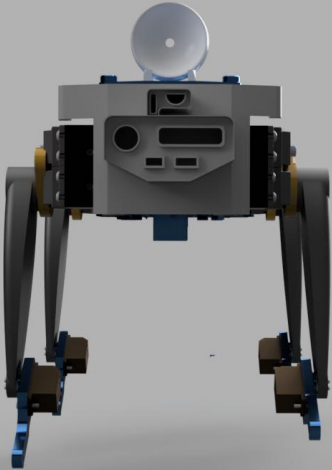


**ISOMETRIC
VIEW**

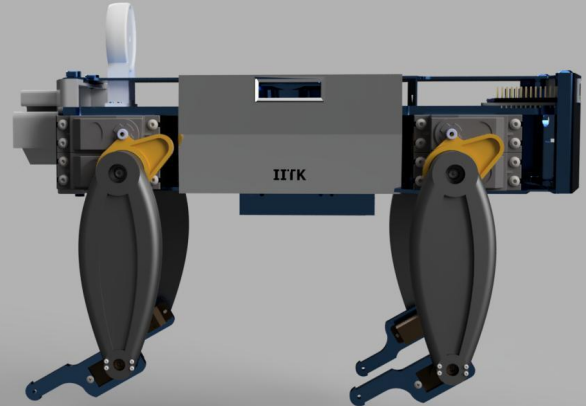


**TOP
VIEW**

VIEWS OF THE MODEL



**FRONT
VIEW**

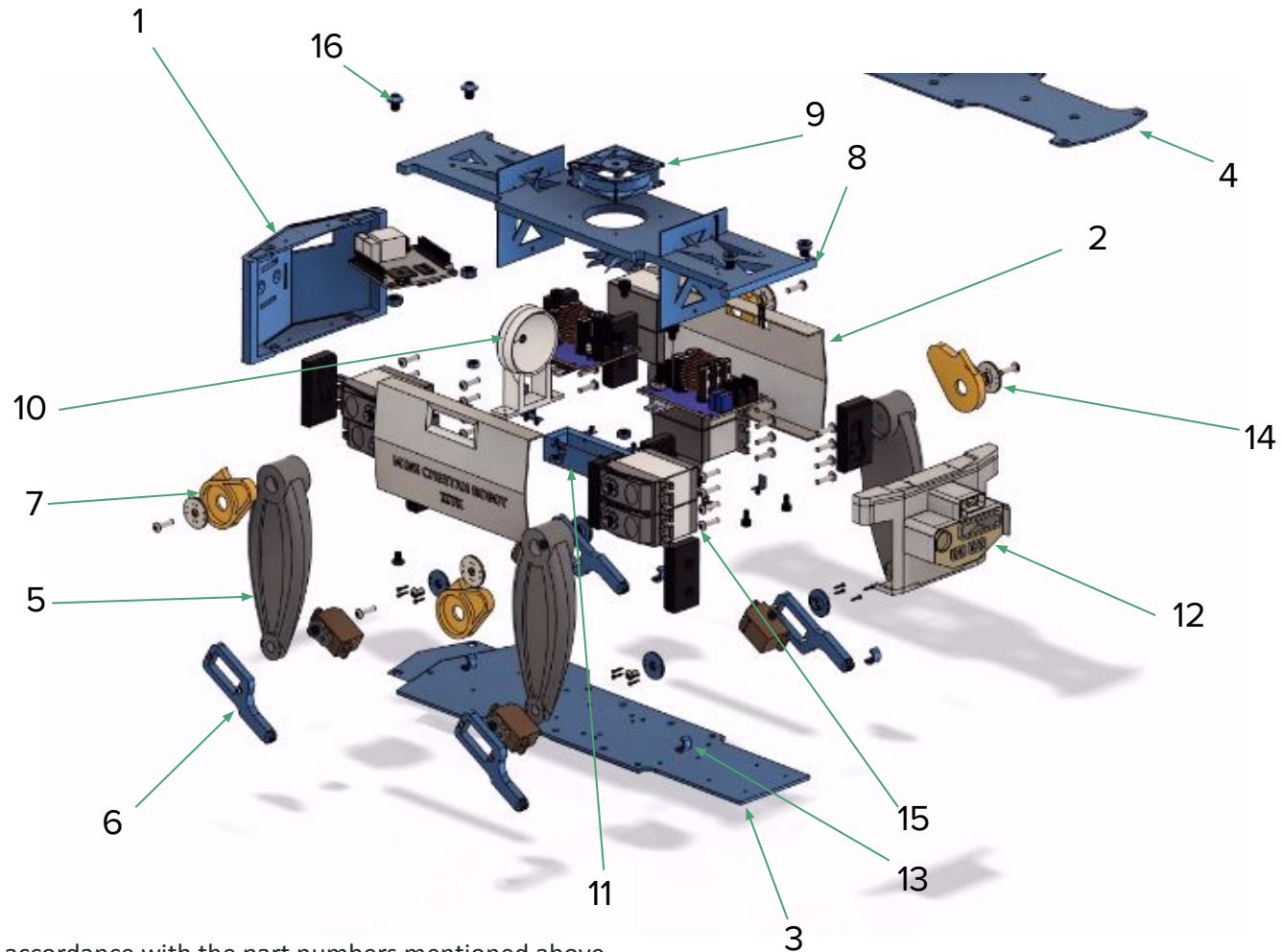


**RIGHT SIDE
VIEW**

LIST OF COMPONENTS

S. No.	Name of the Component	S. No.	Name of the Component
1	Back Cover	9	Cooling Fan
2	Side Covering	10	Headlight
3	Bottom Plate	11	Battery Case
4	Upper Plate	12	Front part
5	Upper leg	13	L Shaped Clamp
6	Lower leg	14	Joining Disc
7	Joint of Upper leg	15	Motor
8	Middle part of Inner Chamber	16	Nuts, Screws and Bolts

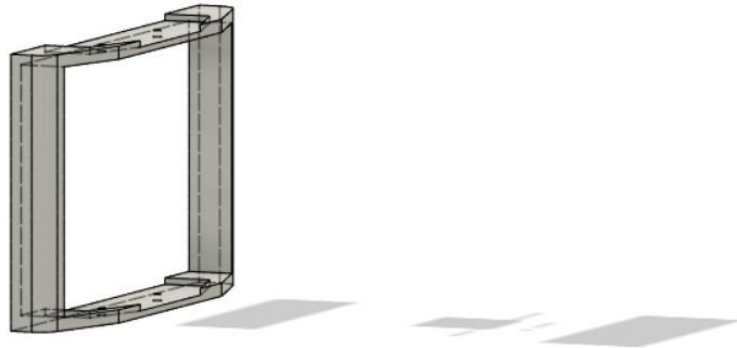
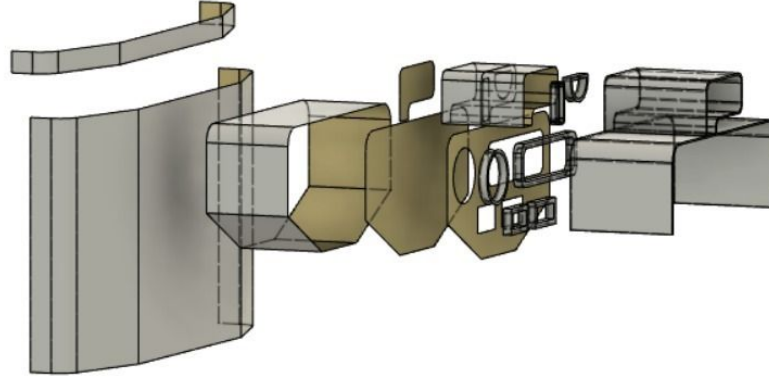
Exploded View of the Bot



