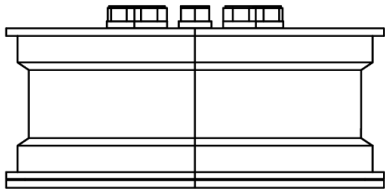
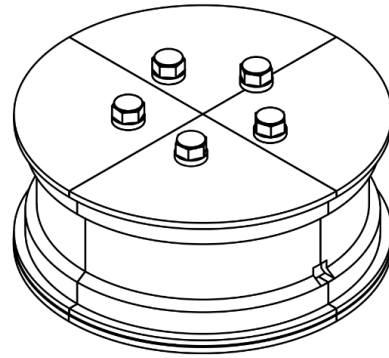
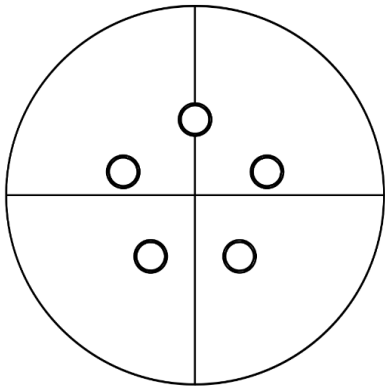


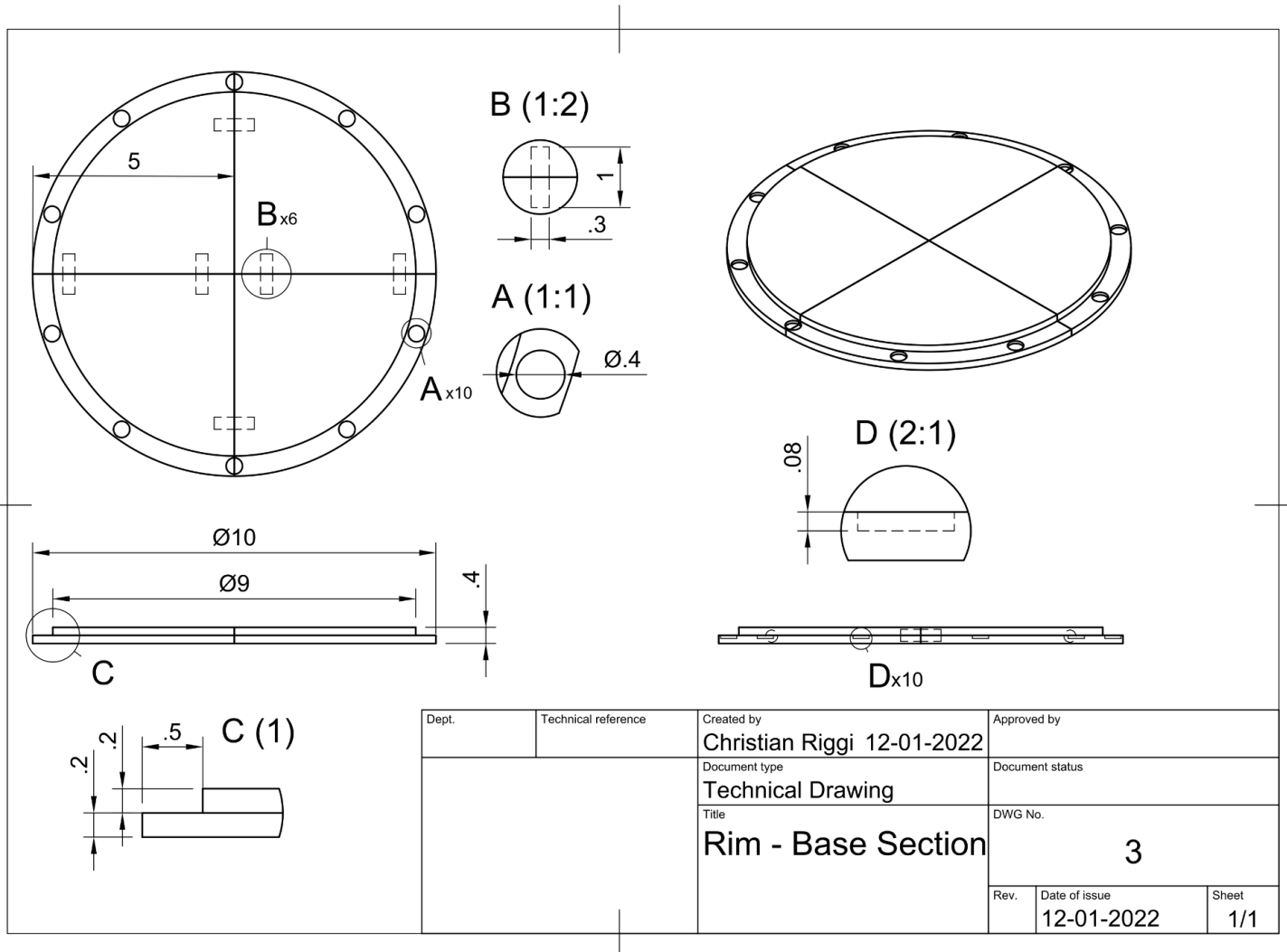
Hardware Course Project: Technical Drawings, SUS and QFD Results**Technical Drawings****Assembly**

