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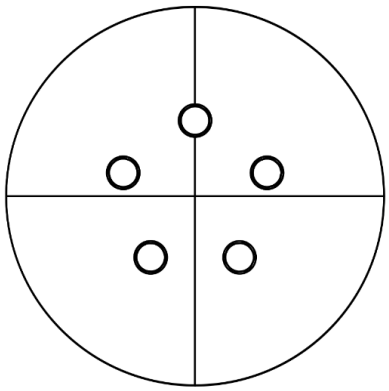
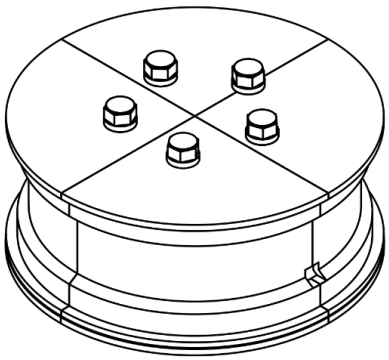
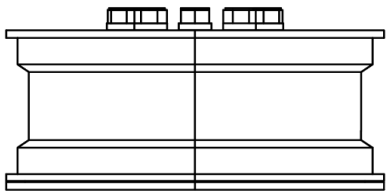
Hardware Course Project: Technical Drawings, SUS and QFD Results

Technical Drawings

Assembly







Dept.	Technical reference	Created by	Approved by	
		Christian Riggi 2022-12-01		
		Document type: Technical Drawing	Document status	
		Title: Rim - Assembly Overview	DWG No.: 1	
			Rev.	Date of issue: 2022-12-01 / Sheet: 1/1

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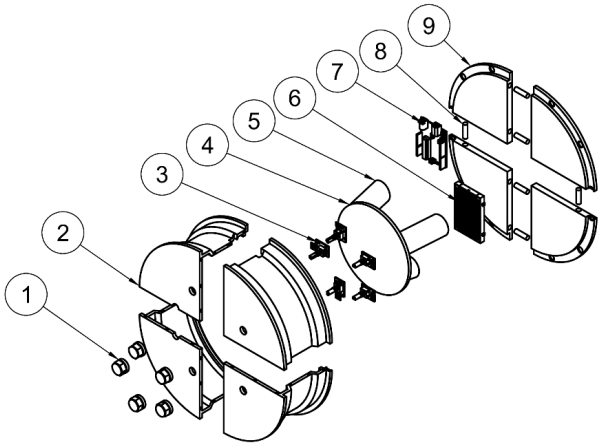
Exploded View

Parts List				
Item	Qty	Part Number	Description	Material
1	5	LUG_N_101 - "Lug Nut"	3D Printed Lug Nut	3D Printed Plastic
2	4	R_SHELL_102	3D Printed Rim Asthetic	3D Printed Plastic
3	5	KY040 Rotary Encoder	Rotary encoders to allow for spin movement	N/A
4	1	ELEV_P_103 - "Elevated Platform"	Platform used to hold rotary encoders above base	3D Printed Plastic
5	3	PLA_L:_104 - "Platform Legs"	Used to hold the platform above the base	3D Printed Plastic
6	1	A000066 - "Arduino Uno"	Main source to program simulation	N/A
7	1	BB400 - "Breadboard"	Used to house Arduino and solderless wires	N/A
8	6	INT_P_105 - "Interior Pegs"	Pegs used to join base pieces together	3D Printed Plastic
9	4	BASE_105 - "Rim Base"	Base to support the shell and all other components	3D Printed Plastic



Dept. / Technical reference		Created by: Christian Riggi 2022-12-02	Approved by:
		Document type: Technical Drawing	Document status:
		Title: Controller Exploded View	DWG No.: 2
			Rev. / Date of issue: 2022-12-02 / Sheet: 1/1