Note: Labelling is done in accordance with the part numbers mentioned above

EXPLODED VIEW OF COMPLEX PARTS

Front Part



Assembly of a Single Leg

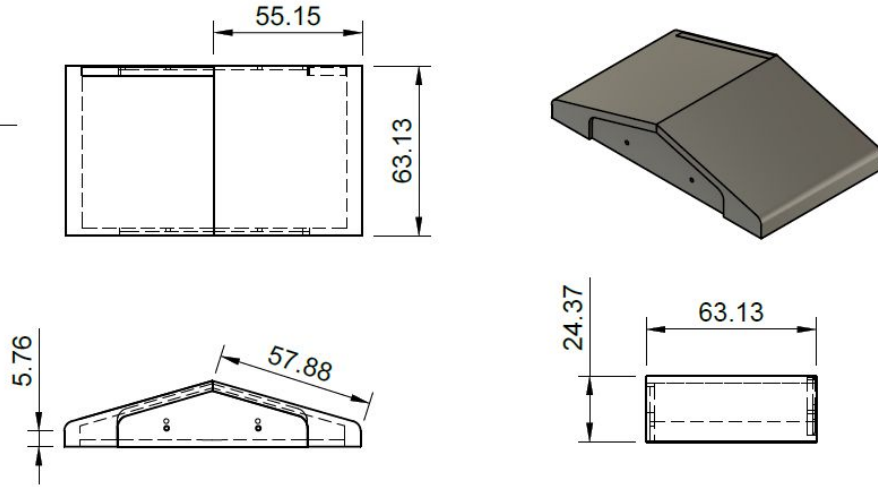


DETAILS OF **COMPONENTS**

NOTE: All the dimensions are in mm and scale is mentioned for each part

1. BACK COVER

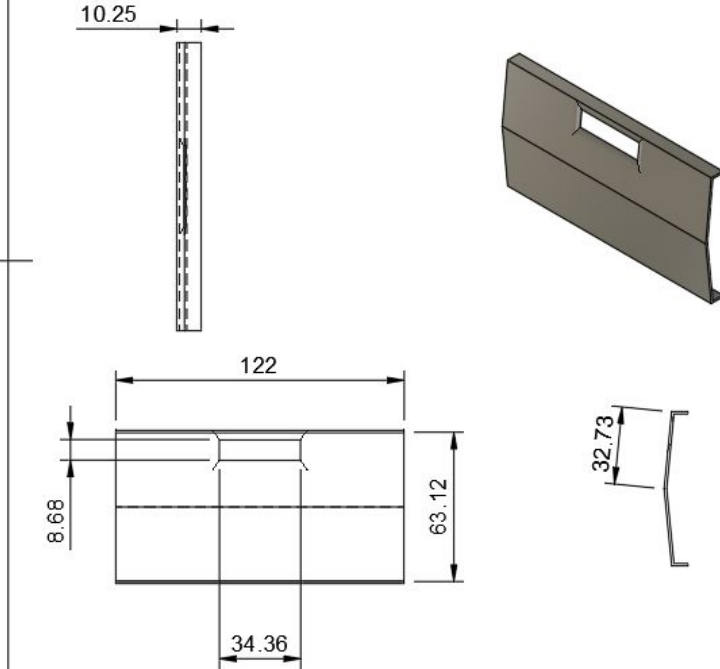
- It serves as the rear covering of the bot.
- It is connected to the rest of the body with the help of screws.



Dept.	Technical reference	Created by Sahil Singh 08-09-2021	Approved by
		Document type	Document status
		Title back cover	DWG No.
		Rev.	Date of issue
		Sheet 1/1	

2. SIDE COVERING

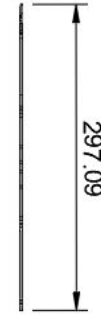
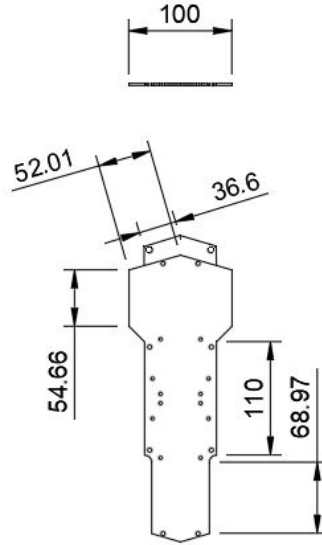
- This part covers the side portion of the bot.
- It is connected to the rest of the body with the help of screws.
- The cover has a rectangle cut in it so that the bot can be picked up easily by putting hands inside the cuts on both sides of it.



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		Document type	Document status	
		Title side part	DWG No.	
			Rev.	Date of issue

3. BOTTOM PLATE

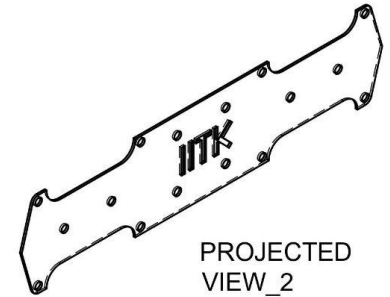
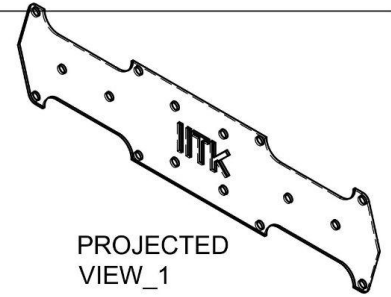
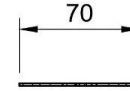
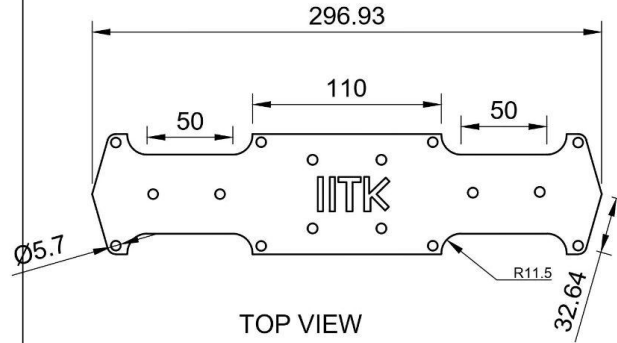
- Serves as the bottom support plate for the bot.
- It is joined to the rest of the body by screws.