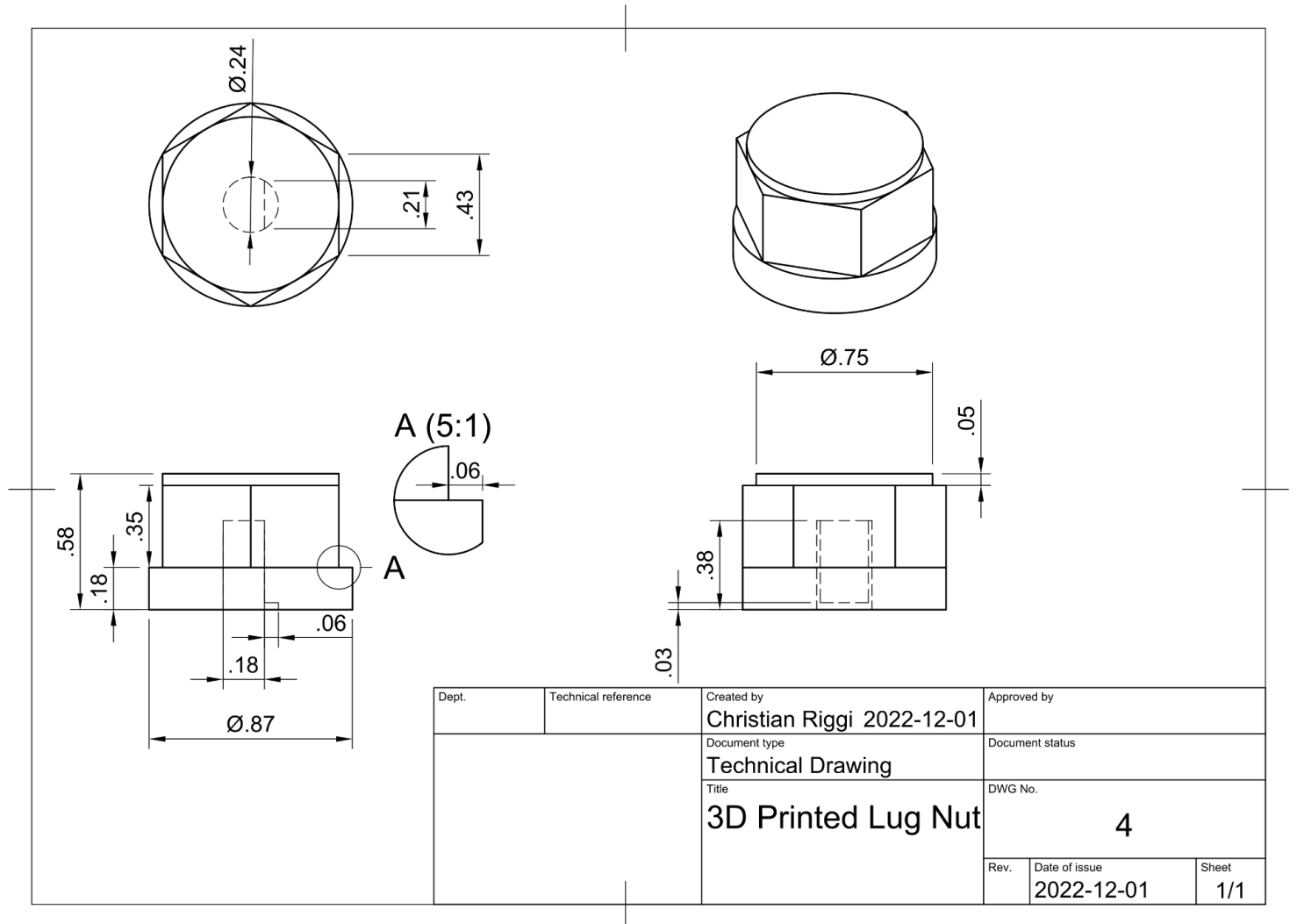
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		Document type Technical Drawing	Document status	
		Title Rim - Assembly Overview	DWG No. 1	
			Rev.	Date of issue 2022-12-01
			Sheet	1/1