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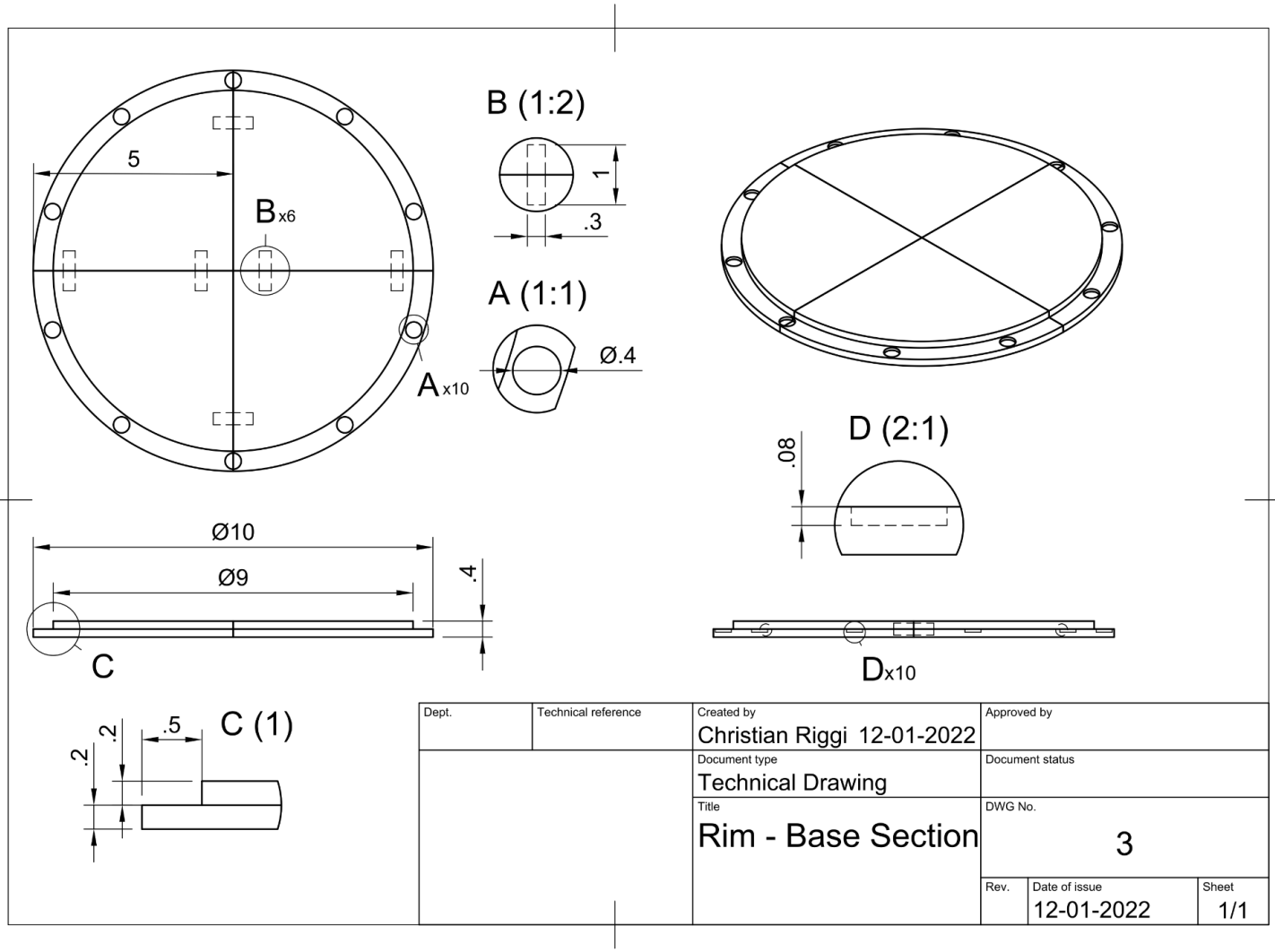
Rim Base



