Project topic: Unmanned Tracked Reconnaissance Vehicle (UTRV)

Project members:

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Jog Desai	AU2040089
Jay Patel	AU2040014
Krish Panchal	AU2140086

What's an UTRV and why do we need it?

1. An Unmanned Tracked Reconnaissance Vehicle (UTRV) is essentially a robot equipped with tracks for mobility and specialised sensors for gathering intelligence. Imagine a tank minus the human crew loaded with high-tech gadgets, and you have the basic idea.

2. Its primary purpose is to gather information about enemy positions, movements, and activities.

3. It is packed with cameras and sensors to provide commanders with detailed visual and thermal even in darkness or through obstacles.

4. Think of a UTRV as a scout sent ahead of the main force, venturing into dangerous areas to provide vital intel without risking lives. They can operate continuously, offering 24/7 surveillance and giving commanders a crucial edge in making informed decisions.

How is it supposed to be used?

1. The UTRV is designed to be used in hostile environments where human lives are at risk.

2. It can be used both in urban and open fields.

3. It is meant to be deployed beyond enemy lines for days; hence, the solar panels are equipped to recharge the battery on the field.

4. The commander can control the UTRV from a safe distance and can access real-time data from the camera feeds.

Project Specifications & Responsibilities:

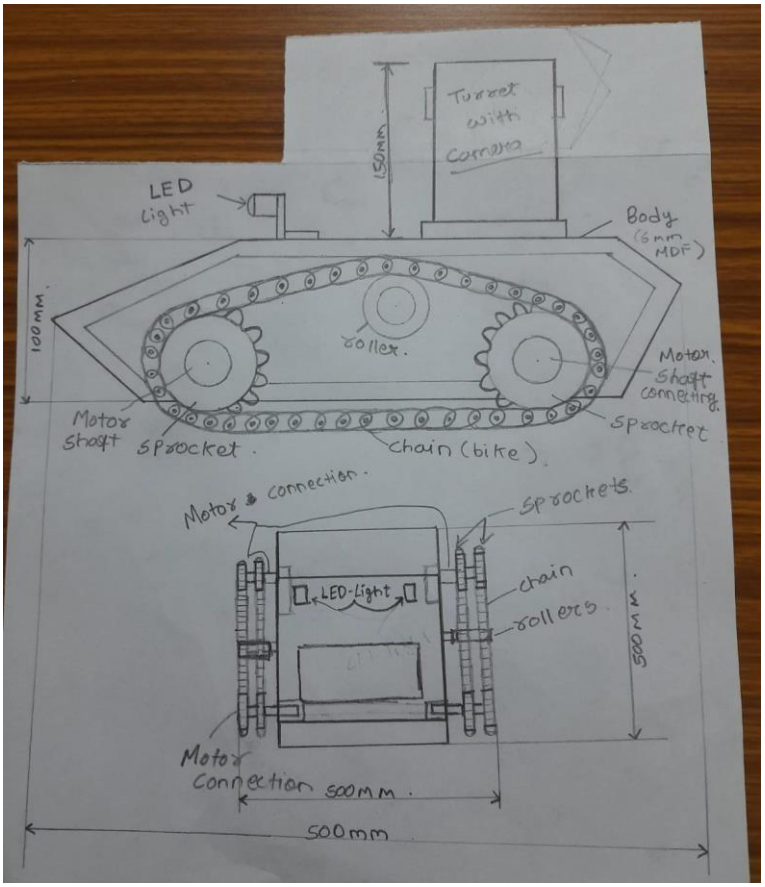
Body & Transmission- Jog, Nihar and Krish

1. Chassis
2. Tracks
3. Body
4. Motors
5. Battery

Electronics & Control- Jay

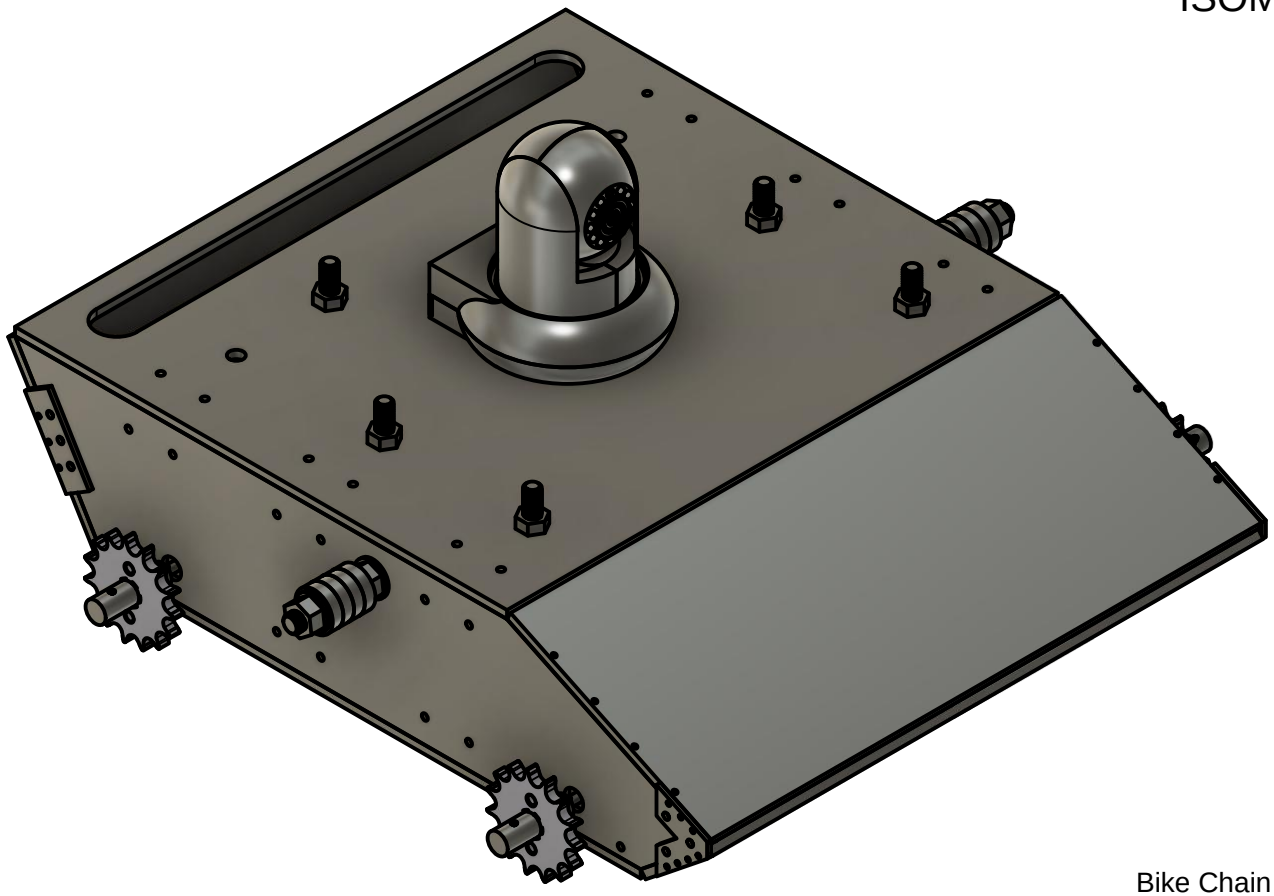
1. Electronics set up
2. FOSCAM
3. Wireless connection to the UTRV, including live camera feed and overall vehicle and turret control

Hand Sketch Design:



CAD drawings:

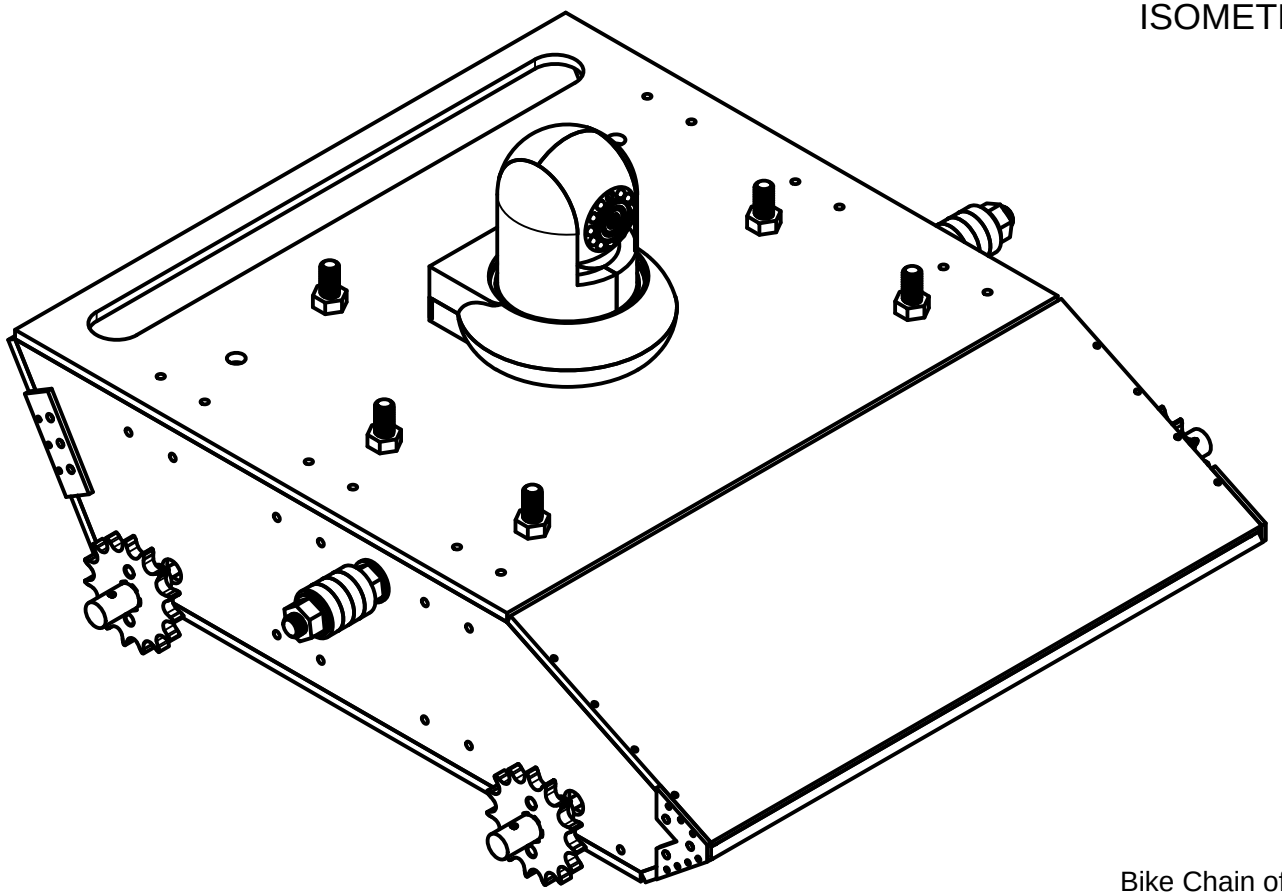
ISOMETRIC VIEW



Bike Chain of Appropriate Length Would Be Attached Through Sprockets and the Roller on Both Sides.

Scale: 1:4	Material: Steel, Acrylic, MDF	Created By: Jog Desai 17-03-2024	Course: **ENR508 - Mobile Robots**
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: 3D - Assembly Drawing	Quantity: 1
		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - AD - 01
Paper Size: A4			Rev. / Date of issue / Sheet 1/1

ISOMETRIC VIEW



Bike Chain of Appropriate Length Would Be Attached Through Sprockets and the Roller on Both Sides.

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Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Assembly Drawing	Quantity: 1
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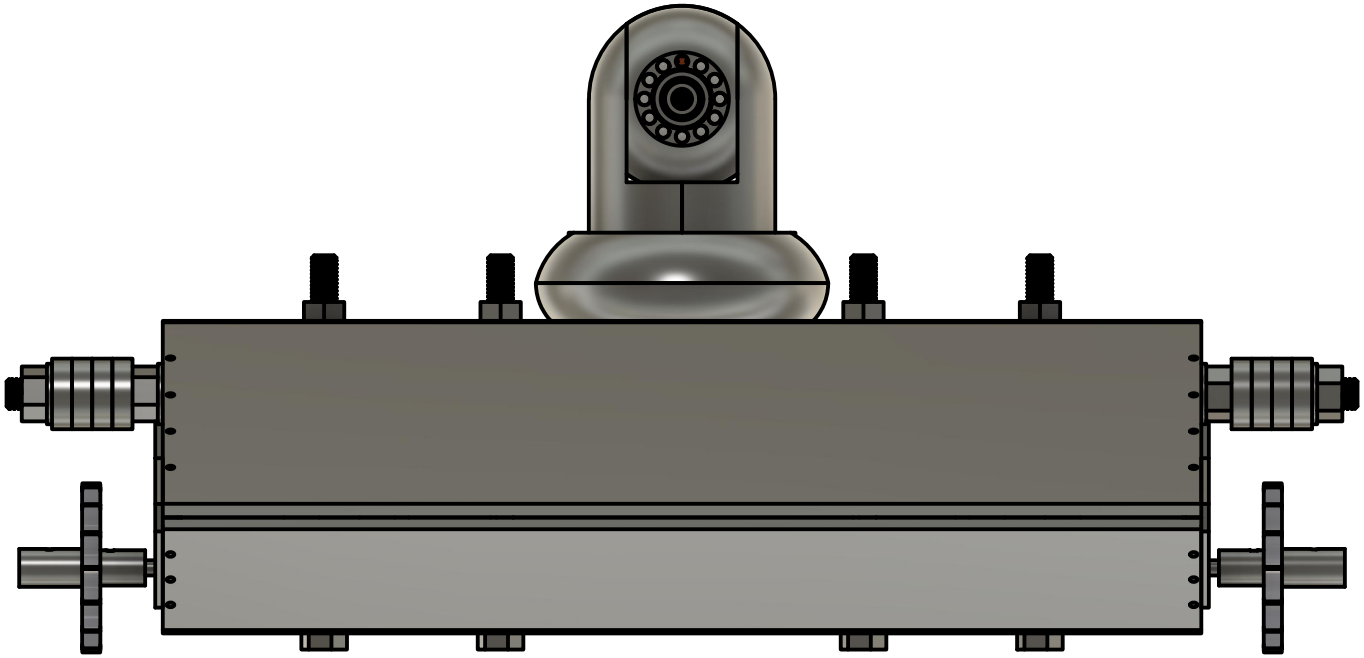
			Rev. / Date of issue / Sheet 1/1

FRONT VIEW



Bike Chain of Appropriate Length Would Be Attached Through Sprockets and the Roller on Both Sides.