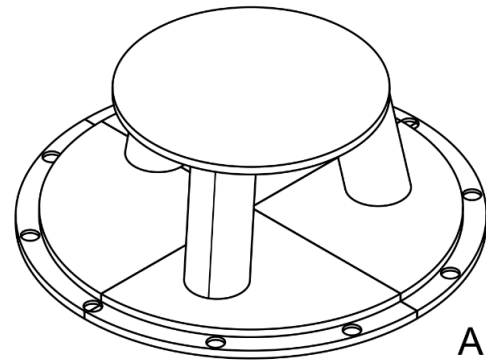
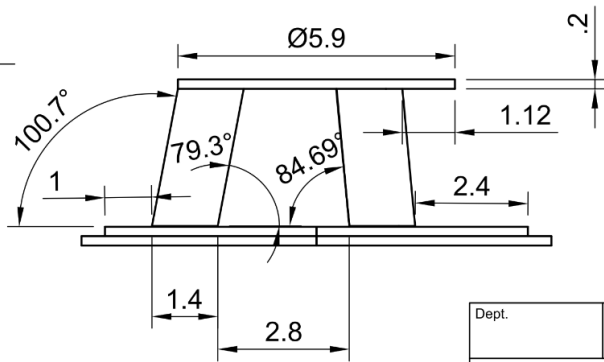
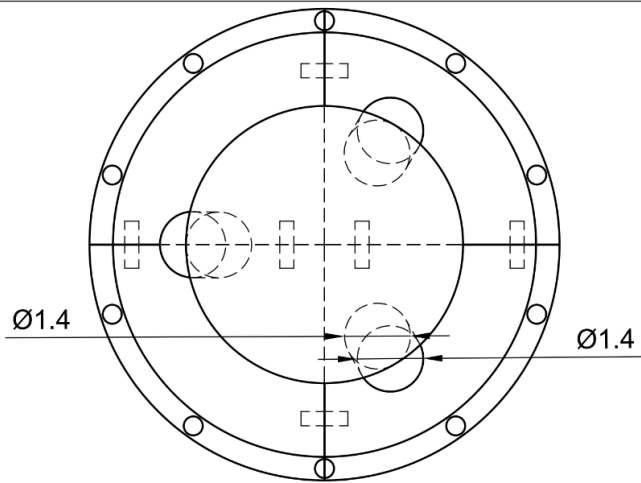
Exploded View

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

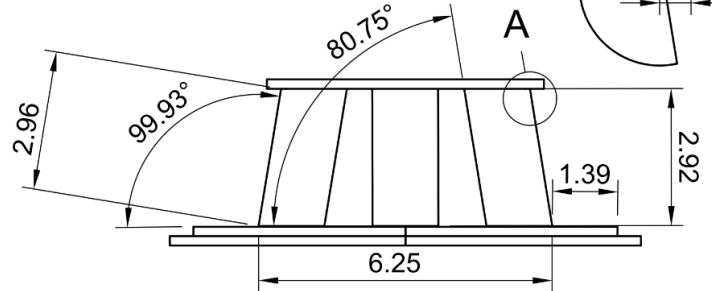
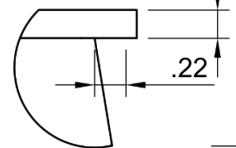
PROJECT				
Hardware Controller				
TITLE				
Controller Exploded View				
APPROVED	SIZE	CODE	DWG NO	REV
CHECKED	B		2	
DRAWN Christian Riggi 2022-12-01		SCALE 1:4	WEIGHT	SHEET 1/1