Dept.	Technical reference	Created by	Approved by
		Christian Riggi 12-01-2022	
		Document type: Technical Drawing	Document status
		Title: Rim - Base Section	DWG No.: 3
			Rev. / Date of issue: 12-01-2022 / Sheet: 1/1

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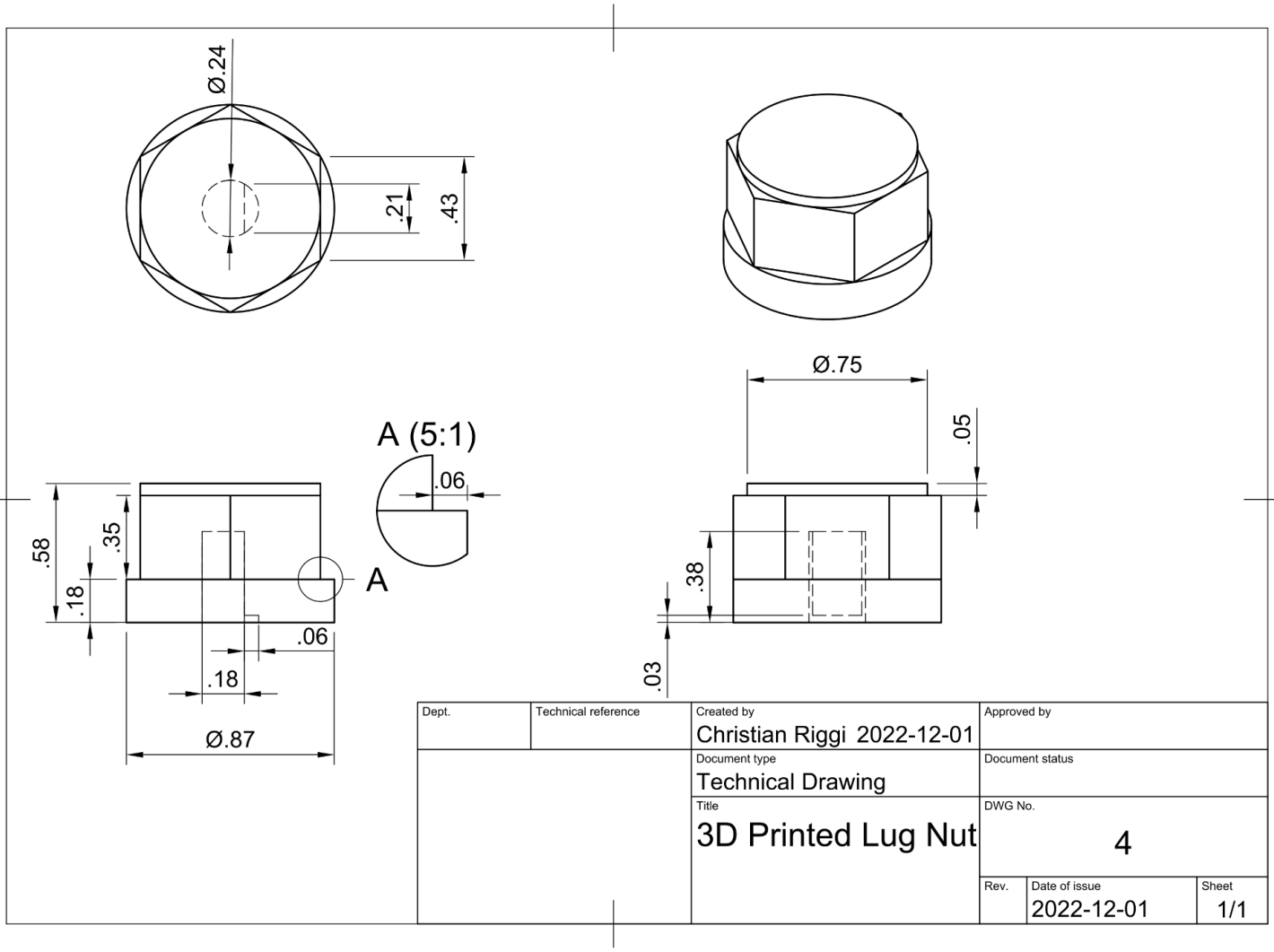
Lug Nut