Dept.	Technical reference	Created by Sahil Singh 08-09-2021	Approved by	
		Document type	Document status	
		Title bottom plate	DWG No.	
			Rev.	Date of issue
			Sheet 1/1	

4. UPPER PLATE

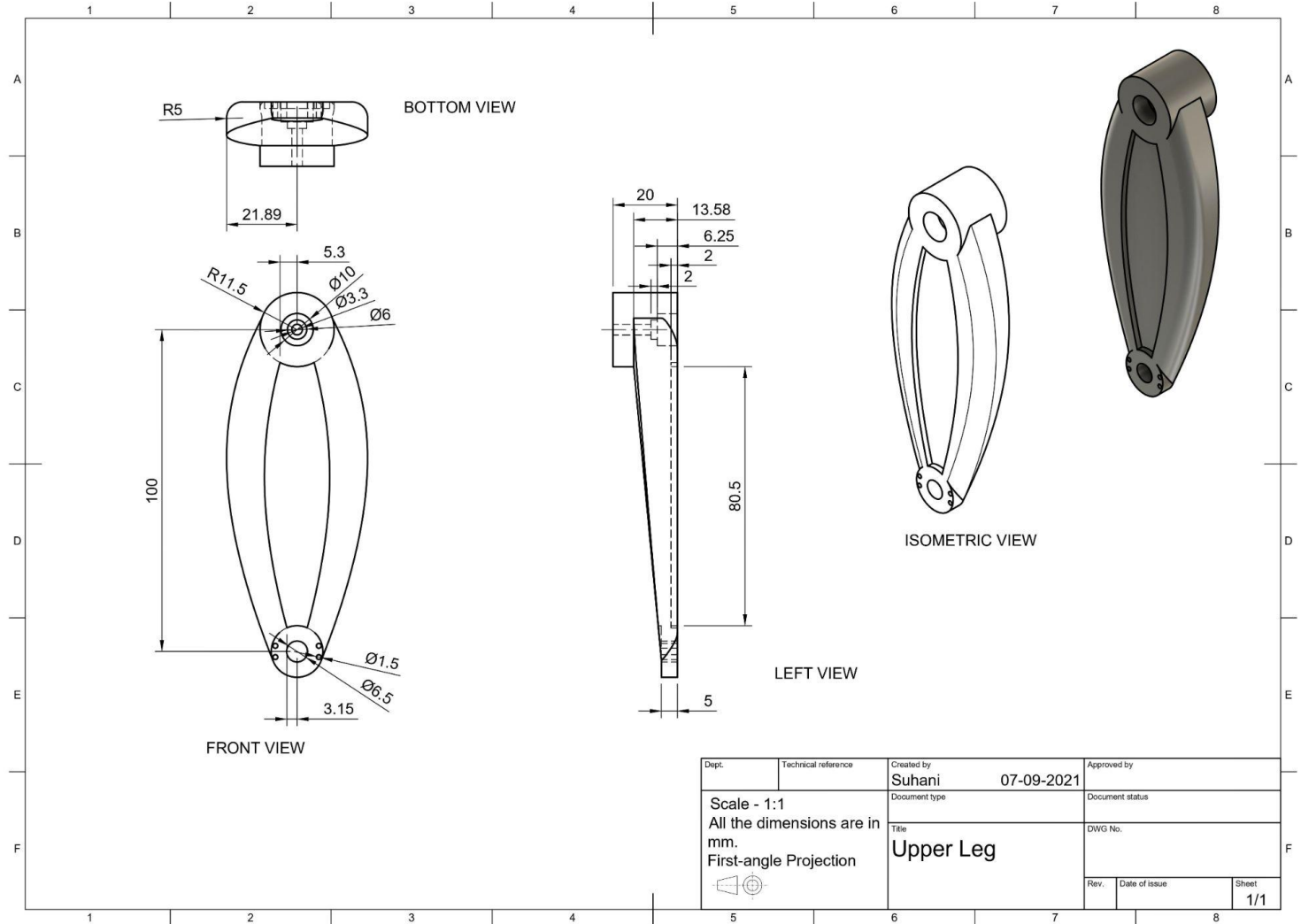
- Serves as the top most plate for the bot.
- It is joined to the rest of the body by screws.



Dept.	Technical reference	Created by Suryanshu kumar jaiswal 9/7/2021	Approved by	
		Document type	Document status	
		Title upper_part	DWG No.	
			Rev.	Date of issue
				Sheet 1/1