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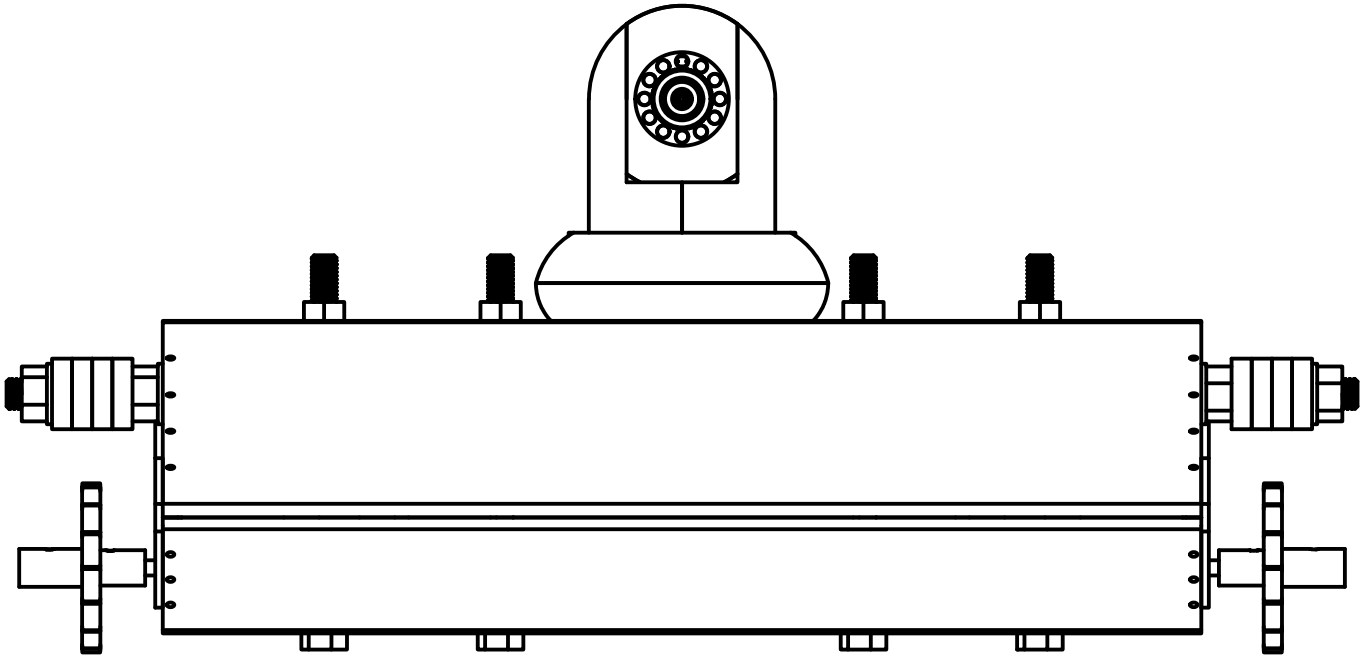
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: 3D - Assembly Drawing	Quantity: 1
		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - AD - 03
Paper Size: A4			Rev. / Date of issue / Sheet 1/1

FRONT VIEW



Bike Chain of Appropriate Length Would Be Attached Through Sprockets and the Roller on Both Sides.

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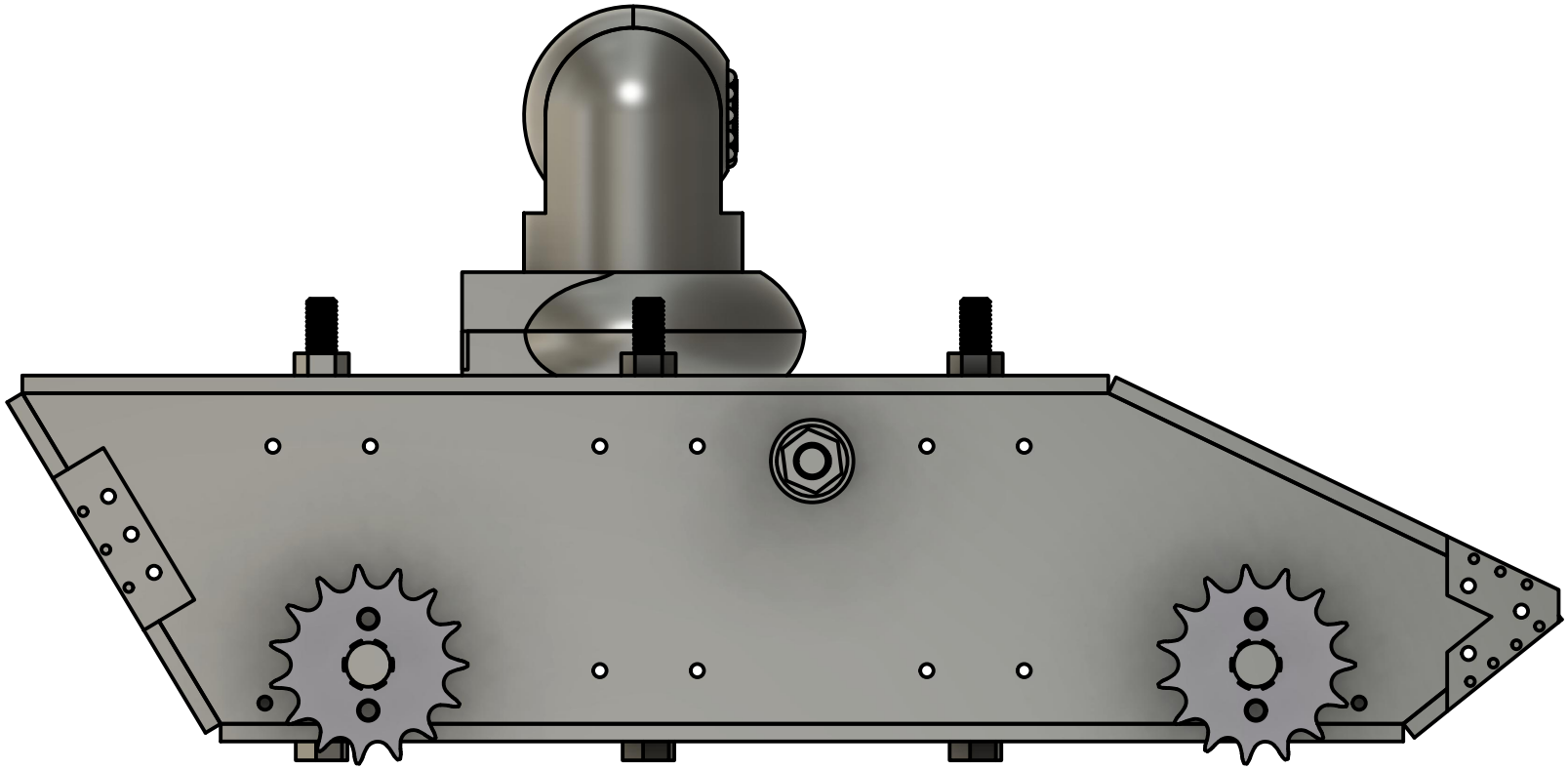
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Assembly Drawing	Quantity: 1
Paper Size: A4		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - AD - 04
			Rev. / Date of issue / Sheet 1/1

SIDE VIEW



Bike Chain of Appropriate Length Would Be Attached Through Sprockets and the Roller on Both Sides.

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Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: 3D - Assembly Drawing	Quantity: 1
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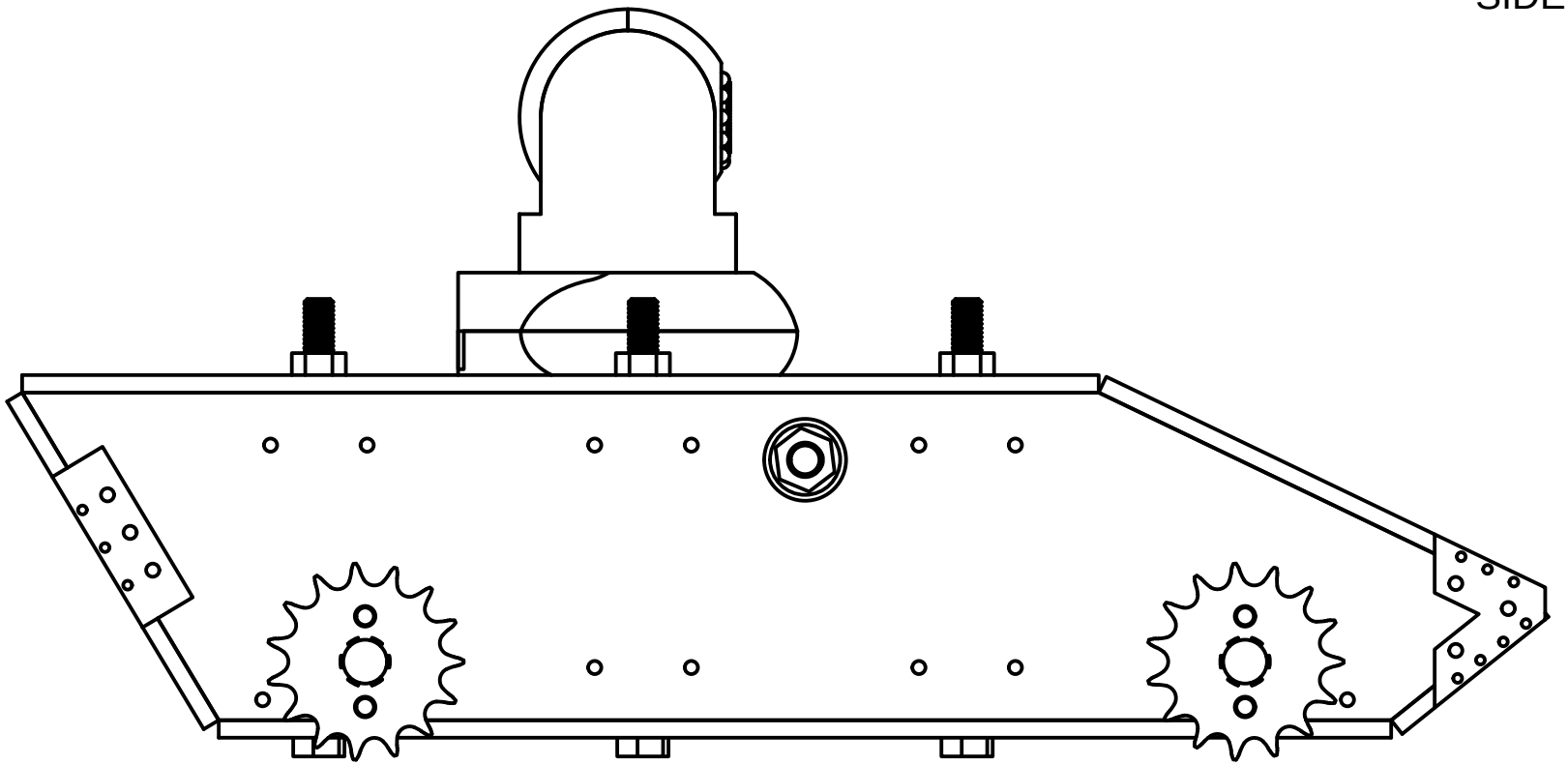
			Rev. / Date of issue / Sheet 1/1

SIDE VIEW



Bike Chain of Appropriate Length Would Be Attached Through Sprockets and the Roller on Both Sides.

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Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Assembly Drawing	Quantity: 1
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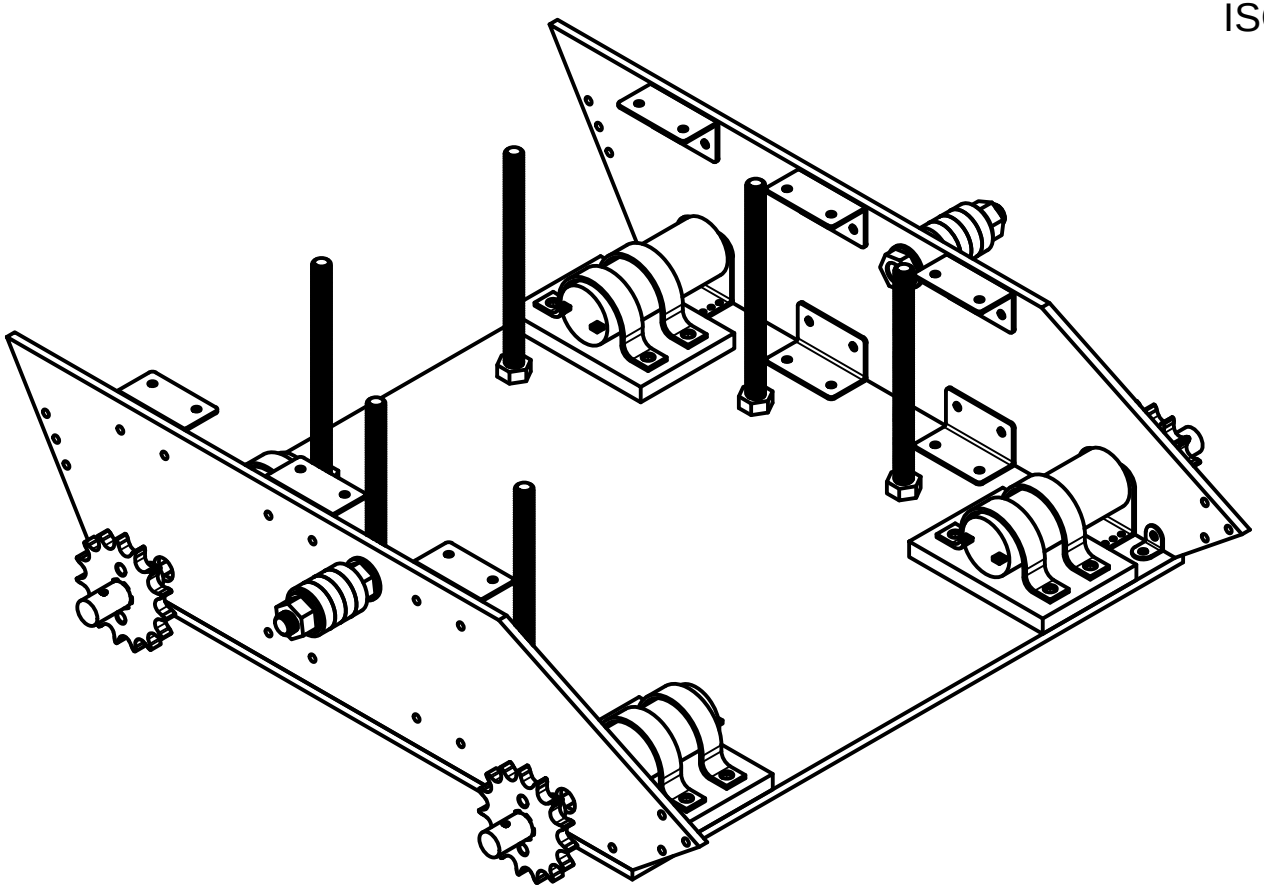
			Rev. / Date of issue / Sheet 1/1