Dept.	Technical reference	Created by	Approved by
		Christian Riggi 2022-12-01	
		Document type: Technical Drawing	Document status:
		Title: 3D Printed Lug Nut	DWG No.: 4
			Rev. / Date of issue: 2022-12-01 / Sheet: 1/1

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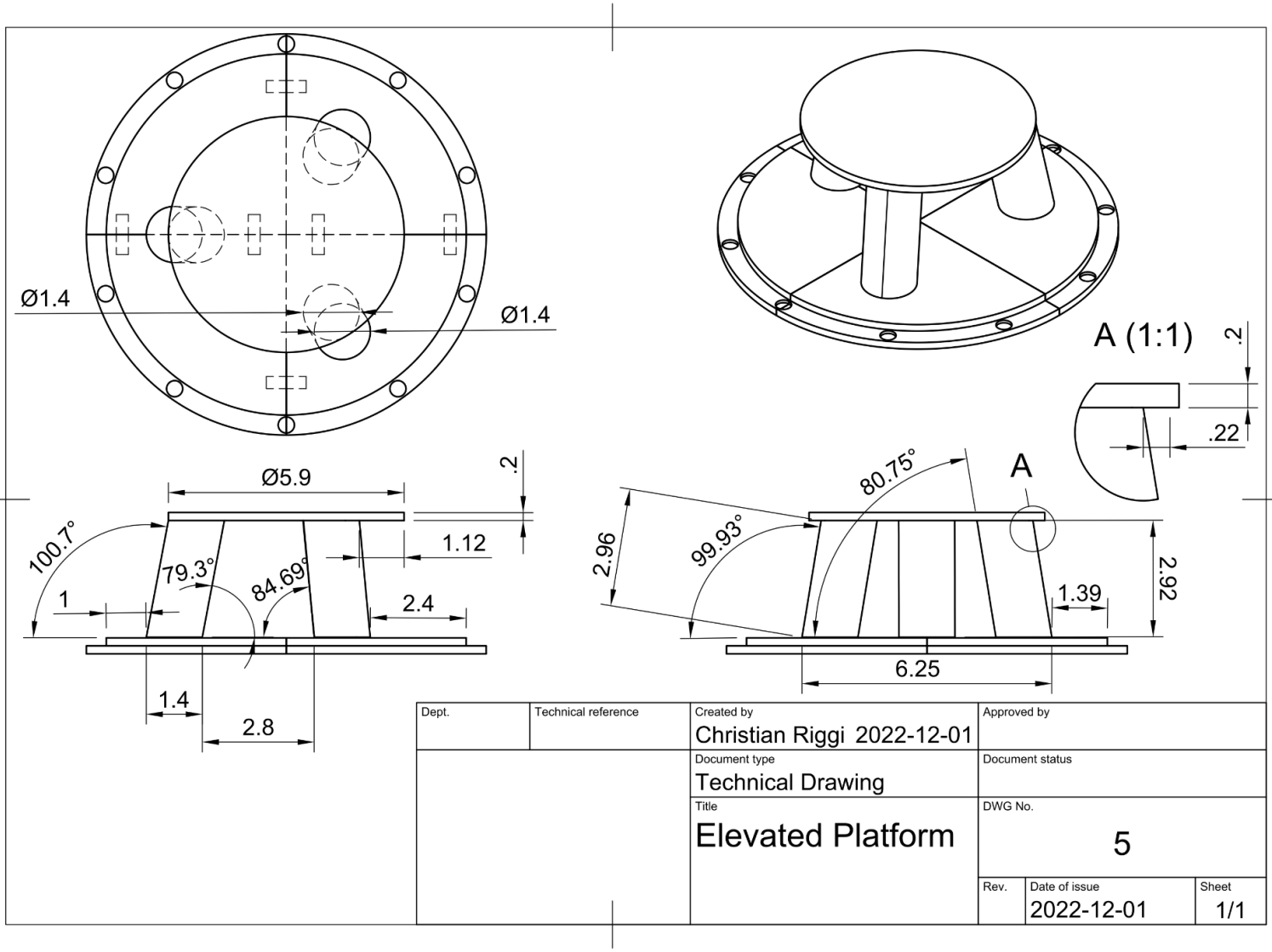
Elevated Platform