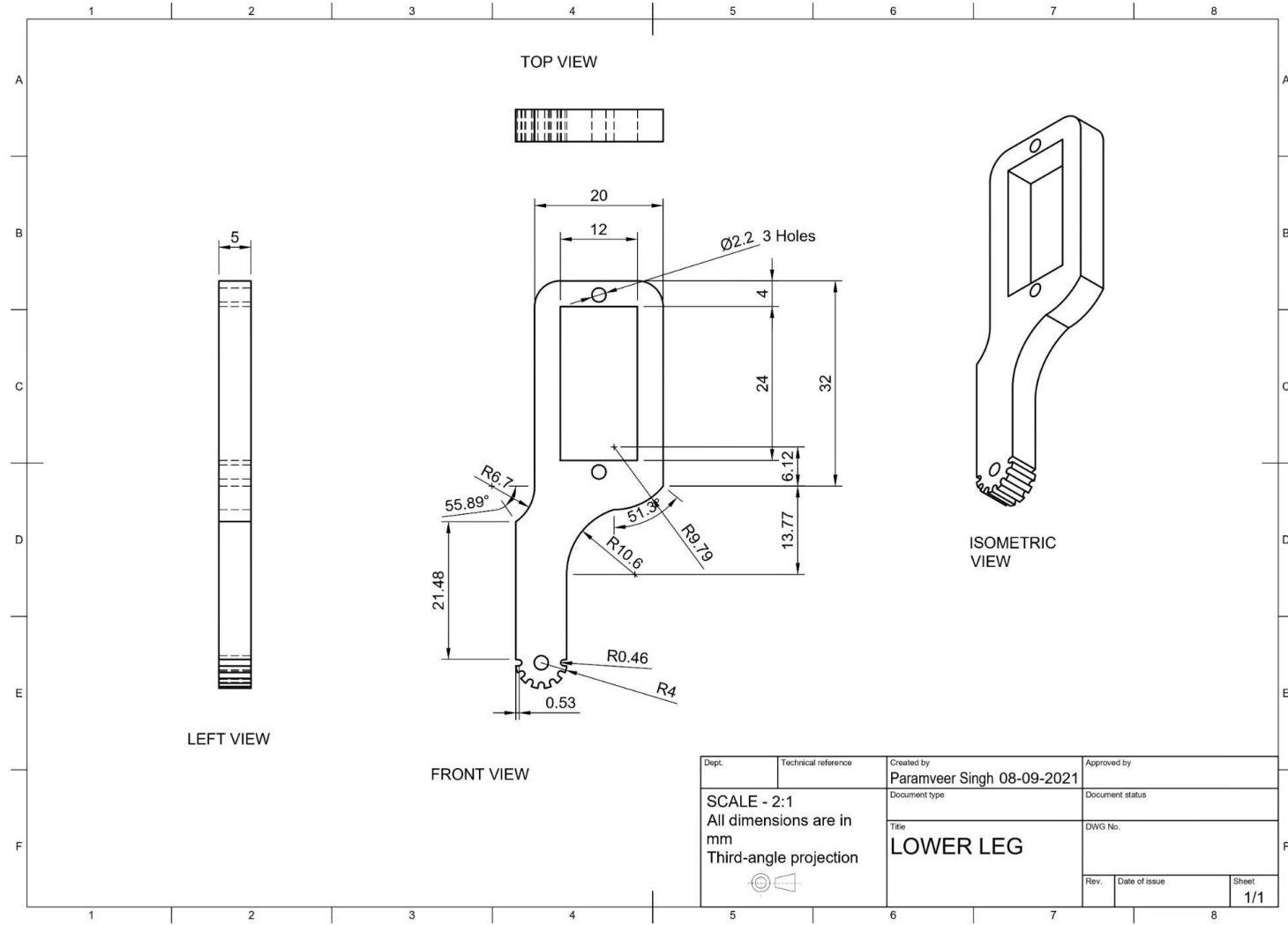
5. UPPER LEG

- It is joint to the upper body by a joining disc and a joint piece



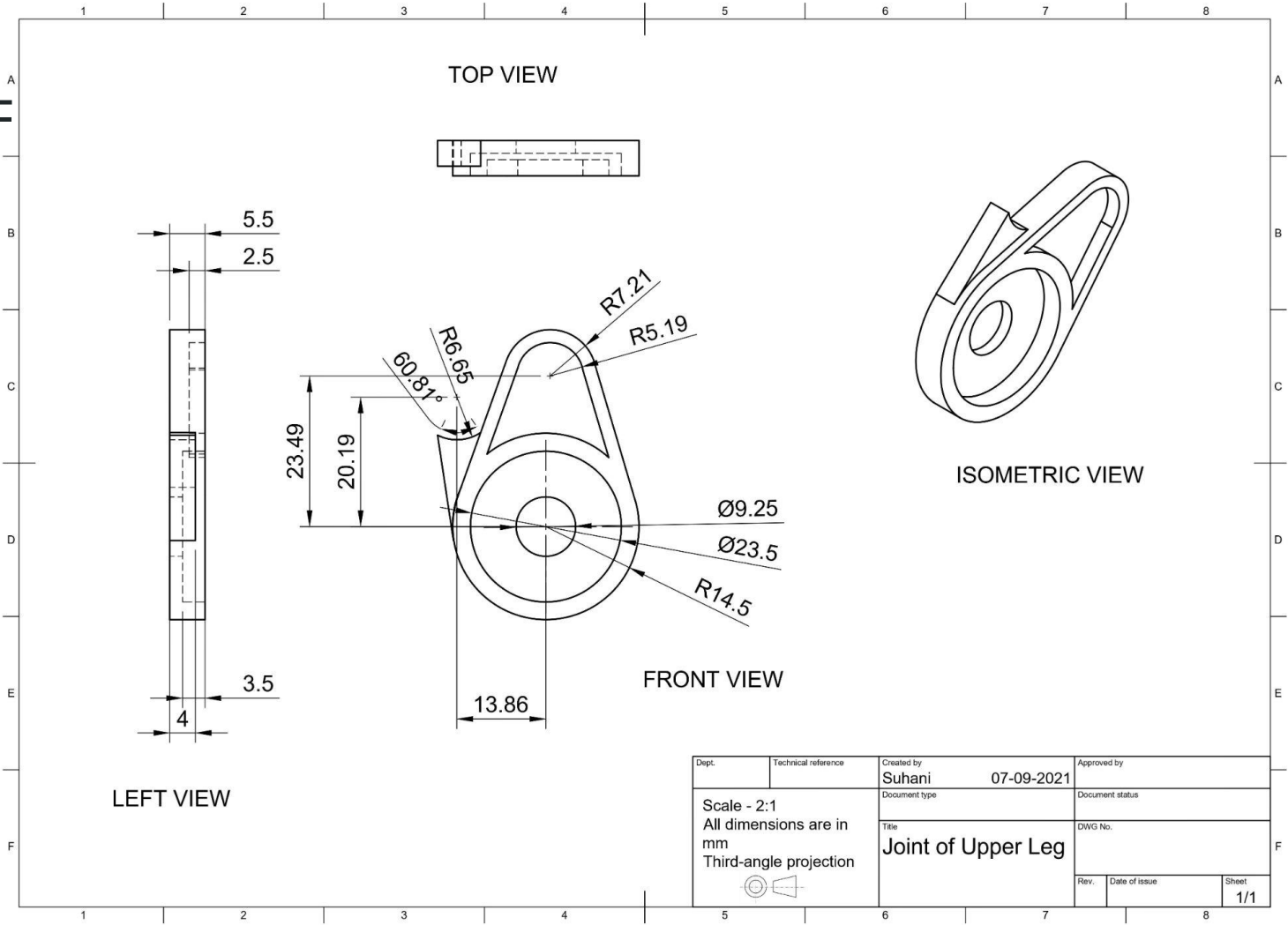
6. LOWER LEG

- Connects to a motor and the upper leg via screw joints.
- The feet is designed such that various moments of leg are possible.