Rim Base

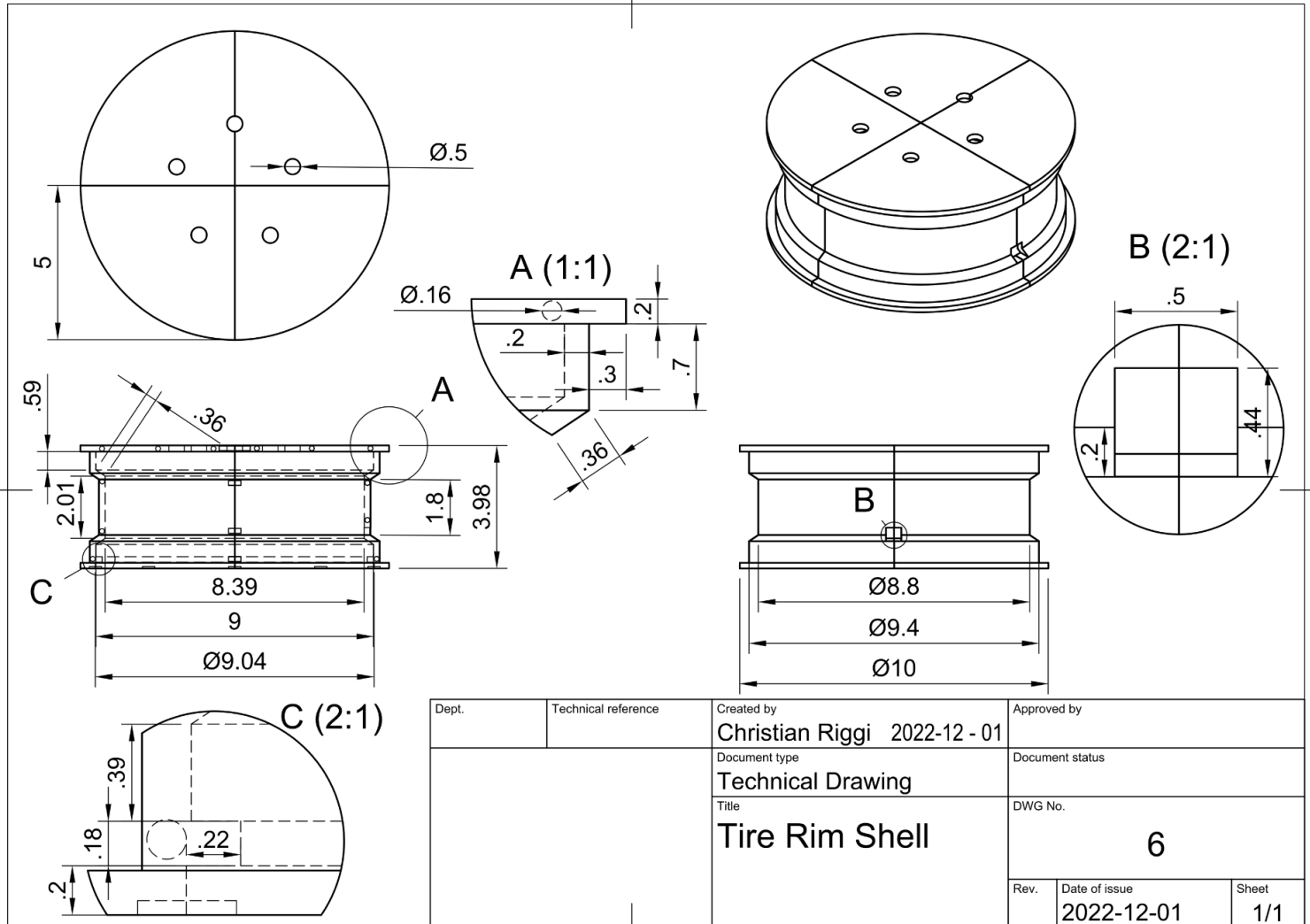
Lug Nut

Elevated Platform

A (1:1)