Dept.	Technical reference	Created by	Approved by
		Christian Riggi 2022-12-01	
		Document type: Technical Drawing	Document status
		Title: Elevated Platform	DWG No.: 5
			Rev. / Date of issue: 2022-12-01 / Sheet: 1/1

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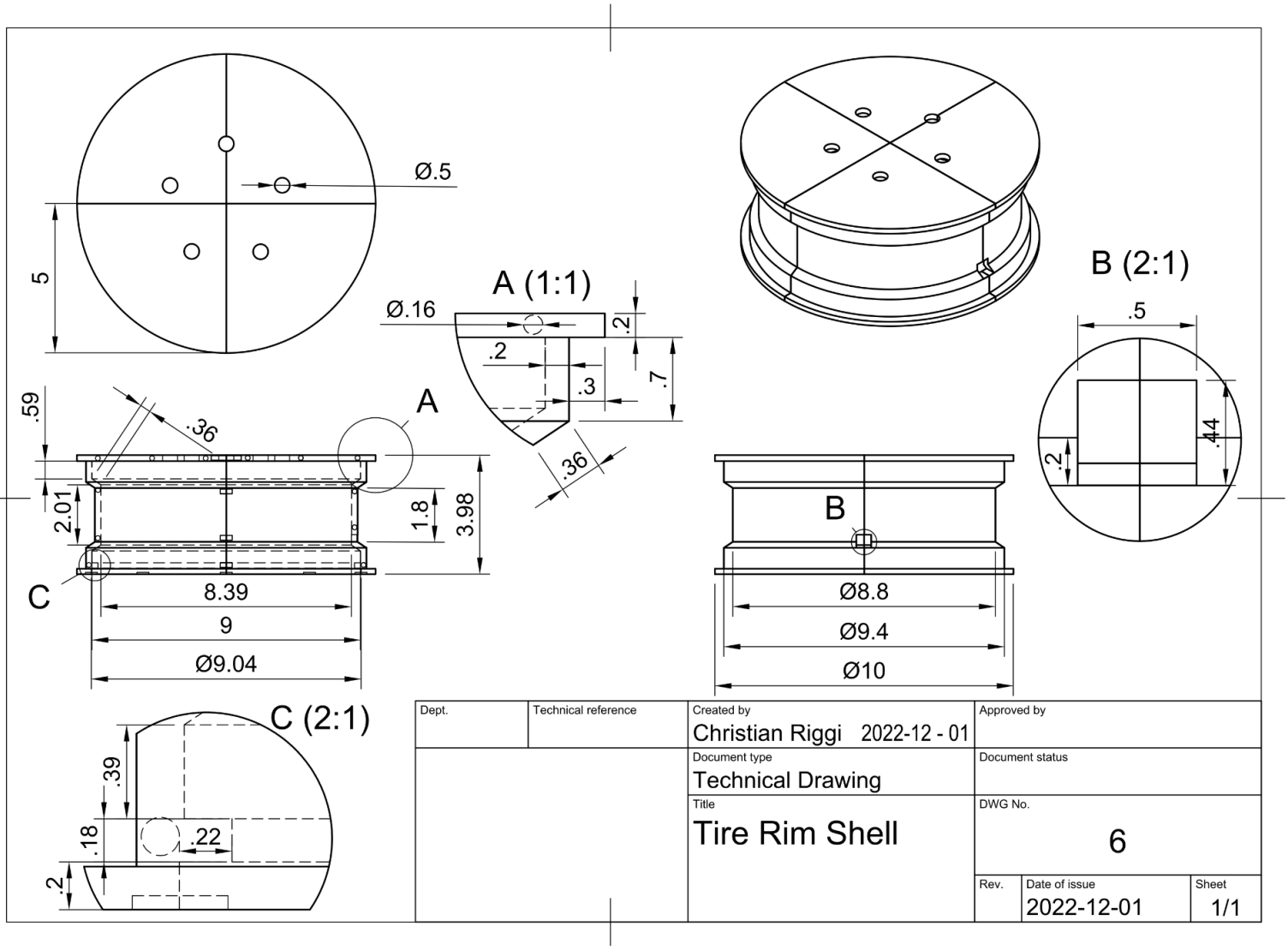
Rim Aesthetic