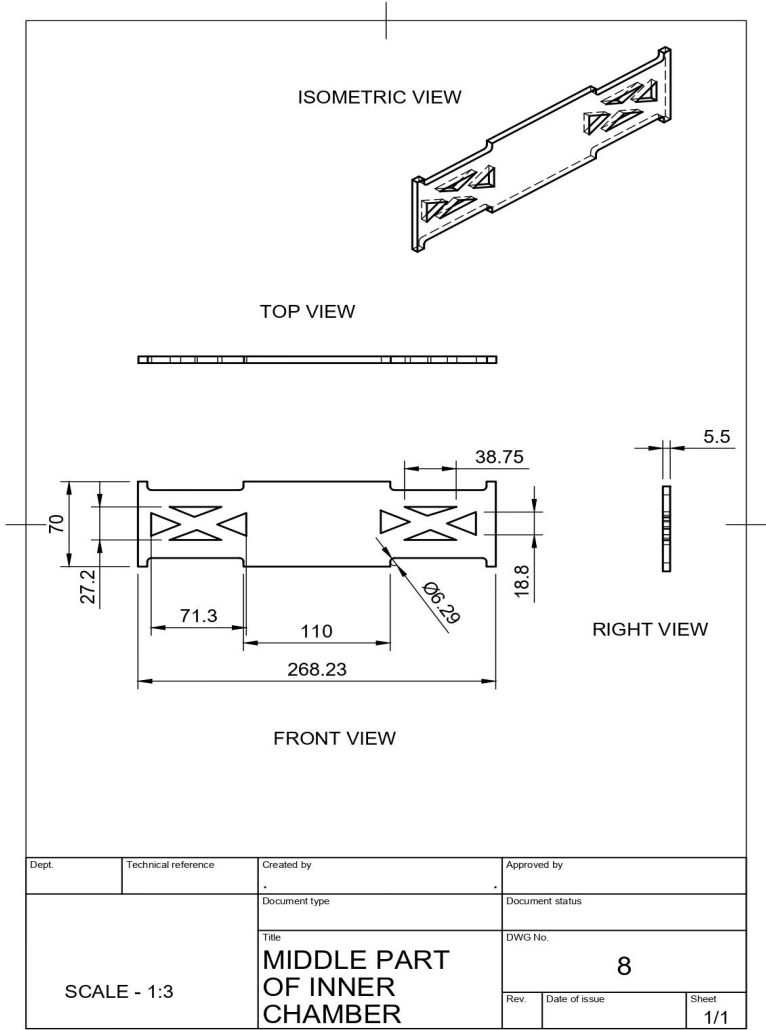


7. JOINT OF UPPER LEG

- Serves as the joint between upper leg and body connecting through a joining disc

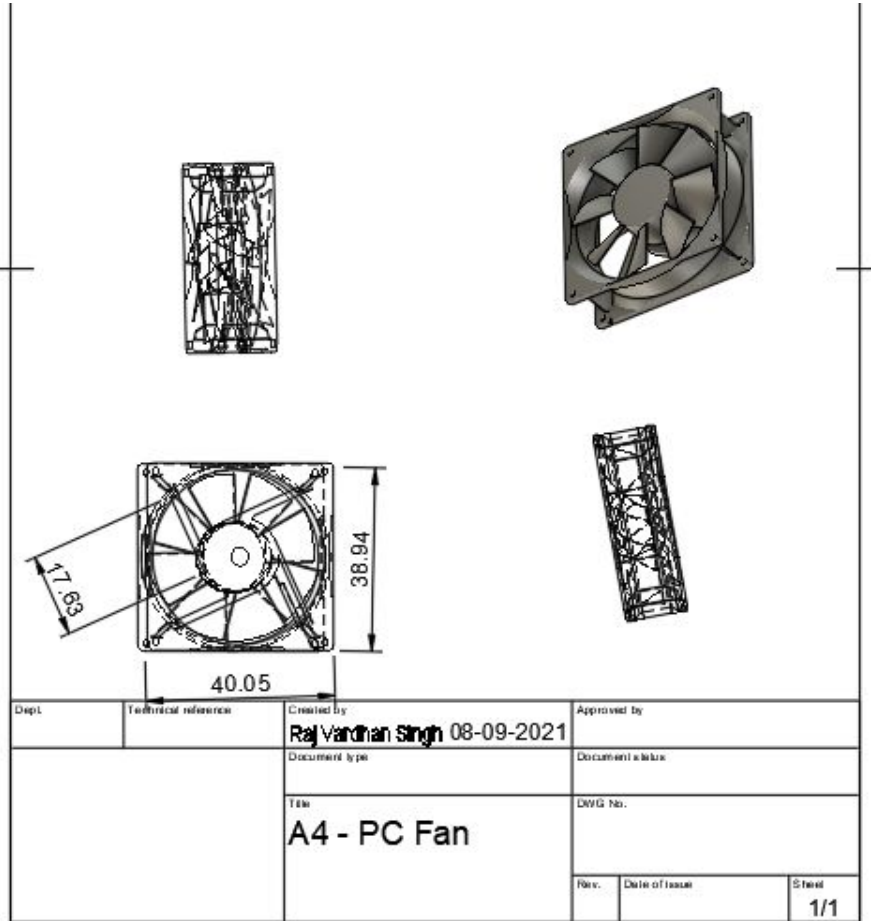


8. MIDDLE PART OF INNER CHAMBER



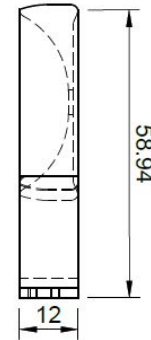
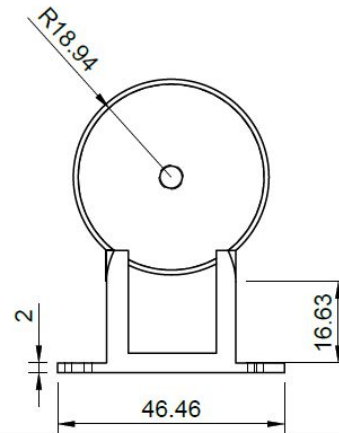
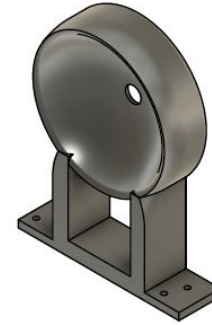
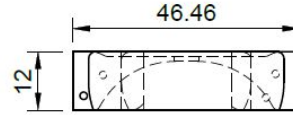
9. COOLING FAN

- The fan keeps the PCB circuit of the bot cool by blowing in air.