ISOMETRIC VIEW



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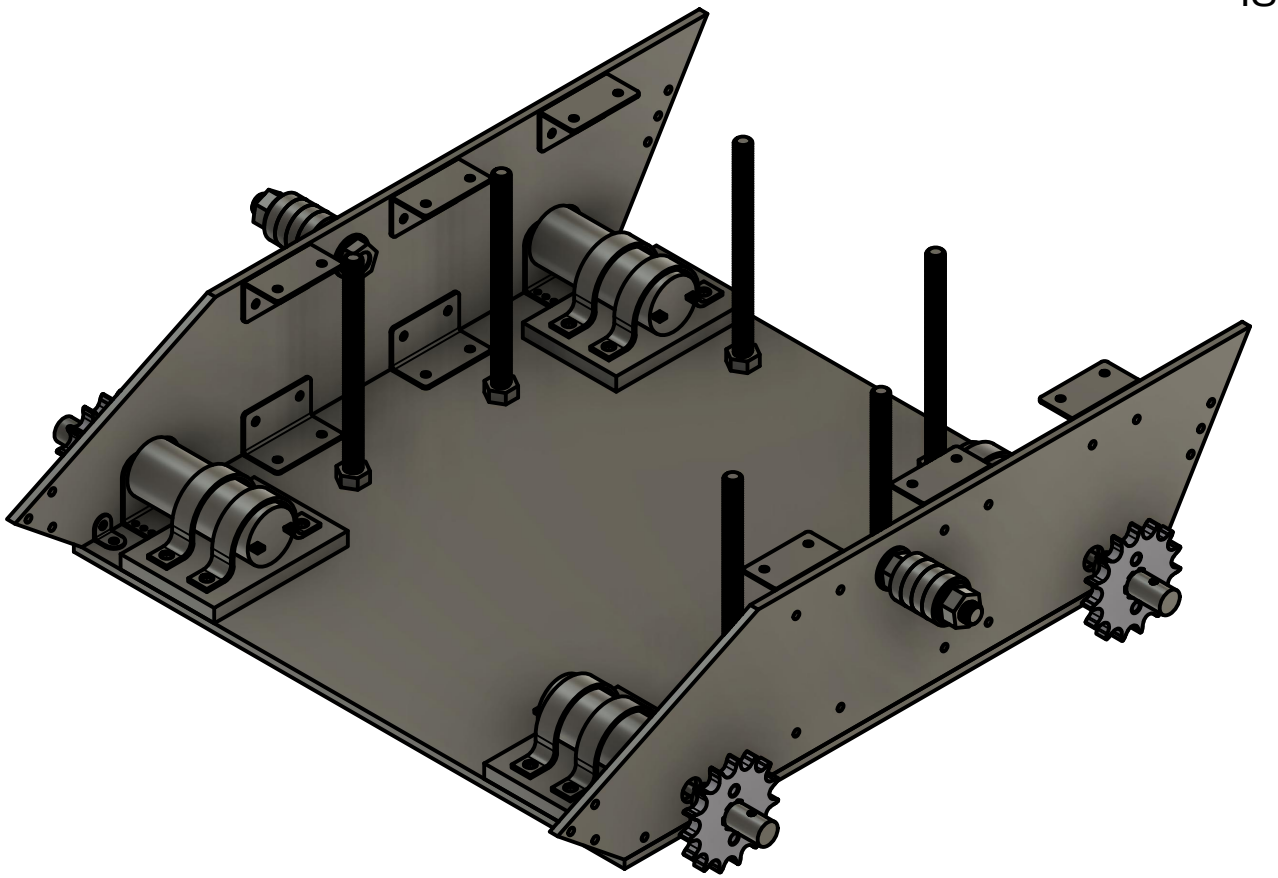
Paper Size: A4			Rev. / Date of issue / Sheet 1/1

ISOMETRIC VIEW



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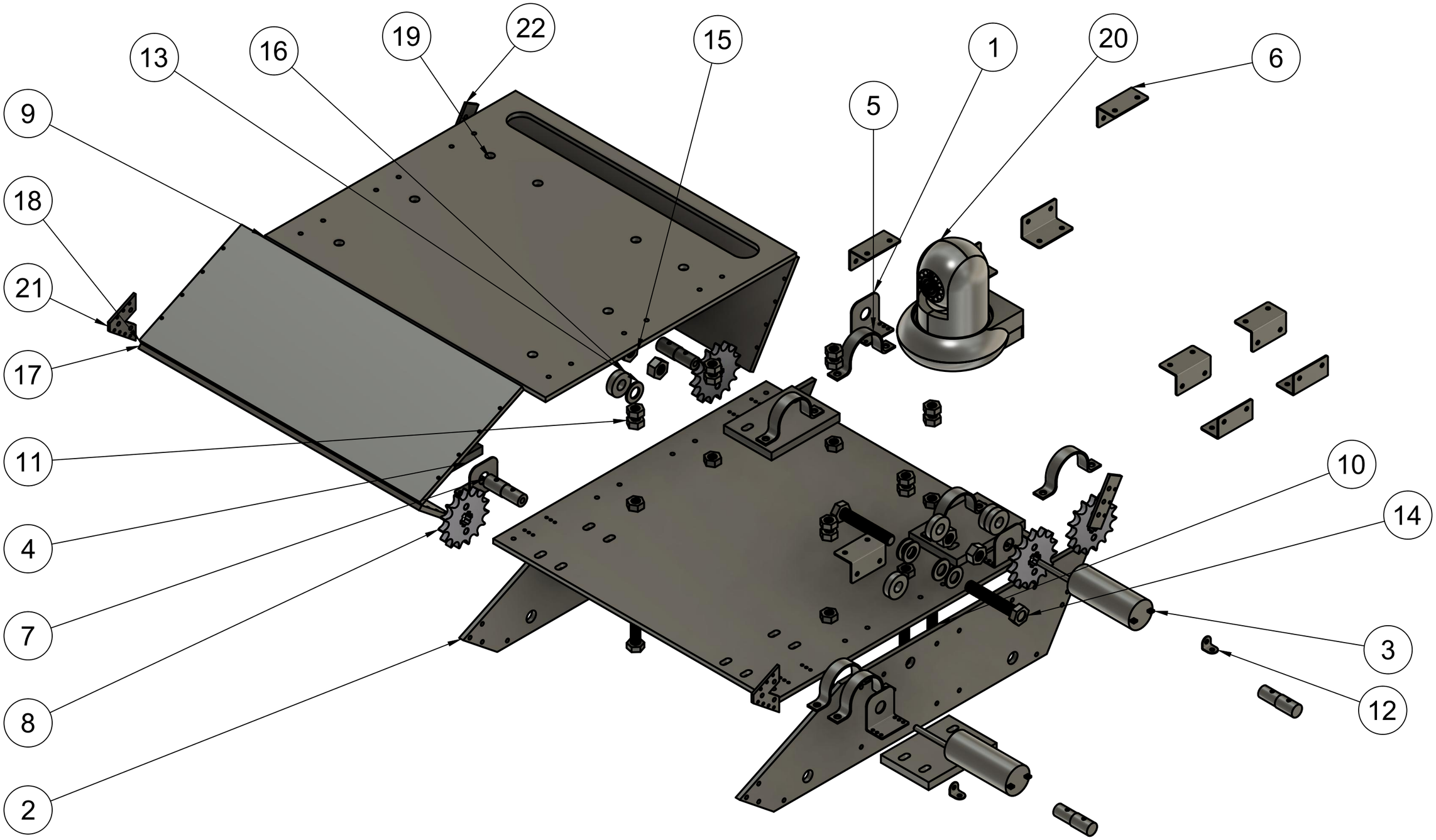
Paper Size: A4			Rev. / Date of issue / Sheet 1/1



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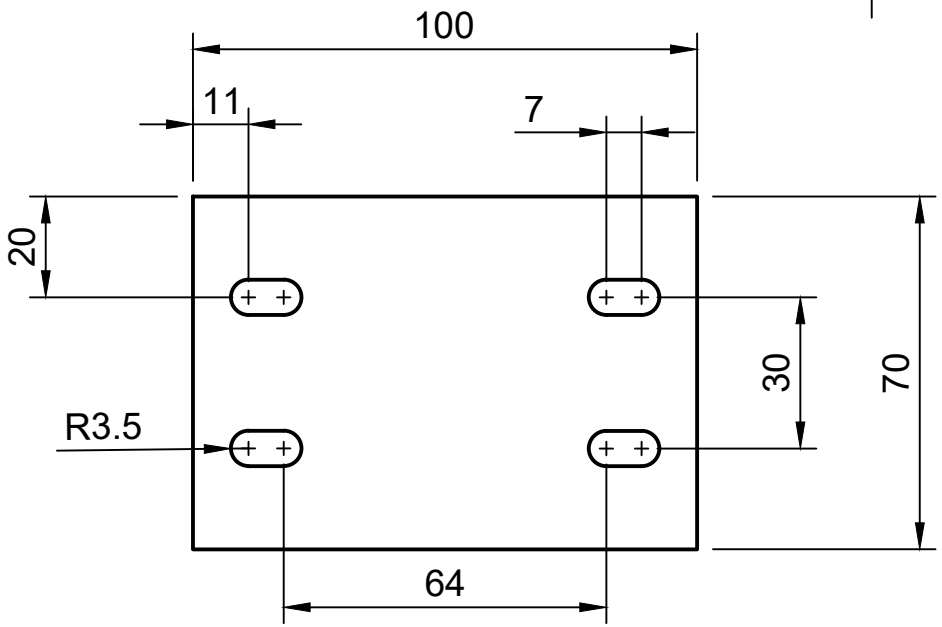
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: EXPLODED VIEW	Quantity: 1
		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - AD - 01
Paper Size: A3			Rev. / Date of issue / Sheet 1/1

Parts List For The Body						
Item No.	**Part Number**	**Material**	**Qty**	**Specifications**	**Raw Material / Part Availability**	**Raw material (RM) or Ready to use (RTU)**
1	L - clamp for Motor	Steel	4	40 mm x 40 mm x 23.5 mm	Available	RTU
2	Side Plate	MDF	2	As Per The Drawing	Available	RM
3	Motor	Steel	4	100 RPM	Available	RTU
4	Support Plate	Acrylic	4	As Per The Drawing	Available	RM
5	C - Clamp	Steel	8	1.5 inch	Available	RTU
6	L - Section Clamp	Steel	10	50 mm x 25 mm	Purchase	RTU
7	Sprocket Shaft	Aluminium	4	As Per The Drawing	Available	RM
8	Sprocket	Steel	4	14 Teeth (ID - 14 mm)	Purchase	RTU
9	Top Plate	MDF	1	As Per The Drawing	Available	RM
10	M10 - Bolt	Steel	6	Length - 150 mm	Purchase	RTU
11	M10 - Nut	Steel	18	16 mm x 6 mm	Purchase	RTU
12	2 - Hole AngleClamp	Steel	4	Mechanno Part (Standard)	Purchase	RTU
13	M12 Bolt - Washer	Steel	6	ID - 13 mm; OD - 24 mm	Purchase	RTU
14	M12 - Bolt	Steel	2	Length - 70mm	Purchase	RTU
15	M12 - Nut	Steel	4	19 mm x 7 mm	Purchase	RTU
16	12 mm - ID -Bearing Rollers	Steel	8	ID - 12 mm; OD - 28 mm	Purchase	RTU
17	Front Plate - 2	MDF	1	As Per The Drawing	Available	RM
18	Front Plate - 1	MDF	1	As Per The Drawing	Available	RM
19	Back Plate	MDF	1	As Per The Drawing	Available	RM
20	Camera Assembly	Plastic	1	FOSCAM - Camera	Available	RTU
21	Front Bracket	MDF	2	As Per The Drawing	Available	RM
22	Back Bracket	MDF	2	As Per The Drawing	Available	RM
23	Bottom Plate	MDF	1	As Per The Drawing	Available	RM
24	M4 - Screw	Steel	70	Length - 12 mm	Purchase	RTU
25	M4 - Nut	Steel	70	7 mm x 3 mm	Purchase	RTU
26	M7 - Bolt	Steel	16	Length - 25 mm	Purchase	RTU
27	M7 - Nut	Steel	16	11 mm x 5 mm	Purchase	RTU
28	M4 - Grub Screw	Steel	8	Length - 6 mm	Purchase	RTU
29	Bike Chain	Steel	2	1.5 m - each	Available	RTU