Dept.	Technical reference	Created by	Approved by
		Christian Riggi 2022-12 - 01	
		Document type: Technical Drawing	Document status:
		Title: Tire Rim Shell	DWG No.: 6
			Rev. / Date of issue: 2022-12-01 / Sheet: 1/1

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Updated Bill of Materials

Item	Quantity	Purpose	Where to Obtain	Costs
Jumper wires (M-F) (M-M) (F-F)	x240	To form a connection between the Arduino, and rotary encoder	amazon.ca	$12.97
LED Lights	x2	Actuators to signal feedback when turning lugnuts	Game Lab (Arduino kit)	
Resistor	x2	Used to regulate the flow of electrical current to LED lights through the breadboard.	Game Lab (Arduino Kit)	
Arduino Uno	**x1**	Power and process inputs from the tire peripheral	Game Lab (Arduino Kit)	
Rotary Encoder	**x5**	Record the rotation input of the torque wrench on the lug nuts.	**Creatron Inc**	$42,38
Magnets (⅜”)	**x20**	Magnets will provide feedback when they	**Amazon**	$14.99
Double Sided Tape (Gorilla Glue)	**x1**	Tape used to secure hardware in place	**Walmart.ca**	$11.97
Socket Wrench (¾” Socket)	**x1**	This will act as our main controller. Rather than utilizing a 3D printed component, we will give the user an actual wrench to play in the simulation.	Personal	
Breadboard	**x1**	Act as a base platform for the Arduino Nano	**Amazon**	$7.90

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QFD Results

Relationships	
Strong	●
Moderate	○
Weak	▽

Direction of Improvement	
Maximize	▲
Target	◇
Minimize	▼

Row #	Weight Chart	Relative Weight	Customer Importance	Maximum Relationship	Customer Requirements (Explicit and Implicit) \ Functional Requirements	Column #	1	2	3	4	5	6	7
						Direction of Improvement	▲	▼	◇				
							Weight	Balance	Knowledge & Understanding	Ease of Use	External Force	Portability	Functionality
1		17%	4	3	Adjusting Weight of Peripheral		○	▽		▽		○	
2		25%	6	9	Stand for the Rim to Rest on		○	○		●			
3		25%	6	9	Explain steps needed before removing tire				●		●		
4		33%	8	9	Simulate the tire to be as real as possible		●			▽			●