10. HEADLIGHT

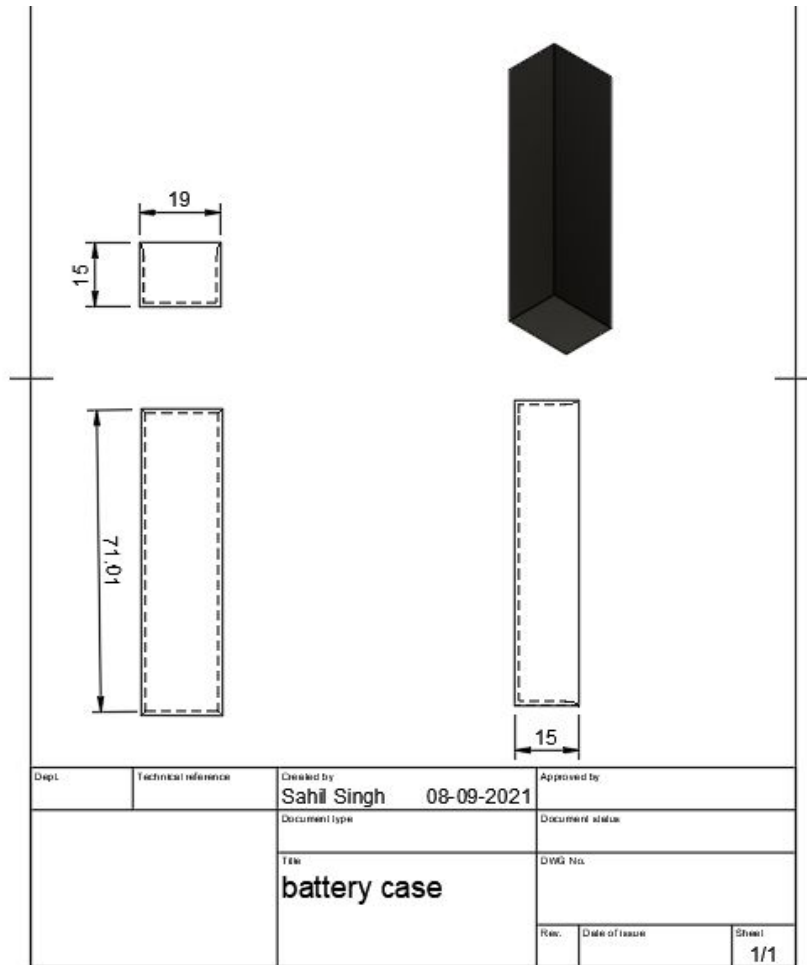
- It lightens up the bot's path by providing luminescence.
- The headlight frame is connected to the middle plate of the bot.



Dept.	Technical reference	Created by Sahil Singh	08-09-2021	Approved by
		Document type	Document status	
		Title light	DWG No.	
		Rev.	Date of issue	Sheet 1/1

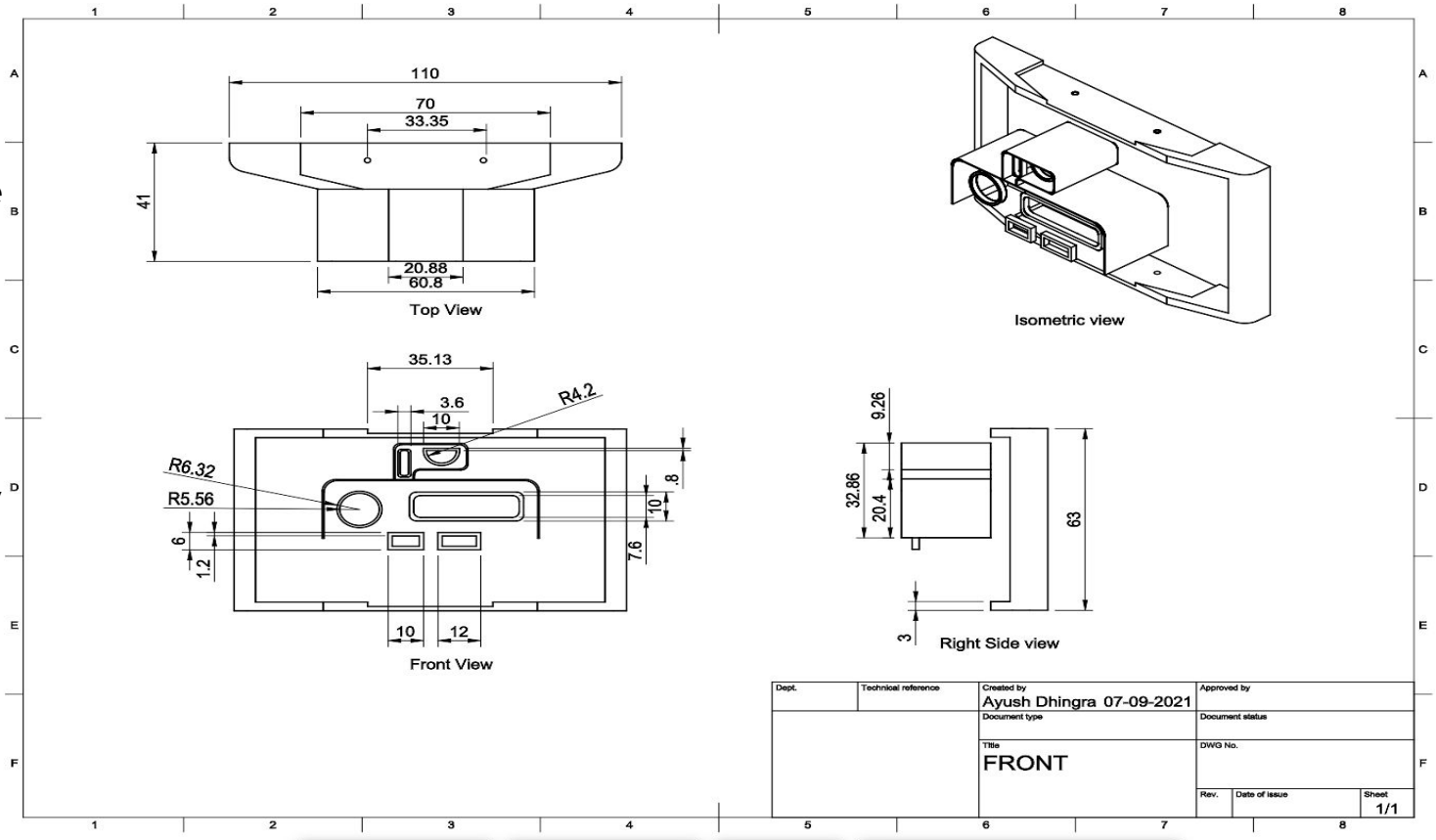
11. BATTERY CASE

- To reduce the wear and tear of the battery and reduce its heating, it is enclosed in a battery case.



