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Industrial Design for Game Hardware Assignment #2
Technical Drawings, Circuitry and Prototyping

Bill of Materials - (based off TinkerCad and general needs).

Item	Quantity	Purpose	Where to Obtain	Costs
Jumper wires (M-F)	x40	To form a connection between the Arduino, and rotary encoder	Creatron Inc	$6.72
Arduino Nano	**x1**	Power and process inputs from the tire peripheral	store.usa.Arduino.cc	$33.18
Rotary Encoder	**x5**	Record the rotation input of the torque wrench on the lug nuts.	**Creatron Inc**	$42,38
Magnets (⅜”)	**x25**	Magnets will provide feedback when they	**Amazon**	$14.99
Torque 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.		
Breadboard	**x1**	Act as a base platform for the Arduino Nano	**Amazon**	$7.90

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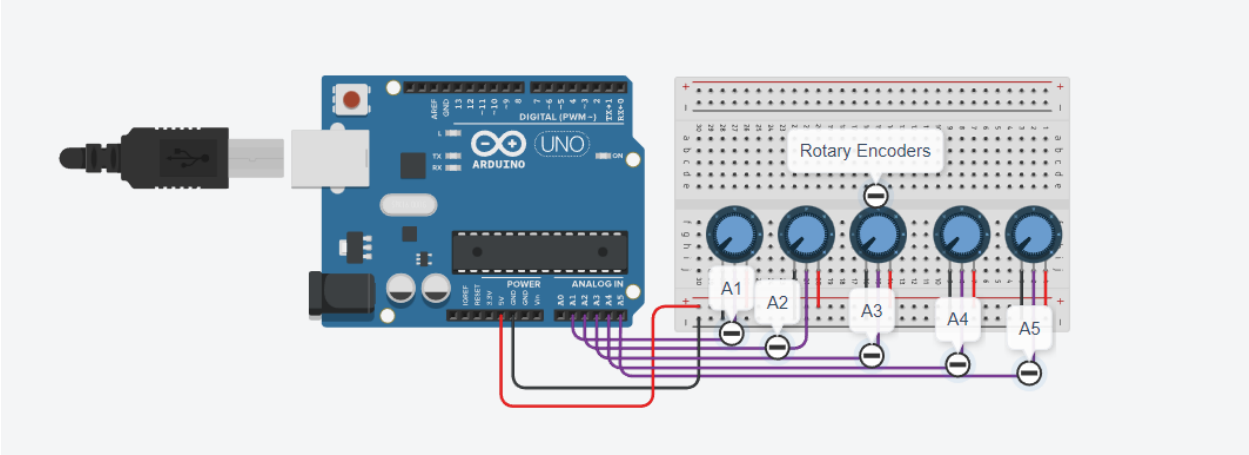
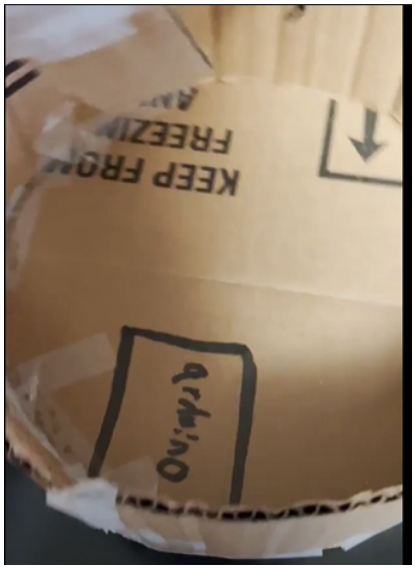
Circuitry Design

Here is an image depicting our circuitry design for this controller in TinkerCad. The circuitry is quite simple as we require only 5 rotary encoders, an arduino nano and breadboard. This depiction is a close representation to the final product's functionality.



Paper Prototype

Here are photos of the paper prototype showing the approximate size and positioning of the components for the tire peripheral. We included a representation for the lugnuts, rotary encoders and the arduino along with the accompanying slot for the usb port.