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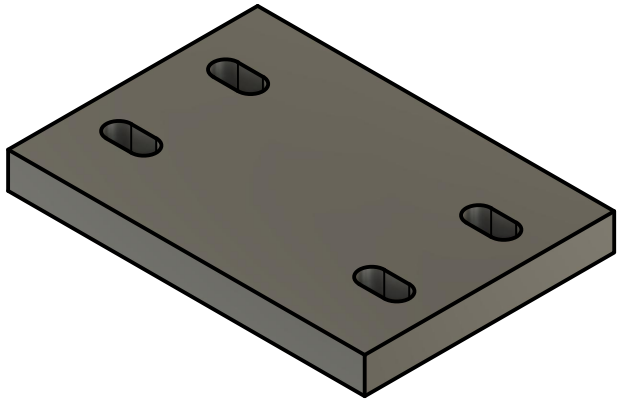
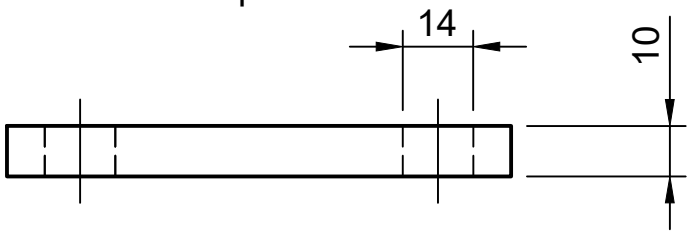
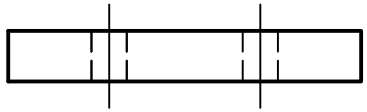


Isometric View



Front View



Side View

Manufacturing Process: Laser Cutting

Third Angle Projection			[All Dimensions Are In (mm)]
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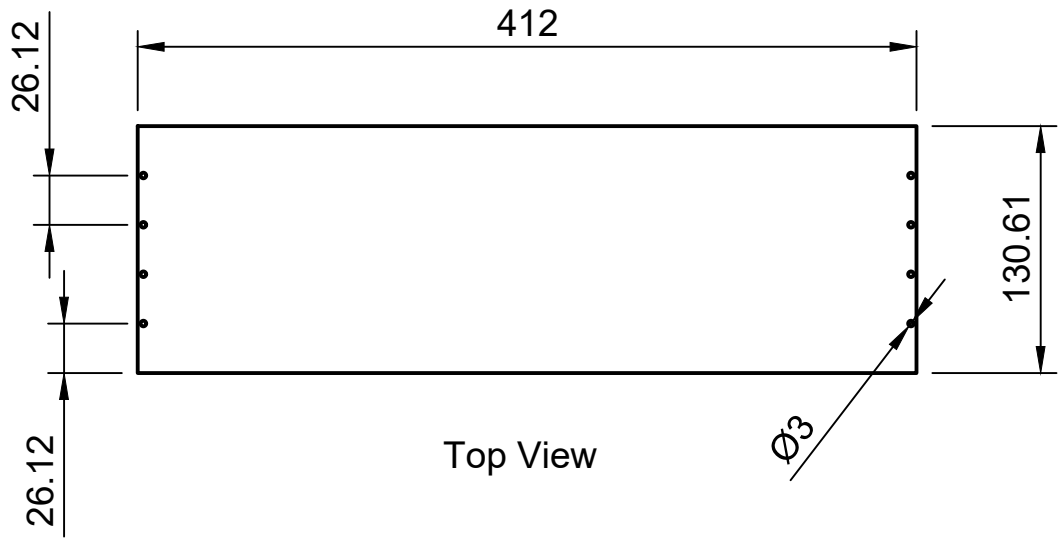
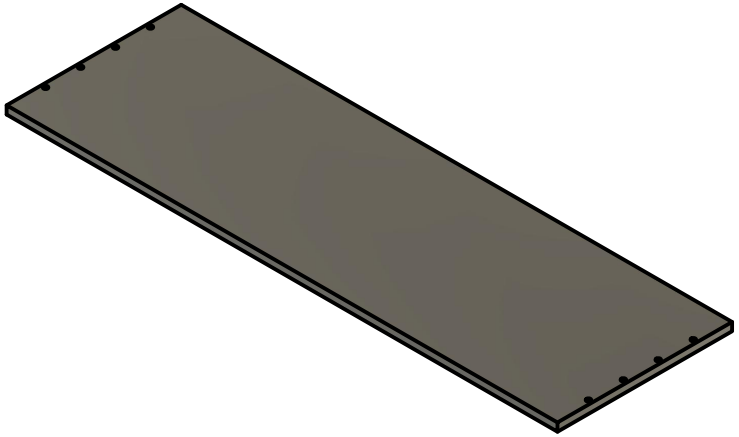
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 04 / Part Name: Support Plate
Paper Size: A4		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 01
			Rev. / Date of issue / Sheet: 1/1

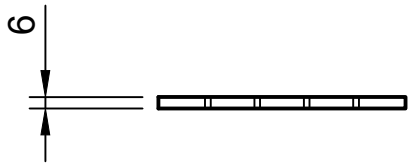


Top View



Isometric View

Front View



Side View

Third Angle Projection [All Dimensions Are In (mm)]

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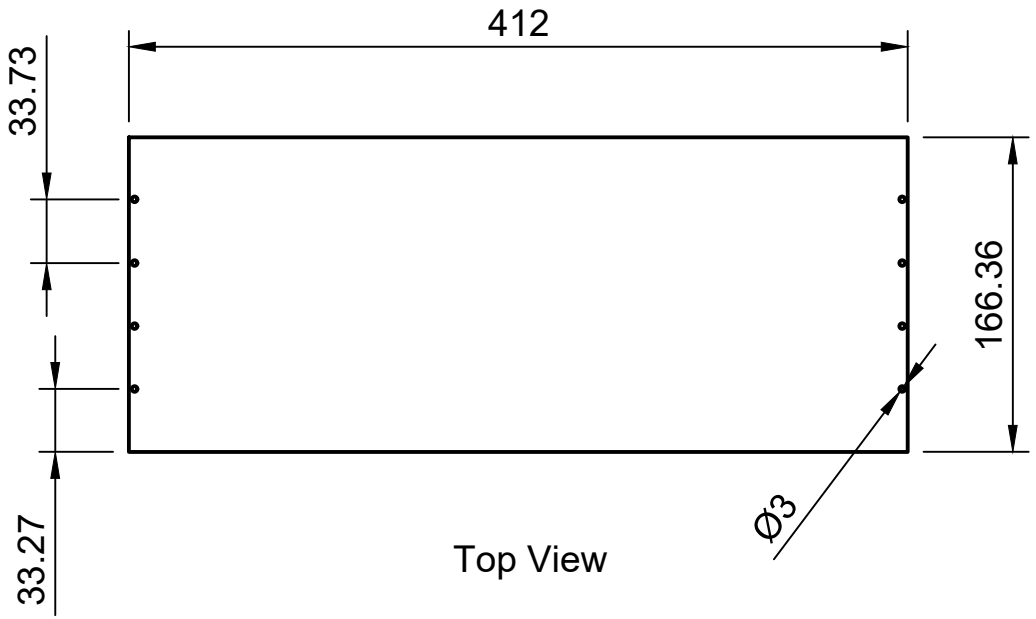
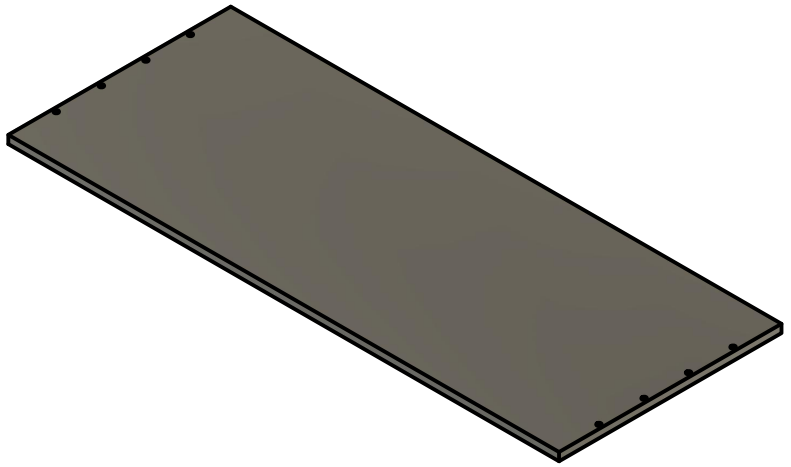
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 01 / Part Name: Back Plate
Paper Size: A4		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 02
			Rev. / Date of issue / Sheet 1/1

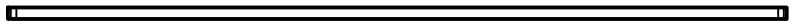
Manufacturing Process: Laser Cutting



Top View



Isometric View

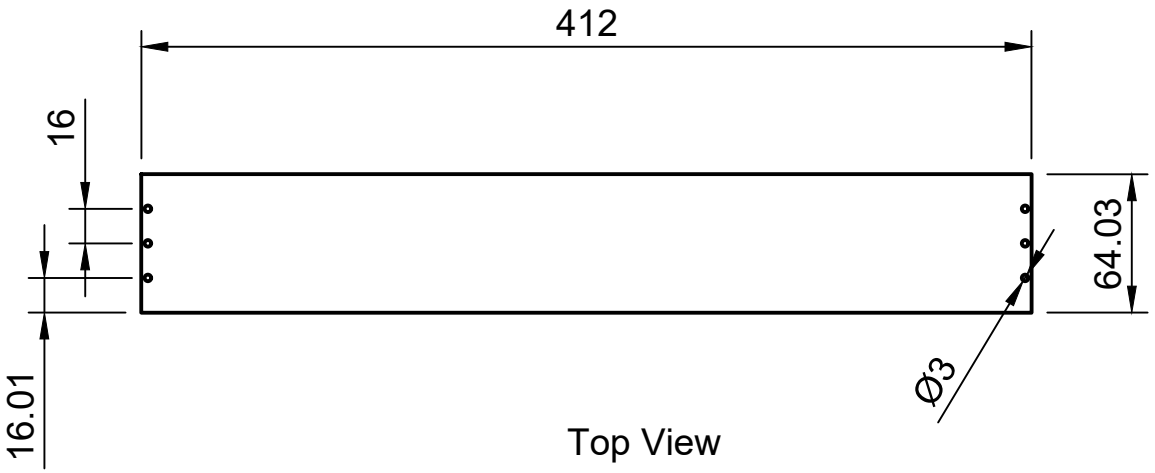


Front View

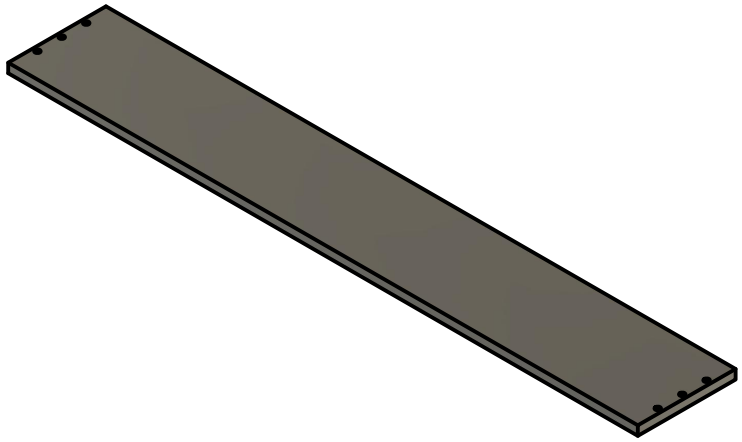
Side View

Manufacturing Process: Laser Cutting

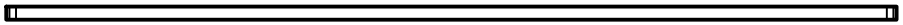
Third Angle Projection			[All Dimensions Are In (mm)]	
Scale: 1:4	Material: MDF	Created By: Jog Desai 19-03-2024	Course: **ENR508 - Mobile Robots**	
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 01	Part Name: Front Plate - 1
		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 03	
Paper Size: A4			Rev. / Date of issue	Sheet 1/1



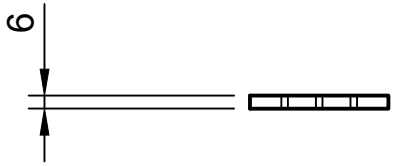
Top View



Isometric View



Front View



Side View

Manufacturing Process: Laser Cutting

Third Angle Projection			[All Dimensions Are In (mm)]	
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Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 01	Part Name: Front Plate -2
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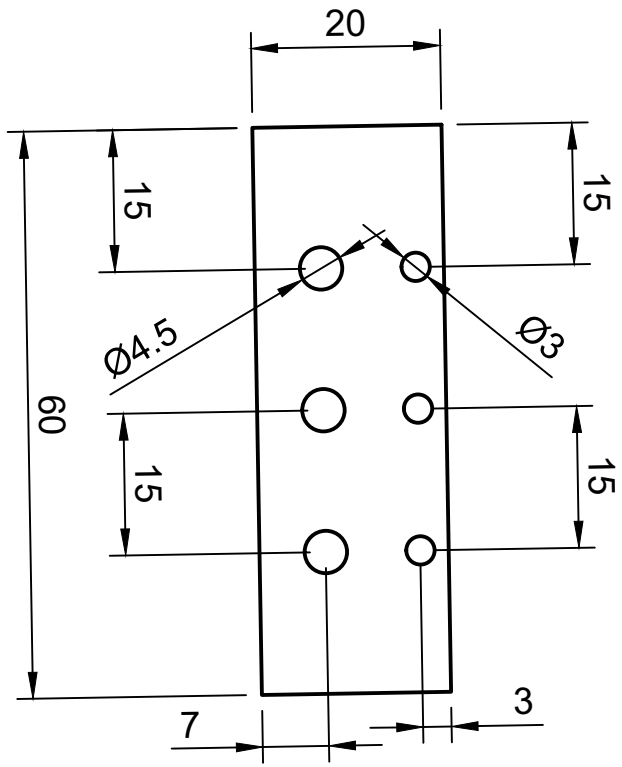
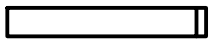
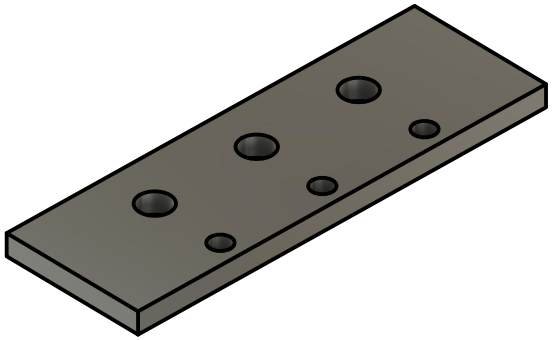
Paper Size: A4			Rev. / Date of issue	Sheet 1/1