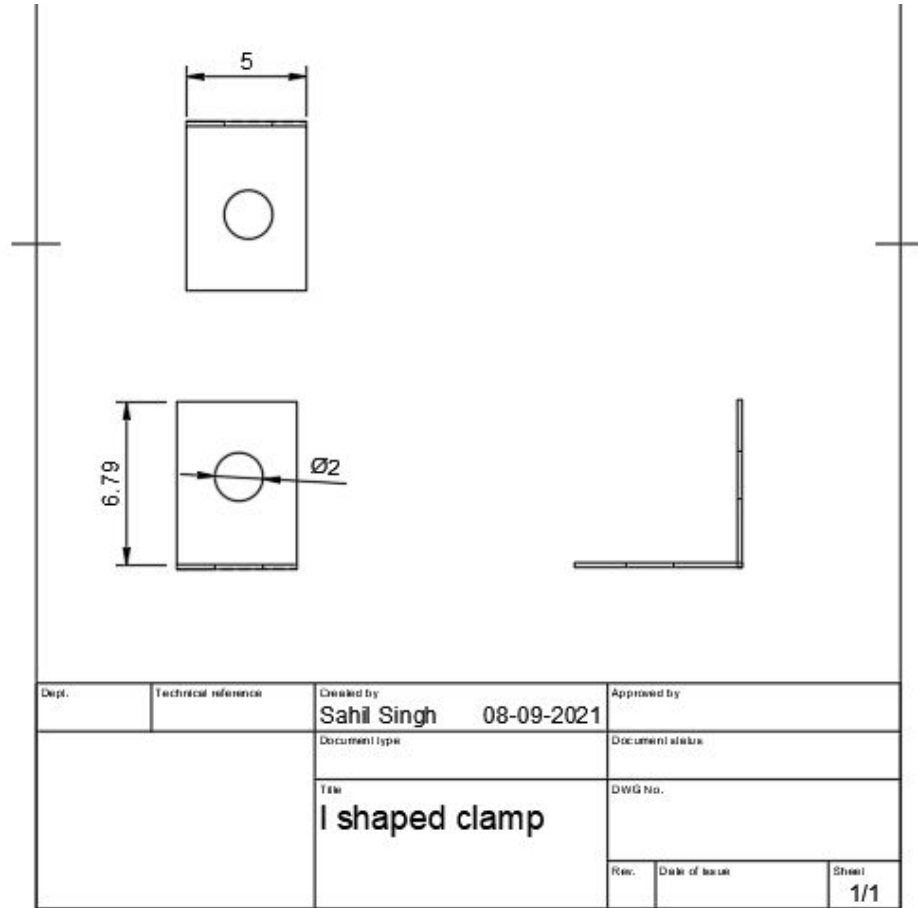
12. FRONT PART

- It will be the face of the bot and include camera sensors- LIDAR and Night sensor.
- It will also contain a display panel.



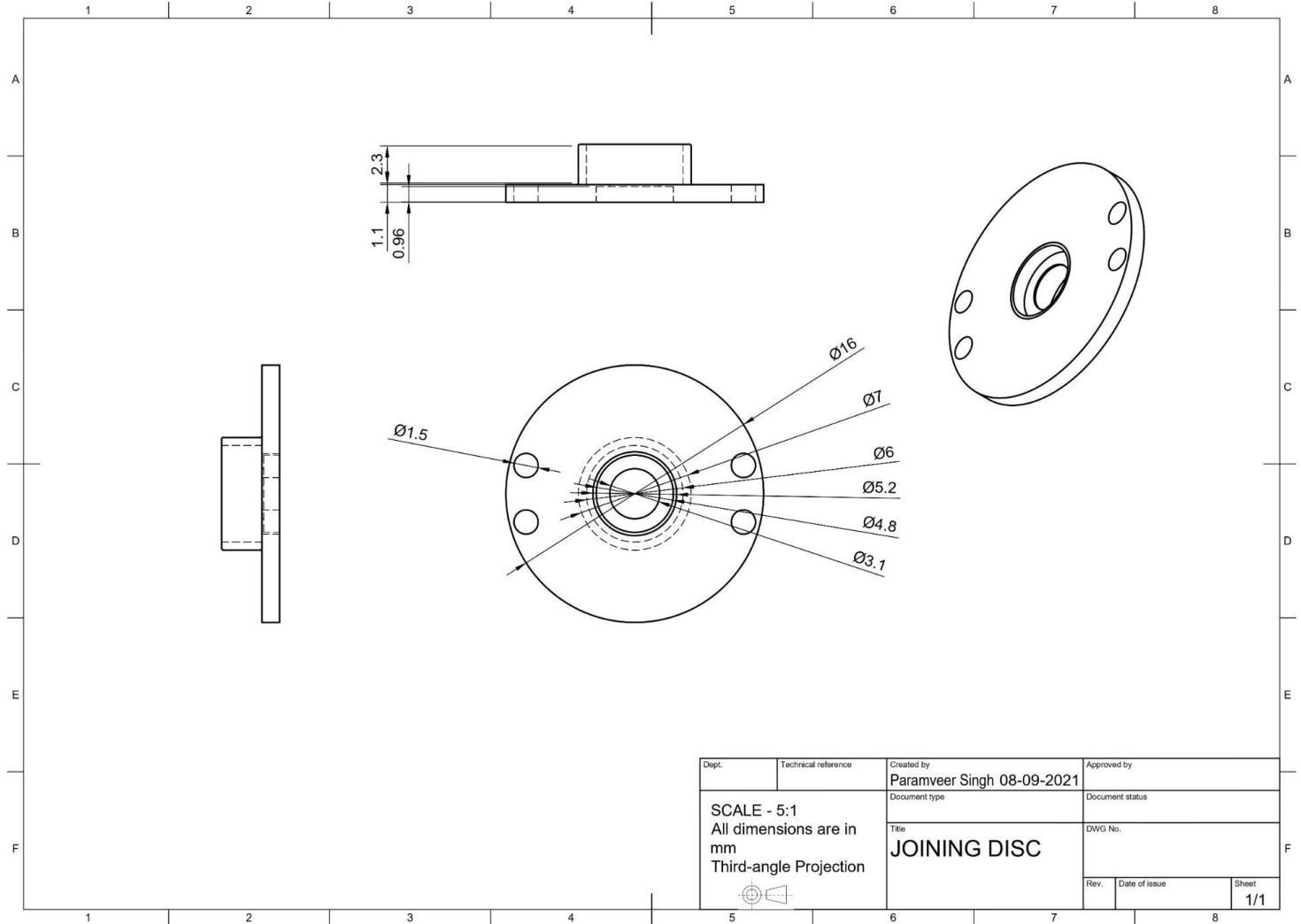
13. L SHAPED CLAMP

- This clamp is used to connect various parts of the bot with each other with the help of screws,



