

# Pseudo GPS for Romi Drawing & Specification Package

May 10, 2024

For Charlie Refvem

## Team

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College of Engineering

California Polytechnic State University, San Luis Obispo

2024

# Indented Bill of Materials

## Psuedo GPS Indented Bill of Material (iBOM)

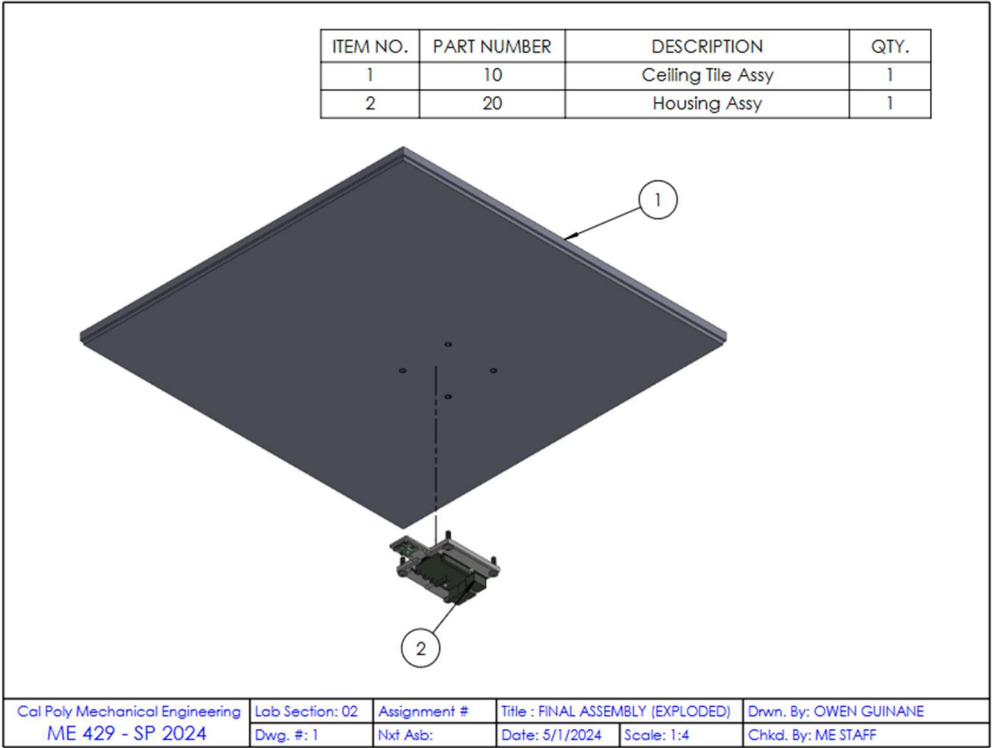
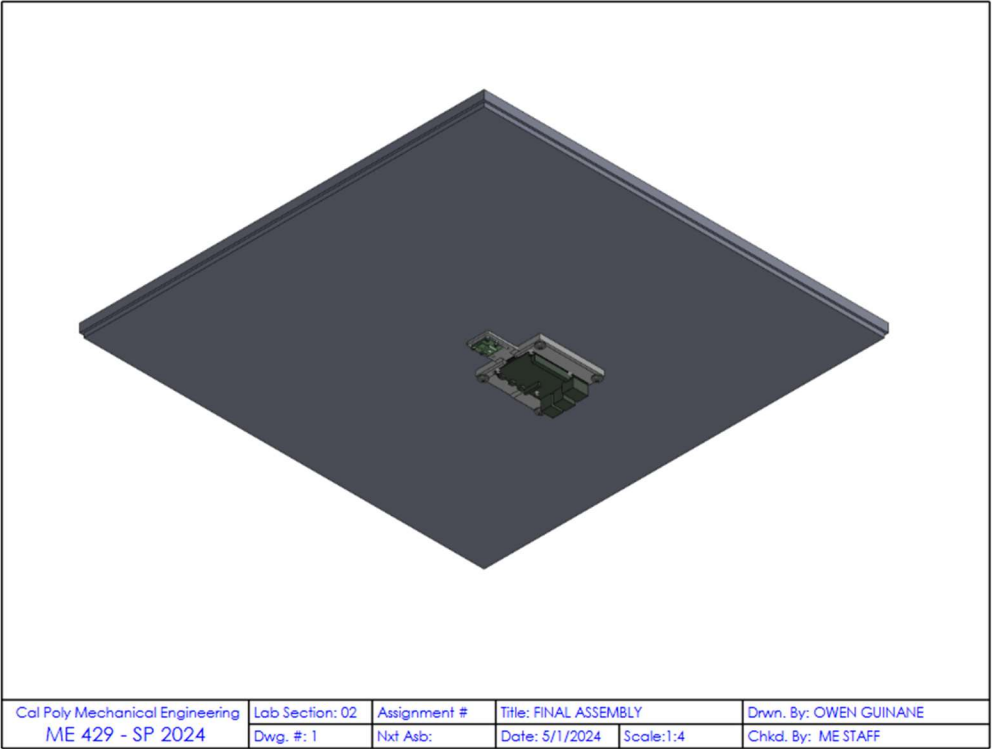
Assy Level	Part Number	Descriptive Part Name	Qty	Part Cost	Source	URL	More Info
		Lvl0 Lvl1 Lvl2 Lvl3 Lvl4					
0	1	Final Assy					
1	10	Ceiling Tile Assy					
2	110	Ceiling Tile	1		Cal Poly Wood Shop		Ask for tiles for lab 192-118
2	120	Threaded Inserts	4	\$3.87	Home Depot	<a href="https://www.homedepot.com/p/Everbilt-1-4-in-20-Zinc-Plated-Insert-Nut-4-Pack-801884/204274222">https://www.homedepot.com/p/Everbilt-1-4-in-20-Zinc-Plated-Insert-Nut-4-Pack-801884/204274222</a>	
2	20	Housing Assy					
3	210	Main Housing	1		3D Printed		
3	220	Microcontroller Assy					
4	2210	Raspberry Pi 4 Model B - 8GB Ram	1	\$150.00	Adafruit	<a href="https://www.adafruit.com/product/4564">https://www.adafruit.com/product/4564</a>	
4	2220	SD/MircoSD - 16GB class 10	1	\$19.95	Adafruit	<a href="https://www.adafruit.com/product/2693">https://www.adafruit.com/product/2693</a>	