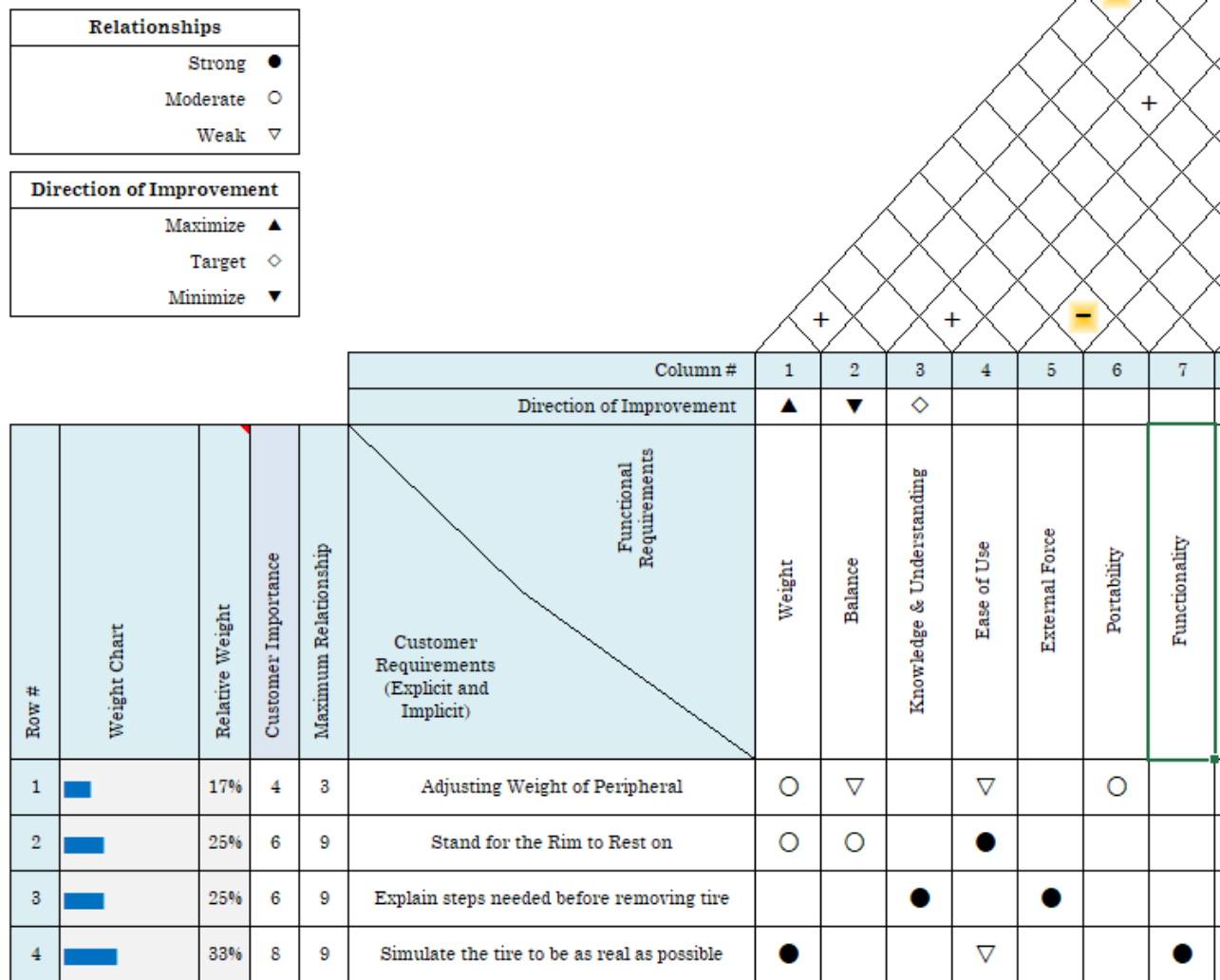
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		Document type Technical Drawing	Document status		
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			Rev.	Date of issue 2022-12-01	Sheet 1/1