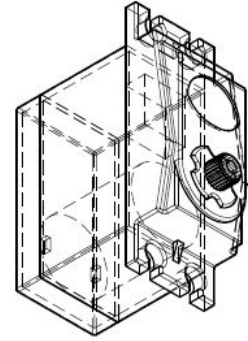
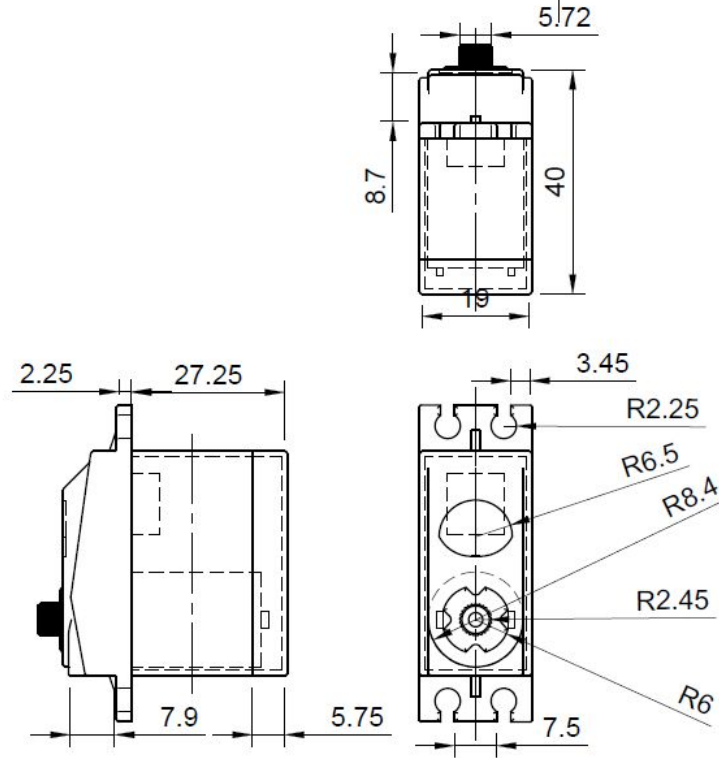
14. JOINING DISC

- This disc is used at two places in each leg.
- First, to join upper leg to motor.
- Second, to join upper leg, lower leg and motor



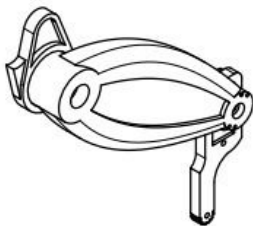
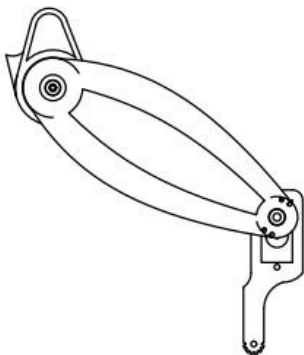
15. MOTOR

- It contains the actuator of the bot enclosed in a plastic frame, designed in such a way to ease the movement of the bot.



Dept.	Technical reference	Created by Anand Maneesh 08-09-2021	Approved by	
Scale -1:1 All dimensions are in mm Third Angle Projection		Document type	Document status	
		Title Motor v2	DWG No.	
		Rev.	Date of issue	Sheet 1/1

ASSEMBLY DRAWING OF A SINGLE LEG



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		Document type	Document status		
		Title LegAssembly	DWG No.		
			Rev.	Date of issue	Sheet 1/1

LIST OF COMPONENTS AND MANUFACTURING PROCESSES

S. No.	Name of the Component	Quantity	Material(s) used	Processes used	Joining Process
1	Back Cover	1	Steel	Sheet metal [Shearing, Bending and Drilling]	screws for joining
2	Side Covering	2	Steel	Sheet metal [Shearing, Bending and Drilling]	screws for joining
3	Bottom Plate	1	Steel	Sheet metal working	screws for joining
4	Upper Plate	1	Steel	Sheet metal [Shearing and drilling]	screws for joining
5	Upper leg	4	Aluminium for Casting	Casting and Drilling	Screws for joining
6	Lower leg	4	Aluminium for Casting	Casting and Drilling	Screws for joining
7	Joint of Upper leg	4	Aluminium for Casting	Casting	Screw and Adhesive

8	Middle part of Inner Chamber	1	Steel	Sheet metal shearing	Welding
9	Cooling Fan	1	Aluminium and Steel	Sheet metal bending	Welding
10	Headlight	1	Aluminium and plastic polycarbonate	Injection moulding	Welding and adhesive
11	Battery Case	1	Polypropylene resin	Cracking process	Adhesive and screws
12	Front part	1	Aluminium	Casting ,Sheet metal [Shearing, Bending and Drilling]	Screw and Adhesive
13	L Shaped Clamp		Mild Steel sheet	Sheet Metal Cutting and Bending	Screws
14	Joining Disc	4	Mild steel discs	Rolling, Drilling	Screws
15	Motor	8	Steel and Polypropylene resin	Sheet metal shearing and bending	Screws and Adhesive
16	Screws, Nuts and Bolts	60	Stainless steel	Forging and Threading	Nil

COST ANALYSIS

S.no.	Component	Dimension	Quantity	Material Cost (Rs)	Processing Cost (Rs)
1.	Back Cover	110.3x63.13x24.37	1	56.76	250
2.	Side Covering	122x90x1	2	7.24	200
3.	Bottom Plate	297x100x2	1	9.8	100
4.	Upper Plate	297x69.5x1.5	1	6.82	100
5.	Upper Leg	115x44x20	4	11.5	600
6.	Lower Leg	63x23x5	4	4	300
7.	Joint of Upper Leg	30 gm	4	30	100
8.	Middle Part of Inner Chamber	269x70x5.5	1	10.12	100
9.	Cooling Fan	Part 1: 40x40x14 Part 2: 132mm ² x 0.25mm	1	Part 1: 8 Part 2: 3	500

S.no.	Component	Dimension	Quantity	Material Cost (Rs)	Processing Cost (Rs)
10.	Headlight + Glass	Part 1: 47x25x12 Part2: 16336.28mm ³	1	Part 1: 2 Part 2: 10	100
11.	Battery Case	75x19x15	1	6.72	25
12.	Front Part	Volume= 14795.43 mm ³	1	16	400
13.	L-shaped Clamp	13.6x5x0.2	30	150	300
14.	Joining Disc	Volume= 724 mm ³	1	2	100
15.	Nut and Bolt	Multiple	60	300	

Electronic parts are mentioned below:

S.no.	Component	Dimension	Quantity	Material Cost (Rs)	Processing Cost (Rs)
16.	LiPo Battery		5	1750	
17.	Servo Motor		8	1500	
18.	PCB		2	1000	
19.	Socket Board		1	50	
20.	Light		1	50	

Total Material Cost of Manufacturing Parts = **Rs 533.96**

Total Processing Cost of Manufacturing Parts = **Rs 3175.00**

Total Cost of Manufacturing Parts = **Rs 3709**

Total Cost of Electronic Parts = **Rs 4350**

Overall Cost of the Bot = **Rs 8059**

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REFERENCES:

- <https://en.m.wikipedia.org/wiki/Aluminium>
- <https://en.m.wikipedia.org/wiki/Steel>
- https://www.researchgate.net/publication/329759867_MIT_Cheetah_3_Design_and_Control_of_a_Robust_Dynamic_Quadruped_Robot
- <https://en.m.wikipedia.org/wiki/Casting>
- https://en.m.wikipedia.org/wiki/Sheet_metal
- <https://grabcad.com/library/diy-quadruped-robot-1>
- Course content of TA201 (manufacturing processes-1).
- All designing and drawing are made through Fusion 360 software.

Thank
You