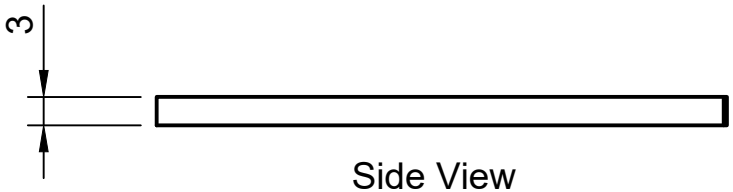
Top View



Front View



Isometric View



Side View

Manufacturing Process: Laser Cutting

Third Angle Projection			[All Dimensions Are In (mm)]	
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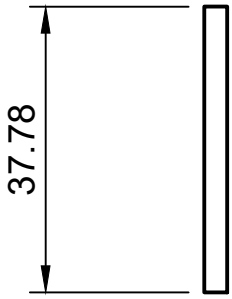
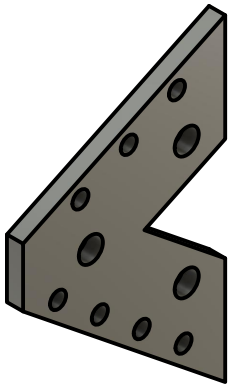
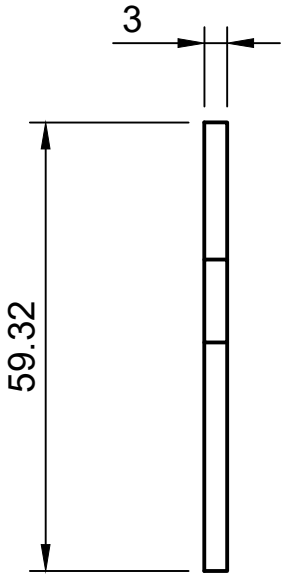
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 02	Part Name: Back Bracket
Paper Size: A4		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 05	
			Rev. / Date of issue	Sheet 1/1



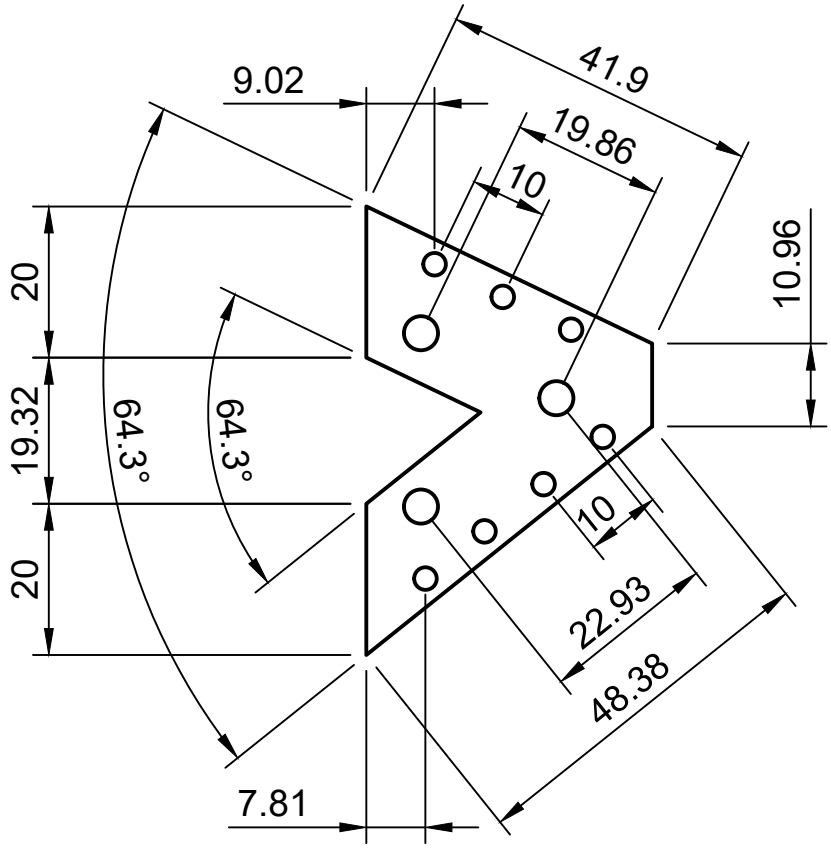
Top View



Isometric View



Front View



Side View

Manufacturing Process: Laser Cutting

Third Angle Projection			[All Dimensions Are In (mm)]
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Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 02
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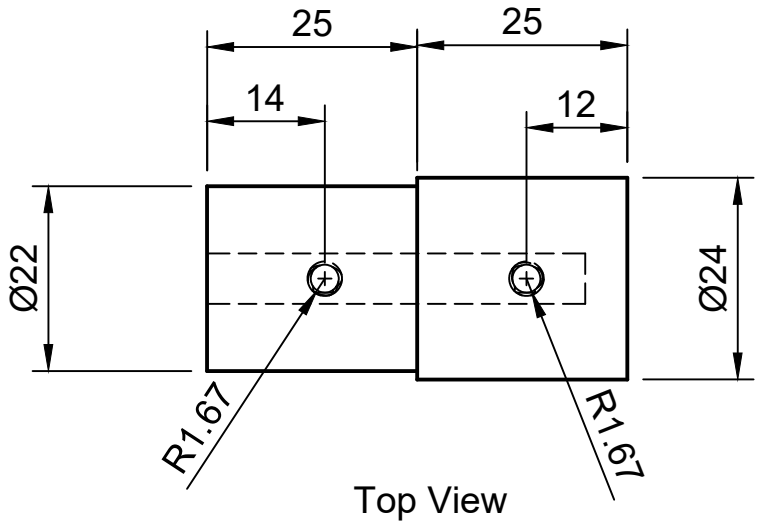
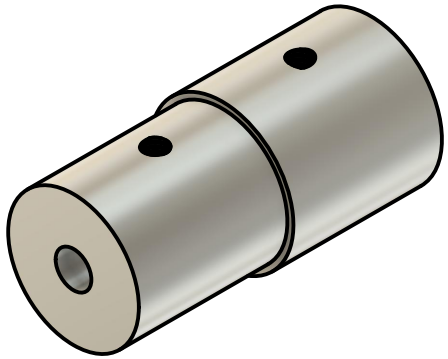
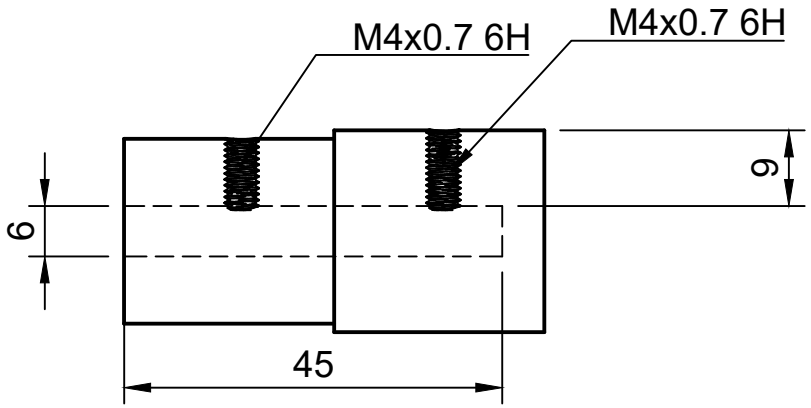
Paper Size: A4			Part Name: Front Bracket
			Rev. / Date of issue / Sheet 1/1



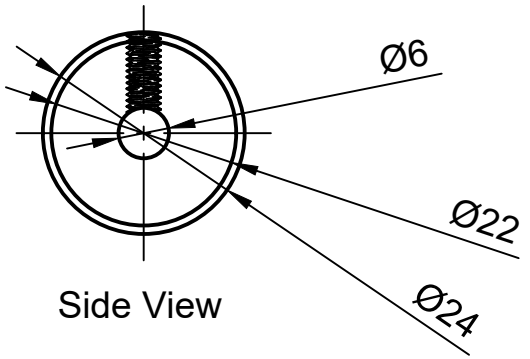
Top View



Isometric View



Front View

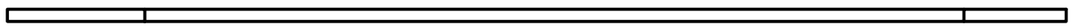


Side View

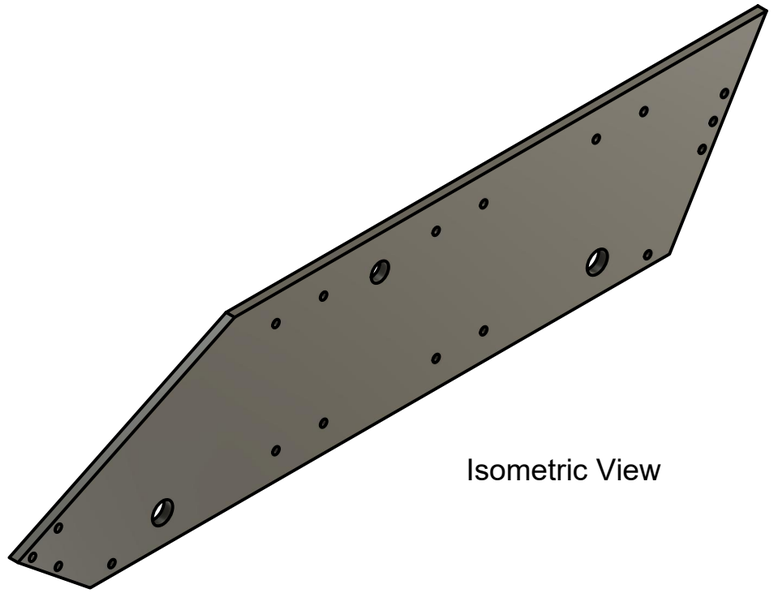
Guidelines:
To make the space for the M4 Grub Screw as locking Key

1. Make Holes of 3.2 mm on the both marked points.
2. Take a M4 Tap Tool to create threads in the hole for the M4 Grub Screw

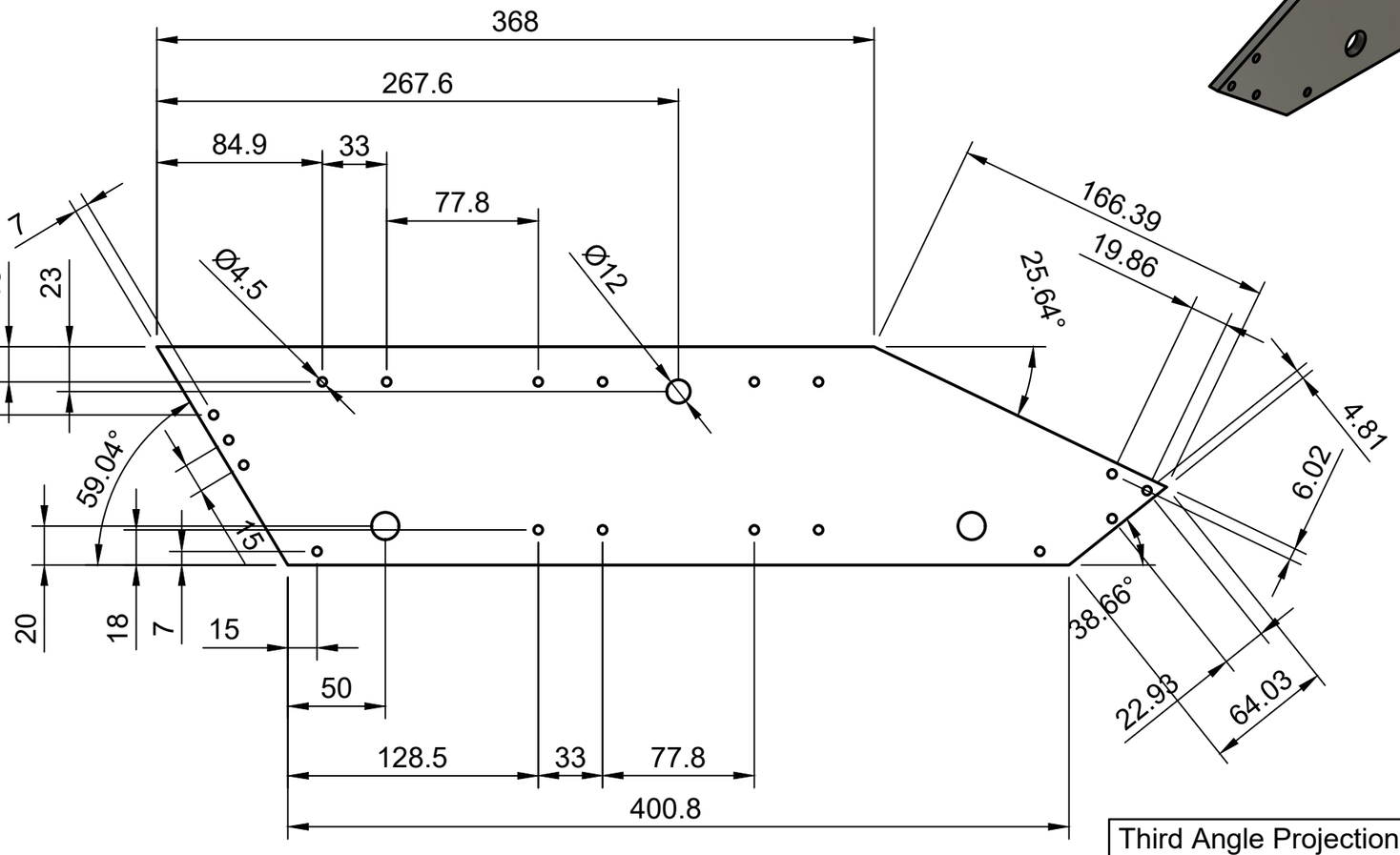
Third Angle Projection				[All Dimensions Are In (mm)]
Scale: 10:9	Material: Aluminium	Created By: Jog Desai 20-03-2024	Course: **ENR508 - Mobile Robots**	
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 04	Part Name: Sprocket Shaft
Paper Size: A4		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 07	
			Rev. / Date of issue	Sheet 1/1