3	230	Camera Assy					
4	2310	Raspberry Pi Camera Module 3 Sta	1	\$25.00	Adafruit	<a href="https://www.adafruit.com/product/5657">https://www.adafruit.com/product/5657</a>	
4	2320	Camera Spacer	1		3D Printed		
3	240	1/4"-20 1" Machine Screws	4	\$1.38	Home Depot	<a href="https://www.homedepot.com/p/Everbilt-1-4-in-20-Zinc-Plated-Insert-Nut-4-Pack-801884/204274222">https://www.homedepot.com/p/Everbilt-1-4-in-20-Zinc-Plated-Insert-Nut-4-Pack-801884/204274222</a>	
3	250	M2.5 10mm Machine Screws	4	\$10.86	Amazon	<a href="https://www.amazon.com/gp/product/B078K38884">https://www.amazon.com/gp/product/B078K38884</a>	Sold in 840 Pc Kit
3	260	M2 10mm Machine Screws	4	\$9.99	Amazon	<a href="https://www.amazon.com/gp/product/B078K38884">https://www.amazon.com/gp/product/B078K38884</a>	Sold in 660 Pc Kit
3	270	M2 Nuts	4	[-]	Amazon		In M2 Screw kit
1	3	Cables					
2	30	Micro HDMI to HDMI Cable	1	\$8.95	Adafruit	<a href="https://www.adafruit.com/product/3537">https://www.adafruit.com/product/3537</a>	
2	31	Power Supply 5.1V 3A w/ USB C	1	\$7.95	Adafruit	<a href="https://www.adafruit.com/product/3537">https://www.adafruit.com/product/3537</a>	
Total Parts			28	\$237.95			