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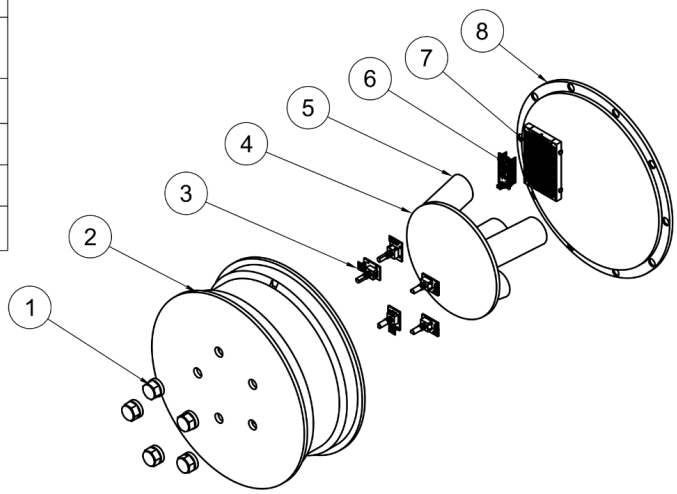
3D Exploded View & Parts List

Here is the 3D exploded view along with the parts list from Fusion 360. The parts list is short as we wanted to keep our design small in scope and only rely on the essentials needed for this project. Within this part list, we highlight our key pieces of hardware, along with all the components we will be making to achieve this.

Parts List				
Item	Qty	Part Number	Description	Material
1	5	LUG_N_101 - "Lug Nut"	3D Printed Lug Nut	3D Printed Plastic
2	1	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	4	PLA_L:_104 - "Platform Legs"	Used to hold the platform above the base	3D Printed Plastic
6	1	A000005 - "Arduino Nano"	Main source to program simulation	N/A
7	1	BB400 - "Breadboard"	Used to house Arduino and saudered wires	N/A
8	1	BASE_105 - "Rim Base"	Base to support the shell and all other components	3D Printed Plastic



Dept.	Technical reference	Created by	Approved by
		Christian Riggi 2022-10-25	
		Document type: Technical Drawing	Document status:
		Title: Controller - Exploded View	DWG No.: 6
			Rev. / Date of issue: 2022-10-25 / Sheet: 1/1

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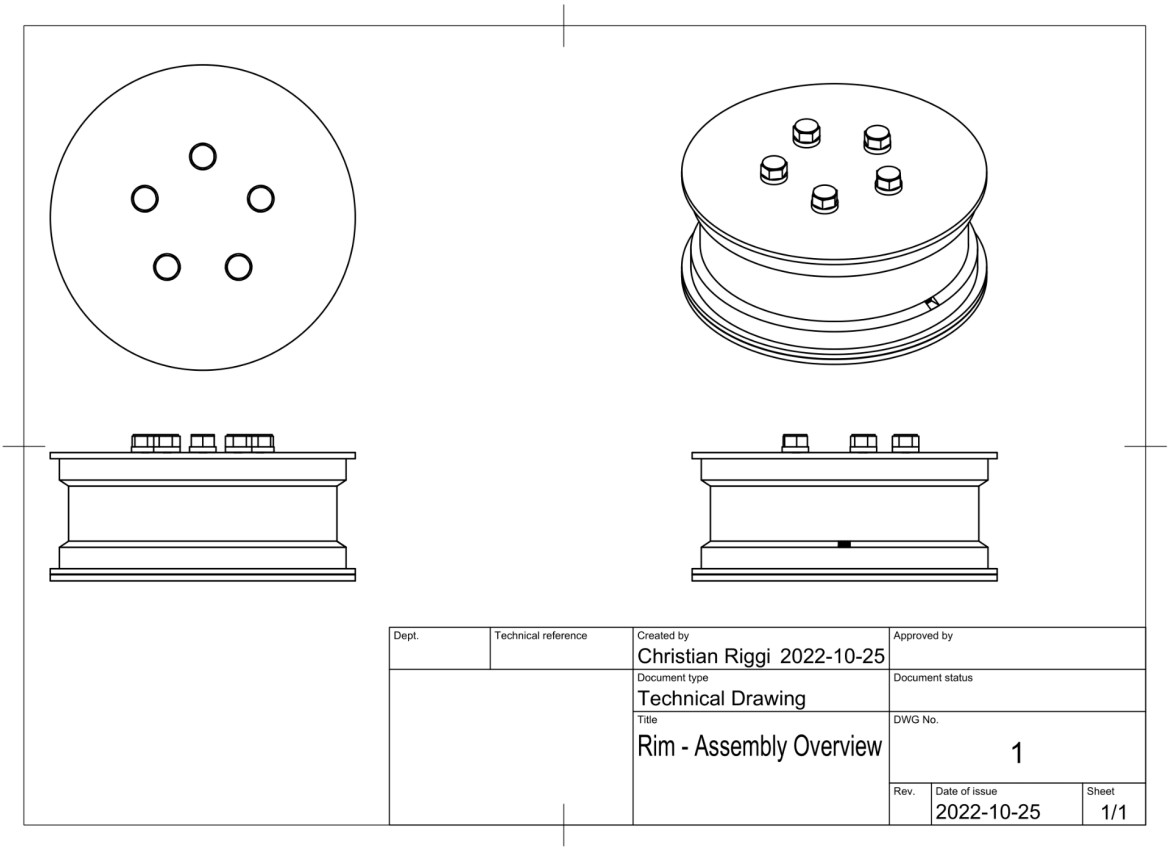
2D Technical Drawings:

1. Rim- Assembly Overview

Here are 2D technical drawings for the tire peripheral featuring a detailed look into the magnetic base, rotary motor stand, lug nut geometry and overall shape of the tire. The first technical drawing here is the assembly overview of the entire peripheral. This drawing highlights the key shots and angles before we began to move on with operations.



Dept.	Technical reference	Created by	Approved by
		Christian Riggi 2022-10-25	
		Document type: Technical Drawing	Document status
		Title: Rim - Assembly Overview	DWG No.: 1
			Rev. / Date of issue: 2022-10-25 / Sheet: 1/1

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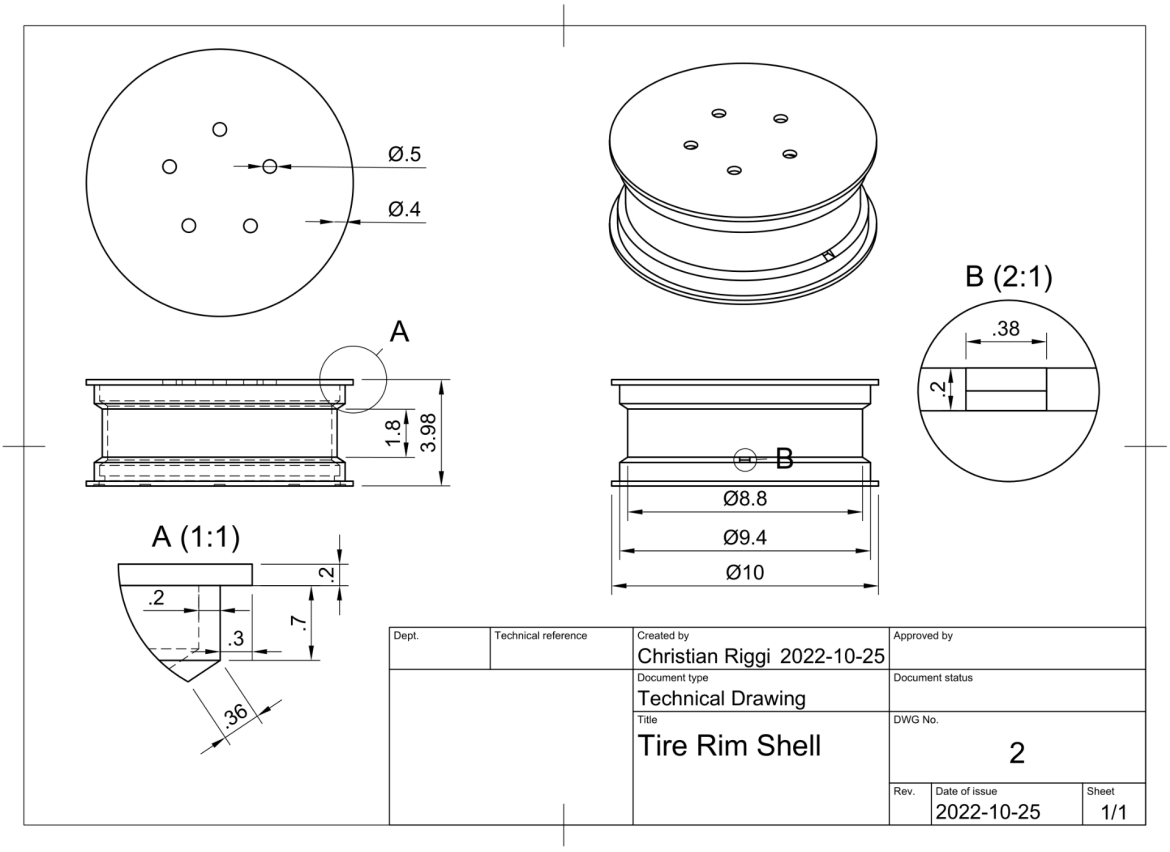
2. Tire Rim Shell

This technical drawing highlights the “shell” component of our peripheral. This shell will wrap around the entire base section in order to house all the hardware on the inside. The shell will connect to the base via 10 magnets lined up along the base and the shell. By having the ability to remove the shell, users can access the hardware on the iside in the event where maintenance needs to be performed. The shell will also host a USB port along the right side where users will be able to plug in a USB and connect it to a PC, which will be our main source of power for our peripheral.