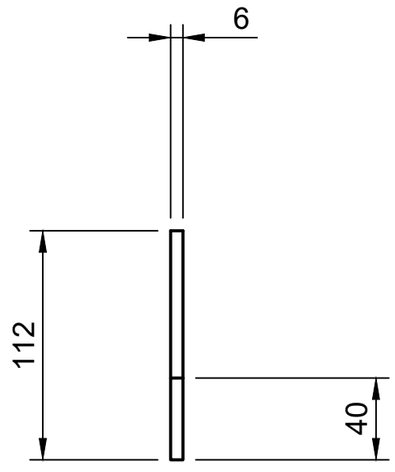
Top View



Isometric View



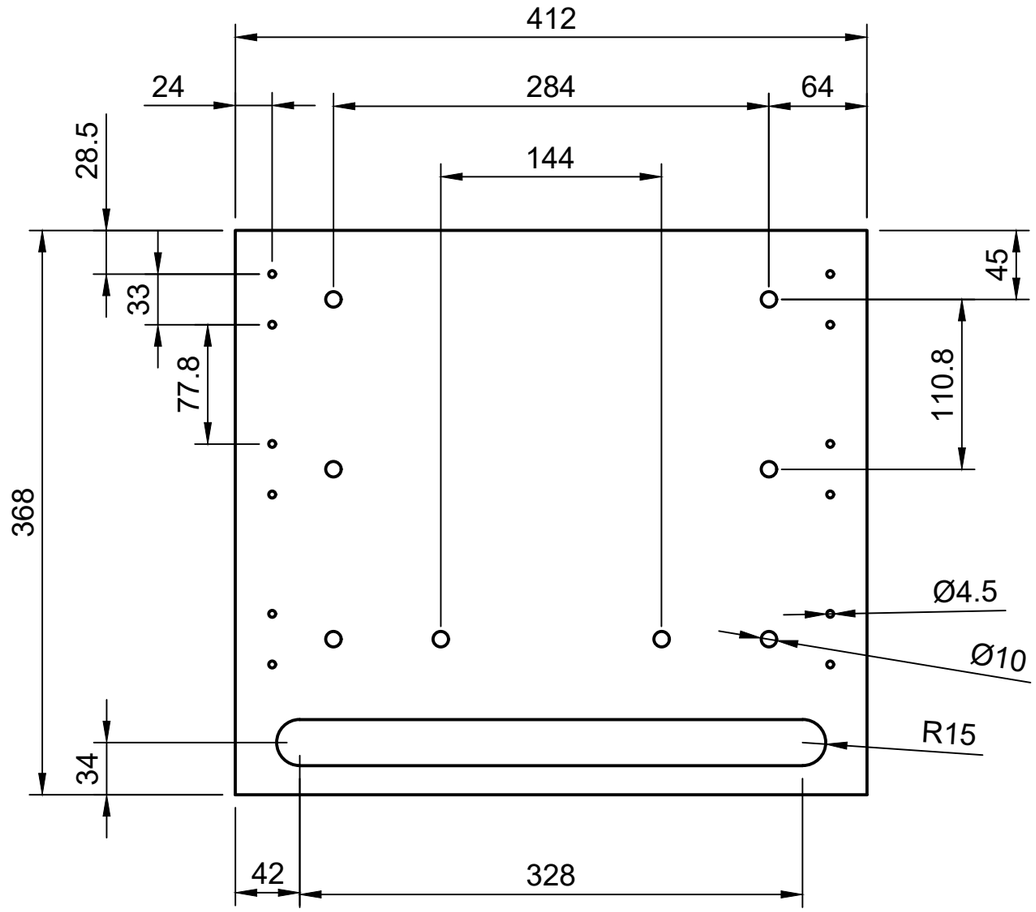
Front View



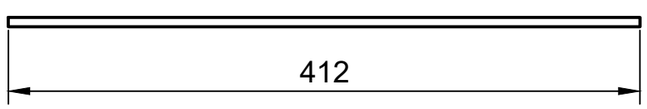
Side View

Manufacturing Process: Laser Cutting

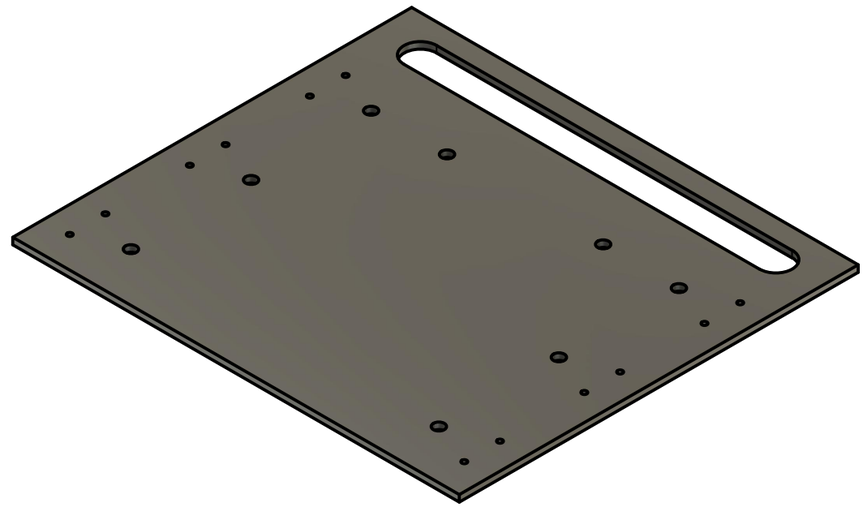
Third Angle Projection				[All Dimensions Are In (mm)]
Scale: 1:3	Material: MDF	Created By: Jog Desai 20-03-2024	Course: **ENR508 - Mobile Robots**	
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 02	Part Name: Side Plate
Paper Size: A3		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 08	
			Rev. / Date of issue	Sheet 1/1



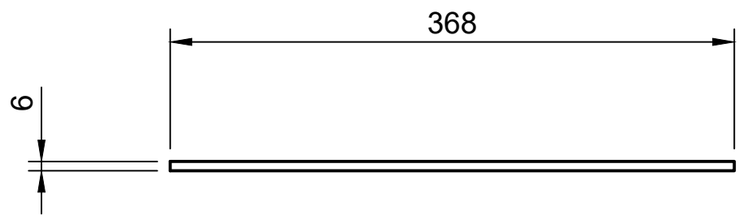
Top View



Front View



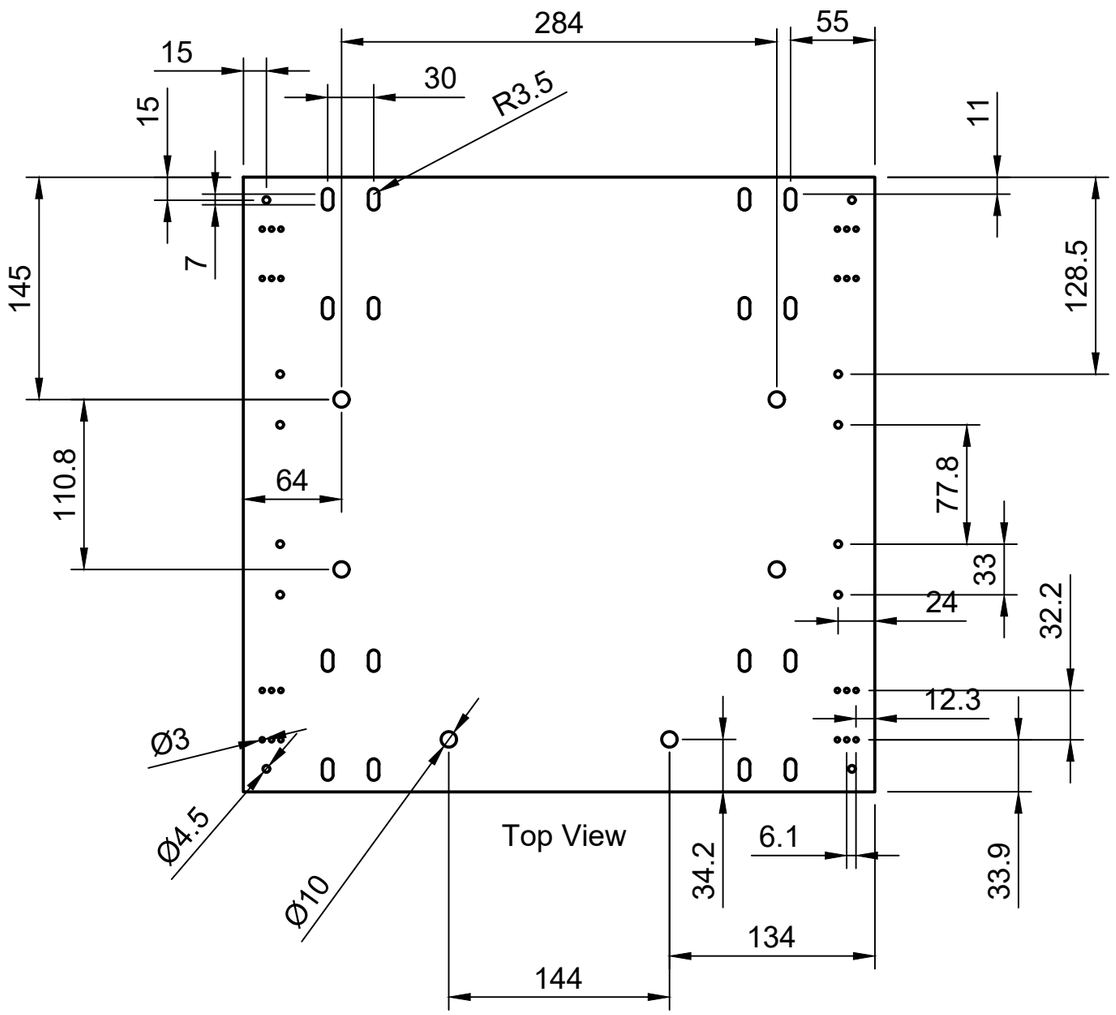
Isometric View



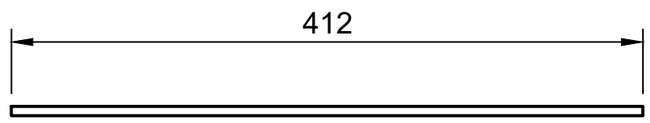
Side View

Manufacturing Process: Laser Cutting

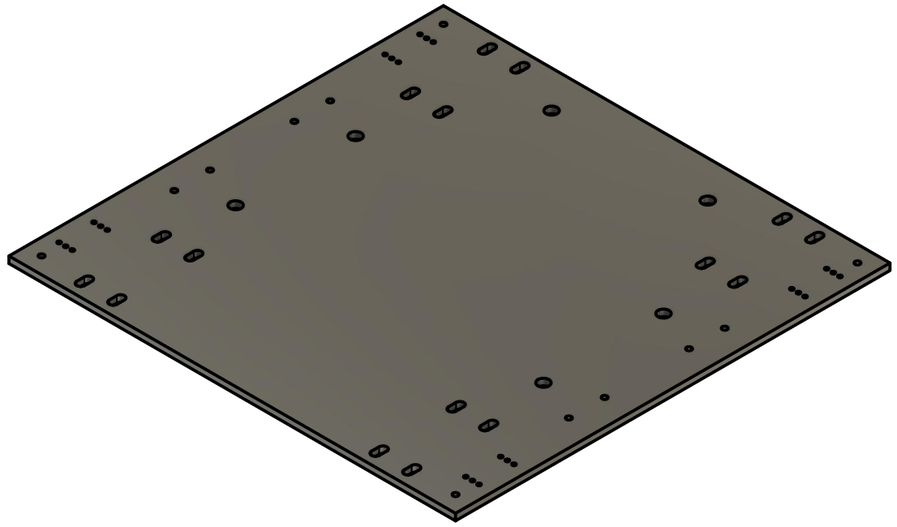
Third Angle Projection			[All Dimensions Are In (mm)]
Scale: 1:4	Material: MDF	Created By: Jog Desai 20-03-2024	Course: **ENR508 - Mobile Robots**
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 01 / Part Name: Top Plate
Paper Size: A3		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 09
			Rev. / Date of issue / Sheet: 1/1



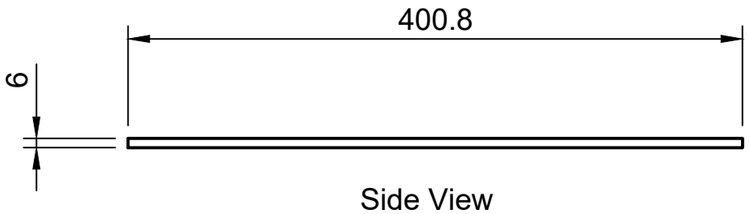
Top View



Front View



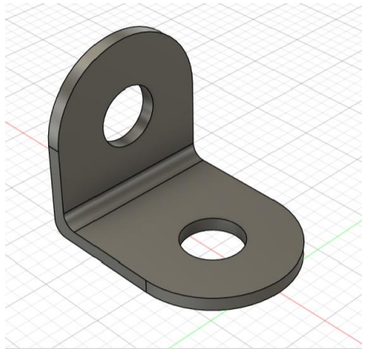
Isometric View



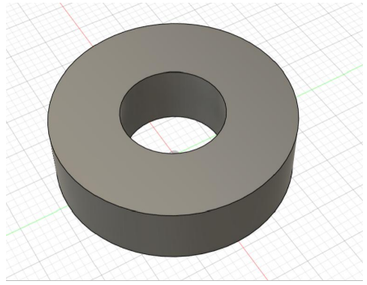
Side View

Manufacturing Process: Laser Cutting

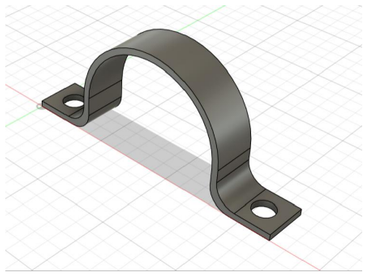
Third Angle Projection			[All Dimensions Are In (mm)]
Scale: 1:4	Material: MDF	Created By: Jog Desai 20-03-2024	Course: **ENR508 - Mobile Robots**
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Part Drawing	Quantity: 01 / Part Name: Bottom Plate
Paper Size: A3		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No: UTRV - PD - 10
			Rev. / Date of issue / Sheet: 1/1