Rim Aesthetic

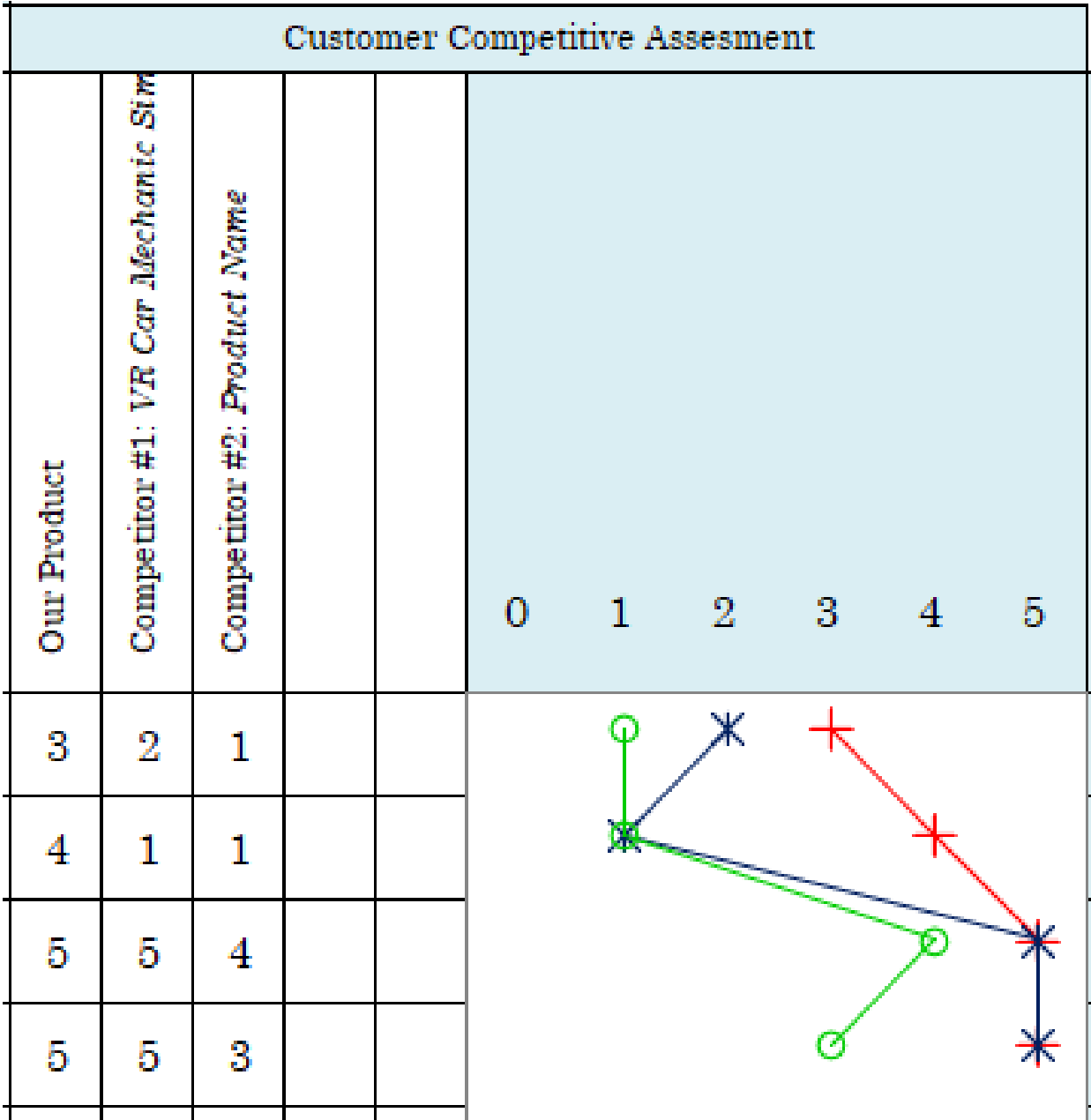
Updated Bill of Materials

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 ($\frac{3}{8}$ ")	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 ($\frac{3}{4}$ " 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