Customer Needs to Functional Requirements

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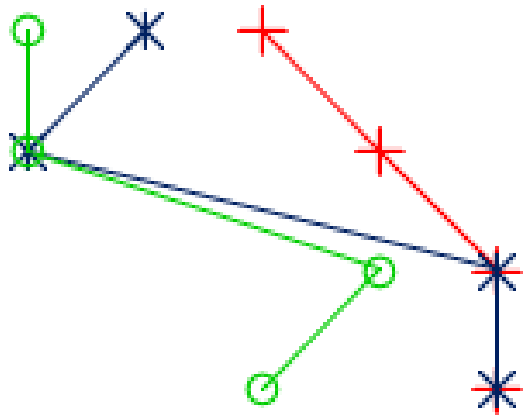
Customer Competitive Assesment					
Our Product	Competitor #1: *VR Car Mechanic Sim*	Competitor #2: *Product Name*			0 1 2 3 4 5
3	2	1			
4	1	1			
5	5	4			
5	5	3			

Customer Competitive Analysis

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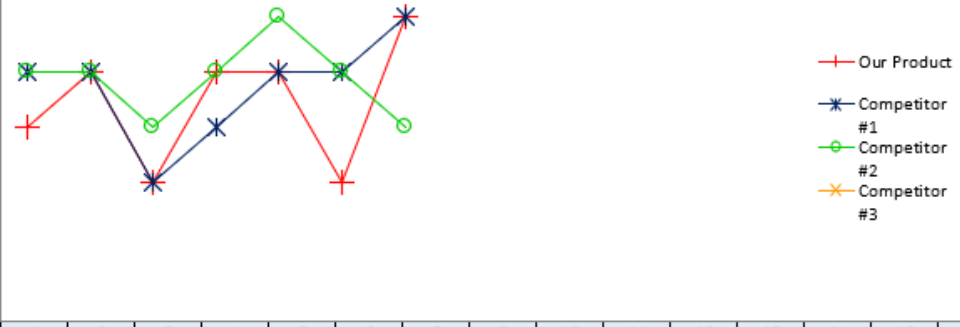
Technical Competitive Assesment	Target	Weight	Balance	Knowledge & Understanding	Ease of Use	External Force	Portability	Functionality								
	Max Relationship	7	3	9	9	9	3	9								
	Technical Importance Rating	425	91.67	225	275	225	50	300								
	Relative Weight	27%	6%	14%	17%	14%	3%	19%								
	Weight Chart															
	Our Product	3	4	2	4	4	2	5								
	Competitor #1: VR Mechanic Simulator	4	4	2	3	4	4	5								
	Competitor #2: AR Training Simulator	4	4	3	4	5	4	3								
	Competitor #3: *Product Name*															
	Competitor #4: *Product Name*															
	0 1 2 3 4 5															
	Column #	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16