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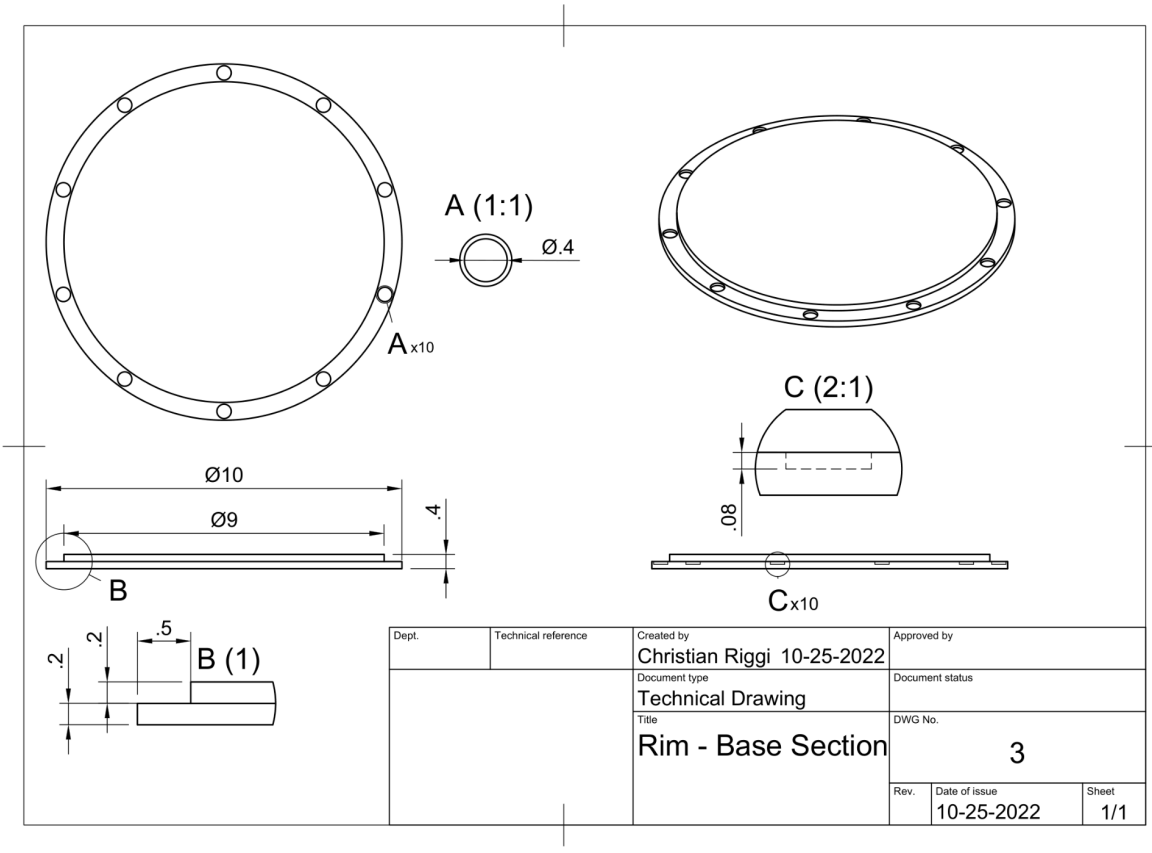
3. Rim-Base Section

This technical drawing outlines the base needed for our peripheral. This component is where all of our hardware will be situated when assembling the peripheral. The arduino and breadboard will be placed on the edge where the USB port is located, in addition with the elevated platform we have planned for the rotary encoders.