QFD Results



Customer Needs to Functional Requirements



Customer Competitive Analysis

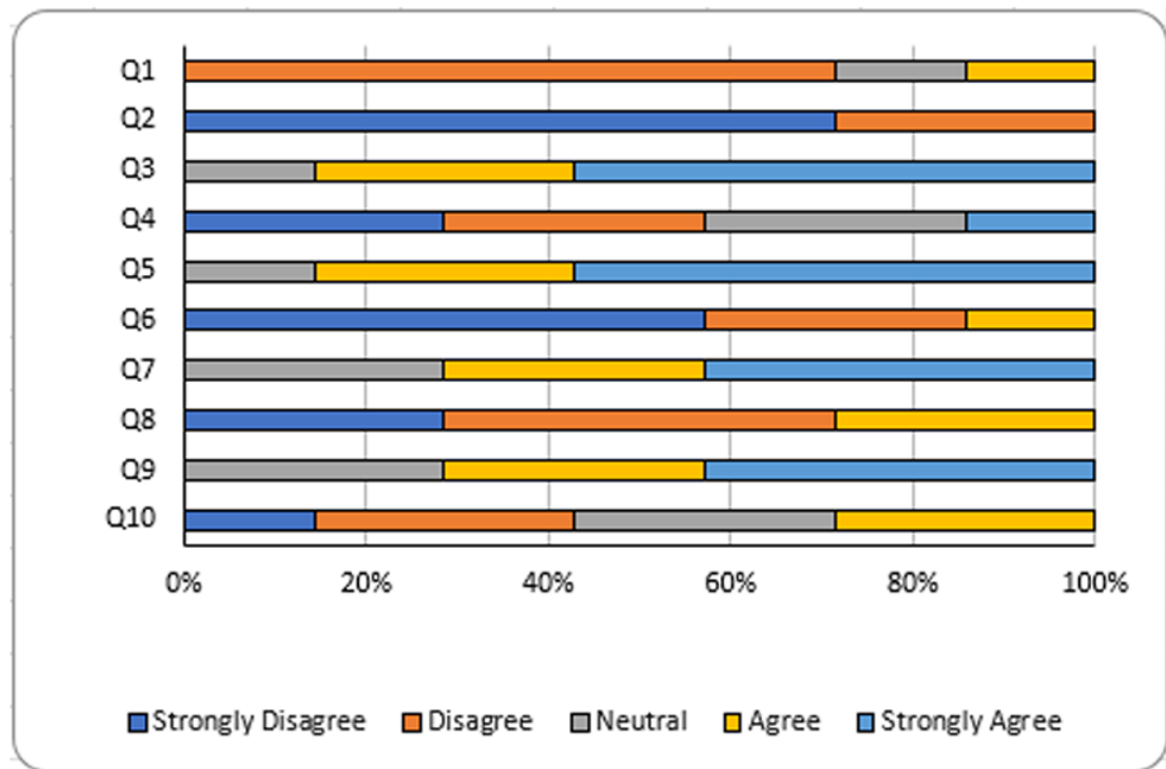
Technical Competitive Assessment	Target	Weight	Balance	Knowledge & Understanding	Ease of Use	External Force	Portability	Functionality								
	Max Relationship	7	3	9	9	9	3	9								
	Technical Importance Rating	425	91.67	225	275	225	50	300								
	Relative Weight	27%	6%	14%	17%	14%	3%	19%								
	Weight 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: <i>Product Name</i>															
	Competitor #4: <i>Product Name</i>															
	Column #	1	2	3	4	5	6	7	9	10	11	12	13	14	15	16

Our Product to Competitor Analysis

SUS Results

Participant	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
	I think that I would like to use this system frequently	I found the system useful	I thought the system was easy to use	I think that I would like to learn a lot of things about this system	I found the system useful	I thought the system was easy to use	I would imagine that I would like to use this system frequently	I found the system useful	I felt very confident when using the system	I needed to learn a lot of things before I could get going with this system		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

Project Timeline

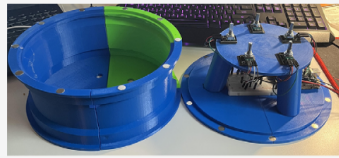
TUNE-UP: PROJECT TIMELINE

IMPROVEMENT 1

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

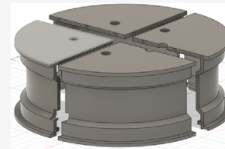
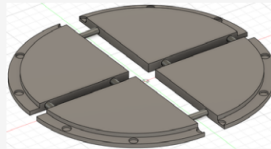
IMPROVEMENT 2

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

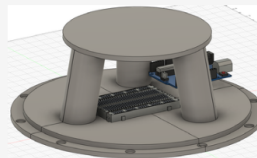
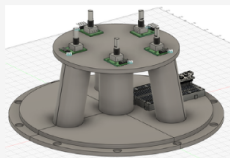


IMPROVEMENT 4

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.