Our Product to Competitor Analysis

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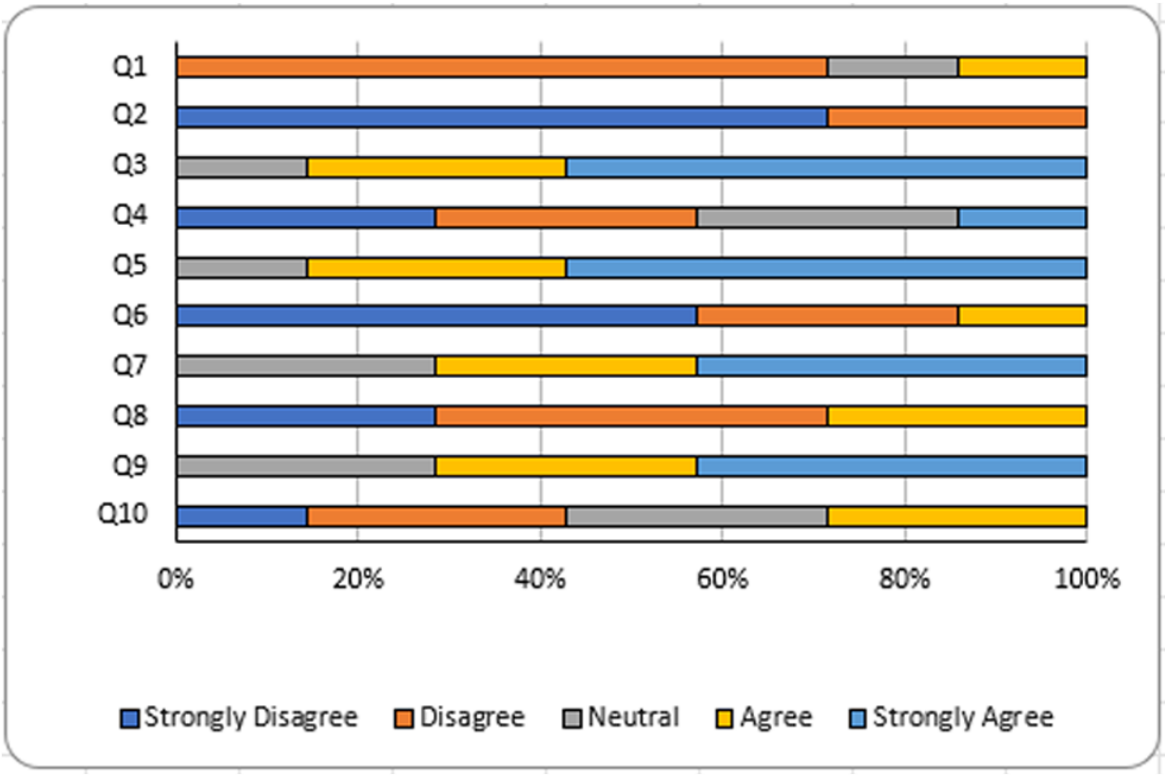
Ehren Chan: 100753167

SUS Results

Paticipant	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
	I think that I would lik	I found the	I thought t	I think that	I found the	I thought t	I would im	I found the	I felt very	I needed to learn a lot of things bef	Score
1	3	1	5	1	5	1	5	1	5	2	92.5
2	2	2	3	5	4	2	3	4	3	4	45
3	2	1	5	2	5	1	5	2	5	2	85
4	4	1	5	1	5	1	5	1	5	4	90
5	2	1	4	3	5	1	4	2	4	3	72.5
6	2	2	4	3	4	4	3	4	3	3	50
7	2	1	5	2	3	2	4	2	4	1	75
											72.8571

Average Participants score from Questionnaire



Results from Questionnaire

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Project Timeline

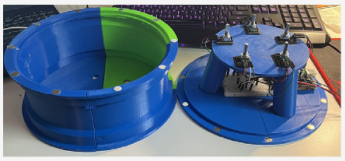
TUNE-UP:
PROJECT TIMELINE

IMPROVEMENT 1

Utilized a real socket wrench rather than making a custom one. Done to avoid complex controller design

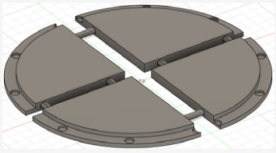
IMPROVEMENT 2

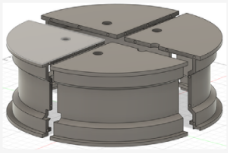
Designed the shell of the rim to be removed from the base in order to access hardware components. Achieved via magnets



IMPROVEMENT 3

Split the base and shell of the controller into 4 pieces as it was too big for the printer bed. Holes were cut along the inside with pegs to attach pieces together



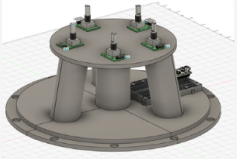


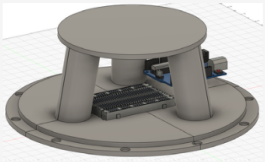
IMPROVEMENT 4

Switched from Arduino nano to Arduino Uno to save time avoiding soldering. Adjusted the port size to match the uno

IMPROVEMENT 5

Removed the middle leg of the platform to re-position breadboard and Arduino Uno





IMPROVEMENT 6

Built a stand for the Arudino Uno so it could reach the height of the port.