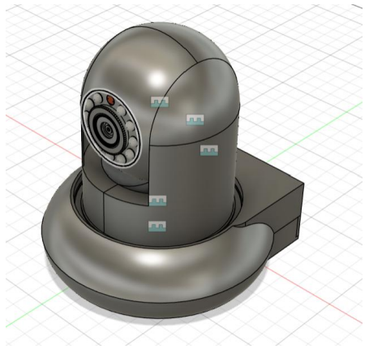
2 - Hole Angle Clamp



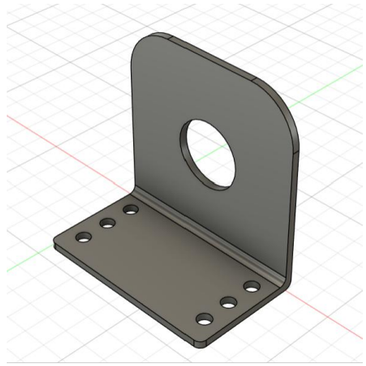
12 mm - ID - Bearing Roller



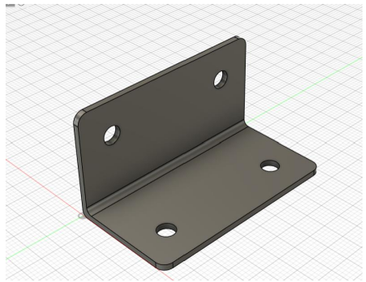
C - Clamp



FOSCAM - Camera

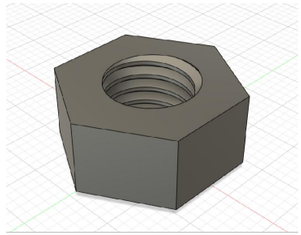


L - Clamp for Motor

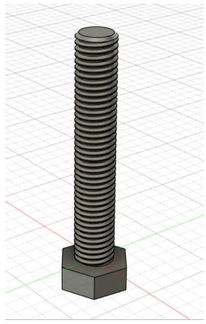


L - Section Clamp

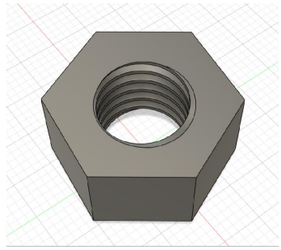
M10 - Bolt



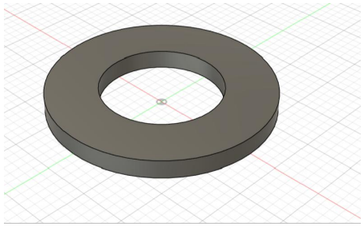
M10 - Nut



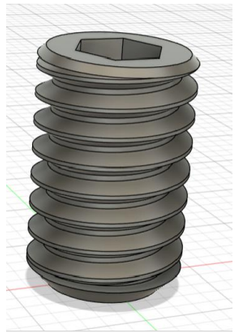
M12 - Bolt



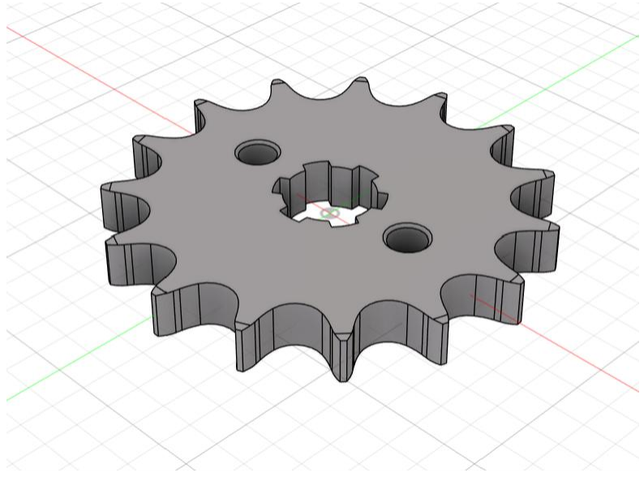
M12 - Nut



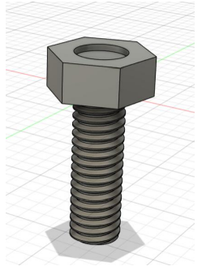
M12 - Washer



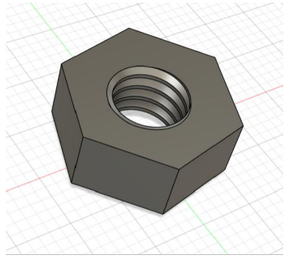
M4 - Grub Screw



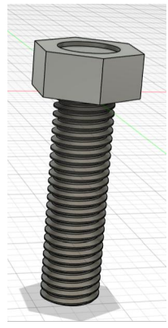
Sprocket - 14 Teeth



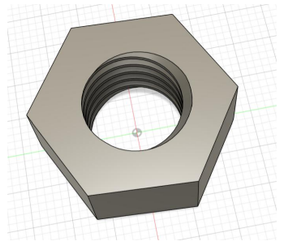
M4 - Screw



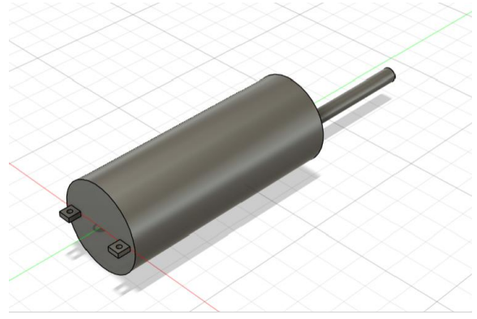
M4 - Nut



M7 - Bolt



M7 - Nut



Motor

Scale:	Material: Steel	Created By: Jog Desai 20-03-2024	Course: **ENR508 - Mobile Robots**
Ahmedabad University **SCHOOL OF ENGINEERING AND APPLIED SCIENCE**		Document Type: Ready To Use Part - Images	Quantity: Mentioned In Part List
Paper Size: A3		Project Title: (UTRV) Unmanned Tracked Reconnaissance Vehicle	DWG No:
			Rev. / Date of issue / Sheet 1/1

About Design:

Our design of the UTRV bot is inspired by the design of the Tank, which has a high strength, stability, and powerful appearance, as well as a surveillance drone that collects information about the enemy using the sky. Our design combines the features of the tank and the surveillance drone, which means it can be used to do surveillance on the ground. It is the first prototype of UTRV, which may lack some features, such as a budget. The primary materials used for making the bot's body are the MDF & Acrylic. Also, the parts used to provide the core strength and join the parts together are made of steel. For the movement of the vehicle bot, we have implemented the idea of using sprockets and roller with the bike chain inspired by the caterpillar belt of the tank. All body parts and chassis will be self-designed and constructed. There may be some variations from the design during manufacturing as the prototype is still in development.

CAD design and manufacturing process of the UTRV:

CAD

The UTRV is a robotic ground drone used for surveillance in enemy territory, so it was important that it could travel in rough terrain. That is why we have chosen the shape of a Tank which navigates through rough terrain with the help of the tracks instead of wheels and is a very strong structure to maintain its personal defence.

The development of the CAD design for the Unmanned Tracked Reconnaissance Vehicle, a tank-shaped surveillance mobile robot, was undertaken using Fusion 360 software. This software facilitated the creation of a detailed prototype that could navigate rough terrain with ease. The design incorporated bike chains with sprockets and rollers for efficient movement, while the main body and chassis were constructed from sturdy 6mm thick MDF, ensuring durability. The fully detachable design allowed for easy maintenance and customization. To enhance structural integrity, L-clamps and 15cm M10 bolts were utilized as pillars, providing robust support. Motors were securely fitted using C-clamps, and the motor support plate was crafted from 10mm thick acrylic for stability.

Manufacturing

The parts of the UTRV were made using the basic manufacturing processes like laser cutting and lathe operations. The major part in manufacturing were the body and the chassis parts along with the sprocket shafts. The other components were procured from scrap or purchased to fit in.

Chassis and the Body parts were made using the 6mm MDF sheets with the Laser cutting process, in which the raw MDF sheet is place in the machine and the drawing is uploaded in the software and the part is cut through laser in that shape.

The Sprocket shafts are made of Aluminium by using the lathe operations which are turning, facing, drilling and tapping at the end. These shafts are coupled with the motors and fitted with grub screw. The sprockets are inserted in the shaft with the process of friction fitting. Then the bike chain is attached to it by adjusting the chain in between the sprockets and the rollers.

We use Measuring tape & vernier caliper to check the dimension accuracy of the manufactured parts as per the drawing.

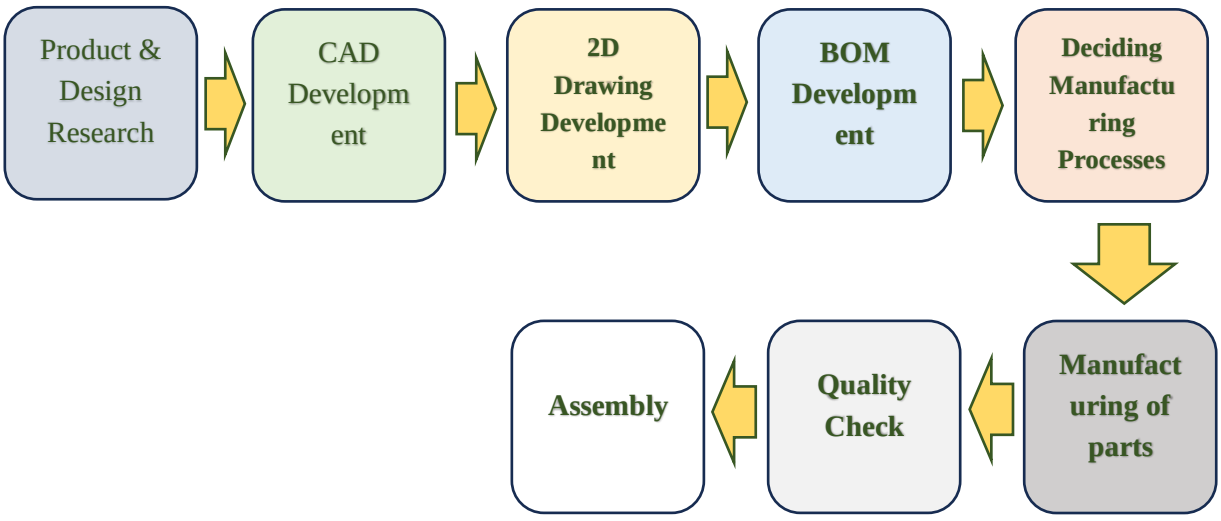
All the parts are attached with each other using the nut and bolt and the L-clamps and C-clamps. So that the prototype can be detached, maintained and updated.

For the assembly of the parts, we have used mostly the hand tools available which are spanners, mallet, screw driver, plier, drill machine, Allen keys, Wire stripper, double tape, file, chisel.

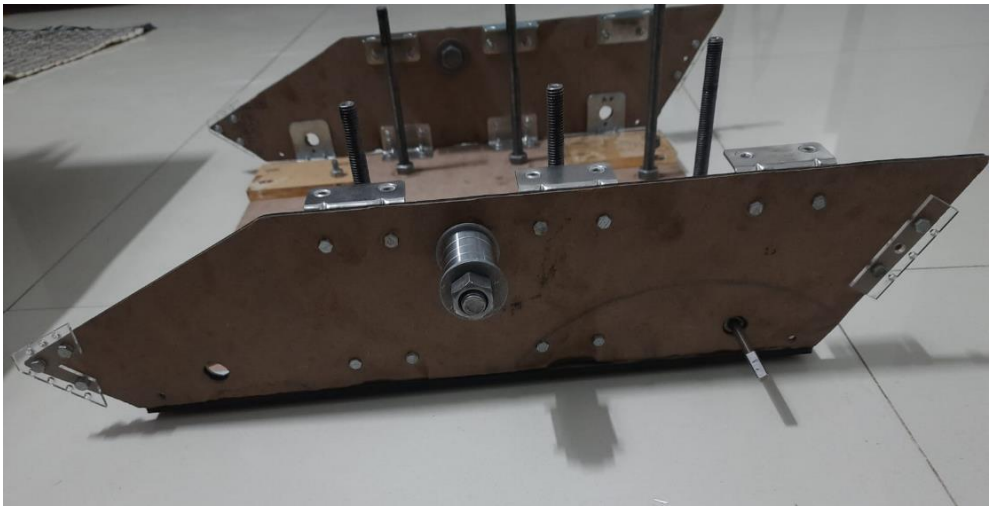
Material

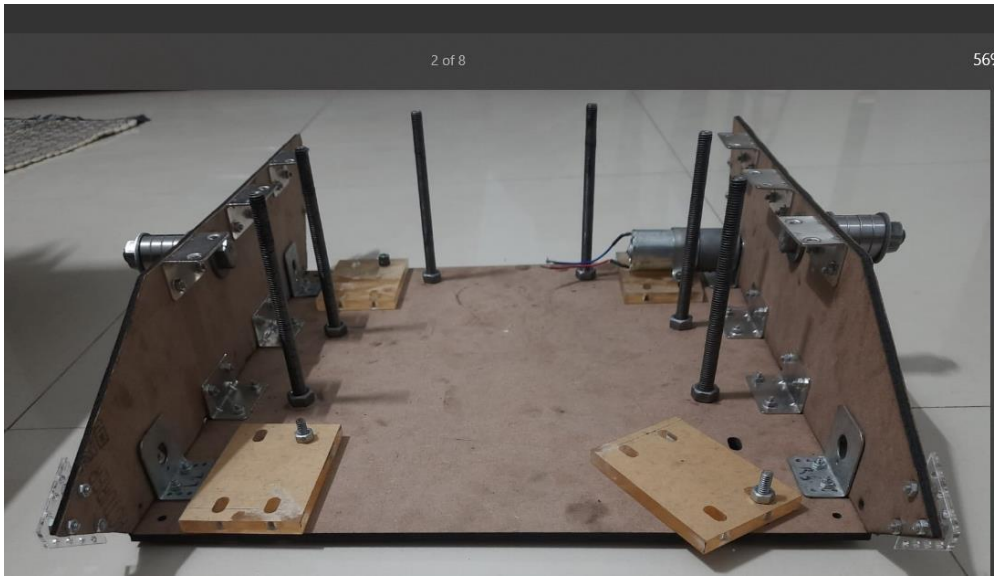
As this is the first prototype of the UTRV project we have used light weight, inexpensive and durable material like MDF, Acrylic, Steel, Aluminium in manufacturing the different parts and body. We have used the material which can be processed easily and which suits the manufacturing process we have used to make the prototype and which provides a specific durable strength and most importantly reduces the making cost.