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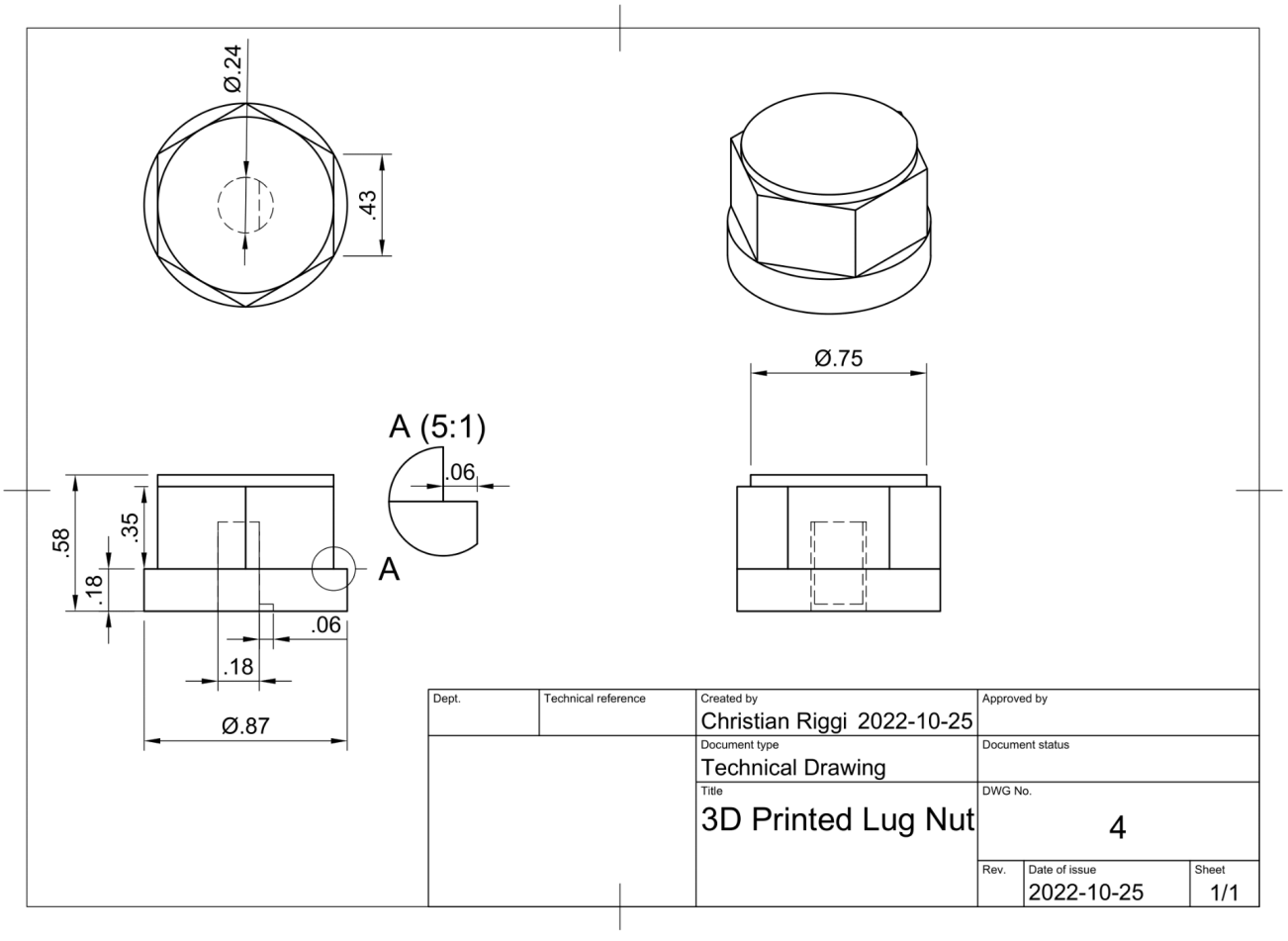
4. 3D Printed Lug Nut

This technical drawing highlights the 3D printed lug nut component for our peripheral. This component is the main interaction feature from our entire peripheral. The lug nut acts as a mold that will sit on top of each rotary encoder. Once the user starts to loosen or tighten each lug nut, they will be able to spin on the rotary encoder. Based off the data we gather from that movement, we can utilize it to update our simulation in unity. The lug-nut will also have a size of ¾." The reason for this is because of information we received from our feedback. Many students mentioned not having specific tutorials for specific cars (it was mainly generalized). With that in mind, we wim to make our peripheral follow the instructions needed for a specific car (a 2022 Honda Civic to be specific). That being said, the lug nut will be that dimension and will need an appropriate wrench to remove it.



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5. Elevated Platform

Finally, the last technical drawing we have created is a drawing for an elevated platform component. This platform will be situated in the middle of the base, surrounding the breadboard and Arudino in the middle as well. The purpose of this platform is to host each rotary encoder in a sturdy position. By also hosting them on an elevated platform, the dial of the encoder will be able to stick out of punctured holes on the top of the shell. This will allow for us to attach our lugnut mold right onto the encoder. We feel that this will be very affective in our peripheral to provide support and aid functionality.