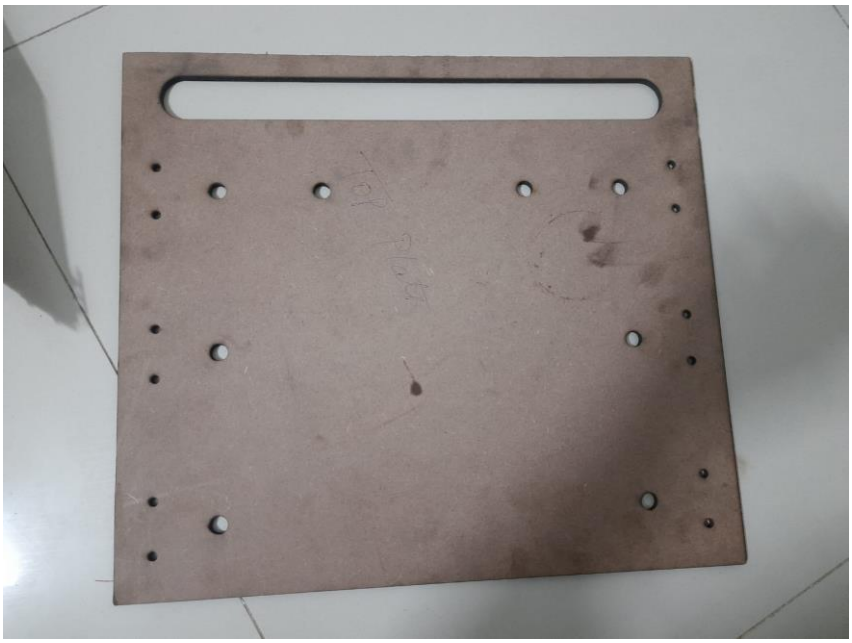
Block Diagram

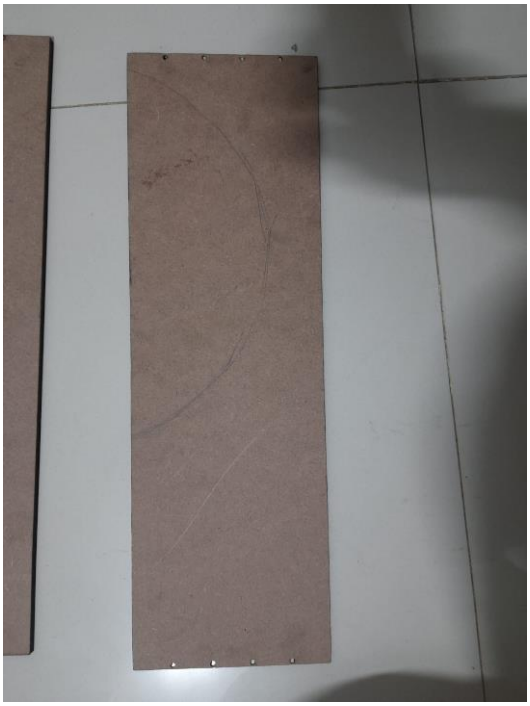


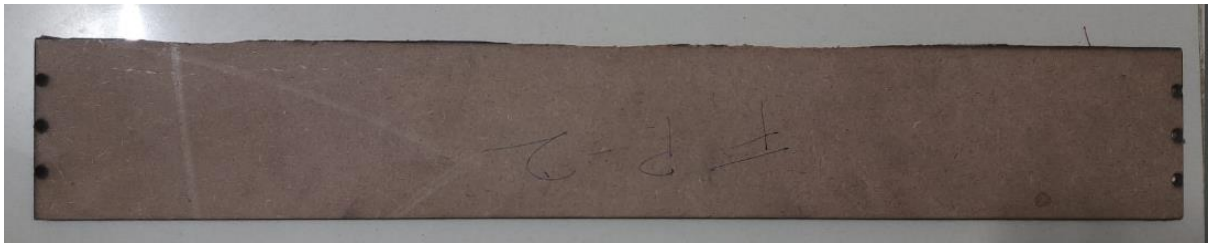
Images of the Completed Assembly:











Electronics:

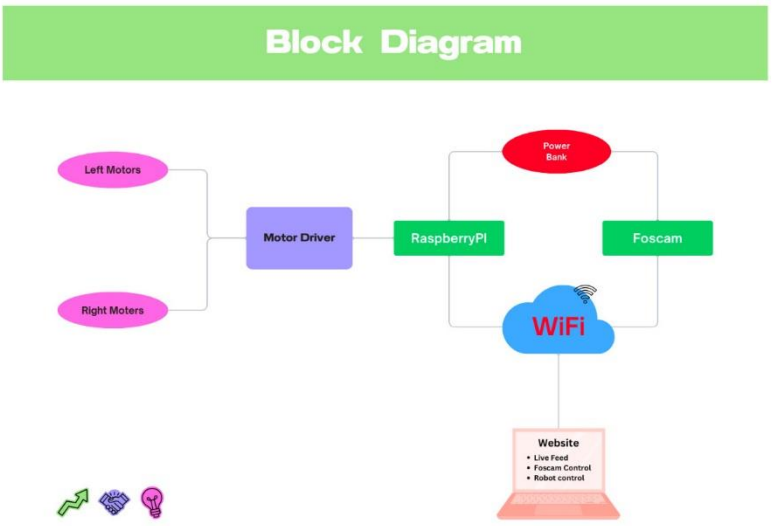
The whole work of the project depends on the electronic components which are mentioned below. The FOSCAM is the major camera that will rotate and provide 360-degree view footage. We are thinking of USB-controlled cameras to fix on each side of robot so we can easily control the operations of the bot.

Electronic Component List

1. Raspberry Pi 4 b
2. Techtonics 1/4 Cmos 640X480 USB Camera
3. FOSCAM
4. 12v dc motor
5. L298N 2A Based Motor Driver
6. 12V, 1.2Ah rechargeable battery

Motor control:

One side of two motors is connected to the same side in one spot in the motor drive. Moreover, both side motors go in the same direction for forward and back work. For the right turn, the Left side motor moves forward and the right side backwards. Moreover, for the left side turn, the right side motors move forward, and the right side moves backwards.



Website Features:

1. Live Stream: Users can see a live stream of the FOSCAM camera. This helps the robot make decisions while controlling it.
2. Camera Control: The website allows users to control the camera's orientation on the robot. Users can use website buttons to adjust the camera's position to capture different surroundings.
3. Robot Movement Control: Users can control the robot's movement using buttons or keyboard controls. It has movement commands such as forward, backwards, left, and right. Additionally, users can adjust the speed of the robot.
4. Authentication: A login Page that required a username and password to go to the next control page was created.

Implementation:

- Frontend: The system's front end is developed using coding languages like HTML, CSS, and JavaScript.

- Backend: The system's backend is implemented using a WebSocket server running on the Raspberry Pi using Python coding language.

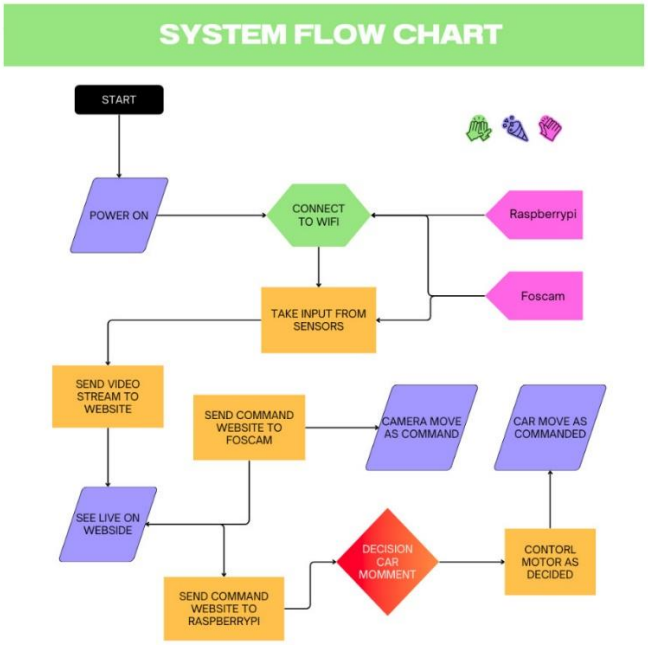
Communication:

1. WebSocket: It provides real-time bidirectional communication between the web interface and the Raspberry Pi backend, enabling fast transmission of control commands.
2. HTTP Requests: Direct HTTP requests control the Foscam camera's pan and tilt functions, allowing users to adjust the camera's orientation and get a live stream.

WebSocket communication for robot control and HTTP requests for camera control provides a robust and responsive system.

Communication Flow:

1. Users interact with the website buttons to control the robot's movement or adjust the camera's position.
2. The web interface sends control commands to the Raspberry Pi's WebSocket server, created on a Wi-Fi IP address.
3. The WebSocket server on the Raspberry Pi receives the commands and gives them to the Movement control code.
4. Camera control buttons send the command-based HTTP requests to the FOSCAM camera to follow that command.



Complete Part list of mechanical and electrical components:

UTRV - Jog, Nihar, Jay, Krish								
Parts List For The Body								
Item No.	Part Name	Material	Qty	Specifications	Part Availability			Raw material (RM) or Ready to use (RTU)
					Available	Purchase	University/Personal/Outside	
1		Steel	4	40 mm x 40 mm x 23.5 mm	Available		University	RTU
2	Side Plate	MDF	2	As Per The Drawing	Available		University	RM
3	Motor	Steel	4	100 RPM	Available		University	RTU
4	Support Plate	Acrylic	4	As Per The Drawing	Available		University	RM
5	C - Clamp	Steel	8	1.5 inch		Purchase	Outside	RTU
6	L - Section Clamp	Steel	10	50 mm x 25 mm		Purchase	Outside	RTU
7	Sprocket Shaft	Aluminium	4	As Per The Drawing		Purchase	Outside	RM
8	Sprocket	Steel	4	14 Teeth (ID - 14 mm)		Purchase	Outside	RTU
9	Top Plate	MDF	1	As Per The Drawing	Available		University	RM
10	M10 - Bolt	Steel	6	Length - 150 mm		Purchase	Outside	RTU
11	M10 - Nut	Steel	18	16 mm x 6 mm		Purchase	Outside	RTU
12	2 - Hole Angle Clamp	Steel	4	Mechanno Part (Standard)		Purchase	Outside	RTU
13	M12 Bolt - Washer	Steel	6	ID - 13 mm; OD - 24 mm		Purchase	Outside	RTU
14	M12 - Bolt	Steel	2	Length - 70mm		Purchase	Outside	RTU
15	M12 - Nut	Steel	4	19 mm x 7 mm		Purchase	Outside	RTU
16	12 mm - ID - Bearing Rollers	Steel	8	ID - 12 mm; OD - 28 mm		Purchase	Outside	RTU
17	Front Plate - 2	MDF	1	As Per The Drawing	Available		University	RM
18	Front Plate - 1	MDF	1	As Per The Drawing	Available		University	RM
19	Back Plate	MDF	1	As Per The Drawing	Available		University	RM
20	Camera Assembly	Plastic	1	FOSCAM - Camera	Available		University	RTU
21	Front Bracket	MDF	2	As Per The Drawing	Available		University	RM
22	Back Bracket	MDF	2	As Per The Drawing	Available		University	RM
23	Bottom Plate	MDF	1	As Per The Drawing	Available		University	RM
24	M4 - Screw	Steel	70	Length - 12 mm		Purchase	Outside	RTU
25	M4 - Nut	Steel	70	7 mm x 3 mm		Purchase	Outside	RTU
26	M7 - Bolt	Steel	16	Length - 25 mm		Purchase	Outside	RTU
27	M7 - Nut	Steel	16	11 mm x 5 mm		Purchase	Outside	RTU
28	M4 - Grub Screw	Steel	8	Length - 6 mm		Purchase	Outside	RTU
29	Bike Chain	Steel	2	1.5 m - each	Available		University	RTU
30	Raspberry pi 3	-	1	1 gb -each	Available		University	RTU
31	L298N Motor Driver	-	1	2A	Available		University	RTU
32	Usb camera	-	4	1/4 640 * 480 usb		Purchase	outside	RTU
33	Foscam	-	1	Ir night vison with	Available		University	RTU
33	12 volt battery	-	1	rechargeable	Available		University	RTU
33	Usb cables	-	1	micro usb to coonect pi			Personal	RTU
33	Power Bank	-	1	5v output			Personal	RTU

Challenges faced:

We faced some challenges in the recent days:

1. As we utilised the sprockets from the scrap, the sprocket had its teeth bent slightly more than others. Because of this, the sprocket does not align with the chain and thus cannot be used.
2. We decided to press-fit the sprockets on the custom-made aluminium shafts, but due to some alignment issues, we couldn't join them using a hammer, so we needed to reduce the shaft diameter again for the sprocket to fit.
3. Some of the C-claps stored in the class went missing, due to which we went to buy new ones, but they didn't fit properly on the motor, and when we finally managed to fit them, we found out we needed longer screws to attach the new clamps.
4. Due to the course presentation of DIM, the fabrication shop has been very packed recently, so we couldn't laser cut our MDF sheets on time, delaying the timeline by a few days.
5. We ordered four small cameras online, but the package was delayed significantly and just got delivered on 8th April, leaving us little time to integrate them into our existing system.

Improvements that can be made:

1. Cameras can be added on all four sides for driving awareness.
2. The turret can be upgraded featuring target auto-tracking and a 2-axis stabilizer.
3. Ground clearance and tracks can be improved as well.

Link to GitHub for Readme and other data:

https://github.com/jay262422/UTRV-Mobile-Robot

Link to Project Video:

https://youtu.be/o7kFr7Nxsds