## Purchased Parts Table

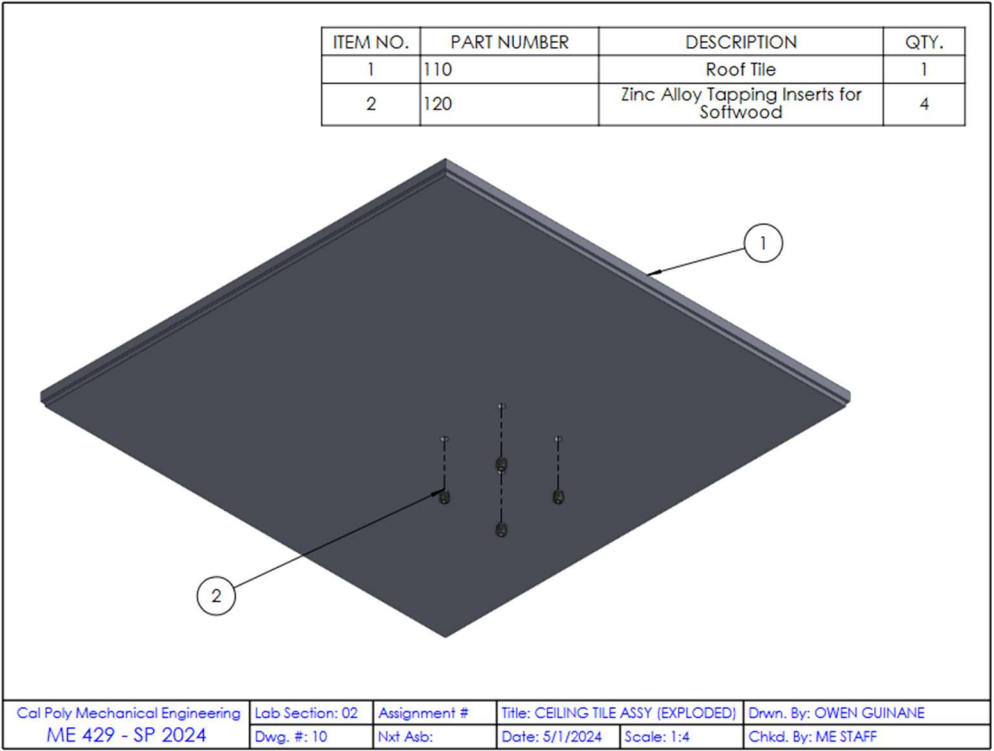
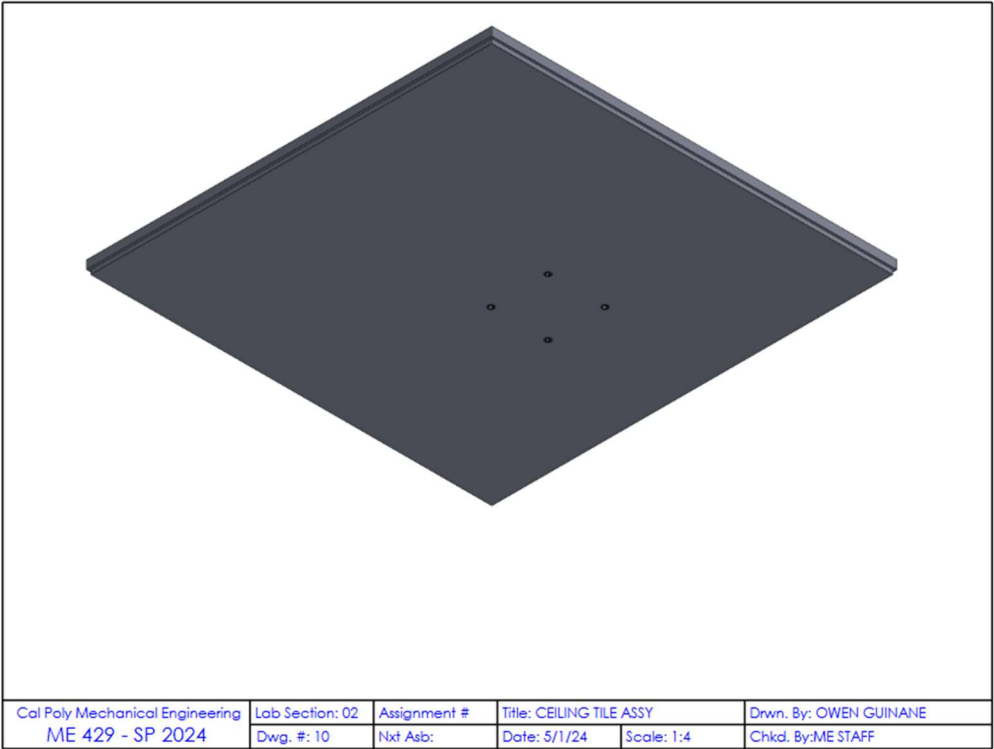
Part #	Part Name	Vendor	Vendor's Part #	Price	Manuf.	Manuf. Part #	Key Features/Specs	URL
120	1/4"-20 Zinc Plated Insert Nut	Home Depot	204274222	\$3.87	Everbilt	801884	1/4" Diameter, 20 TPI, 3/4" Depth, Steel, Zinc Plated	<a href="https://www.homedepot.com/p/Everbilt-1-4-in-20-Zinc-Plated-Insert-Nut-4-Pack-801884/204274222">https://www.homedepot.com/p/Everbilt-1-4-in-20-Zinc-Plated-Insert-Nut-4-Pack-801884/204274222</a>
2210	Raspberry Pi 4 Model B	Adafruit	4564	\$150.00	Raspberry Pi	N/A	Microcontroller	<a href="https://www.adafruit.com/product/4564">https://www.adafruit.com/product/4564</a>
2220	16GB MicroSD Card	Adafruit	2693	\$19.95	SanDisk	N/A	16GB MicroSD card	<a href="https://www.adafruit.com/product/2693">https://www.adafruit.com/product/2693</a>
2310	Raspberry Pi Camera Module 3	Adafruit	5657	\$25.00	Raspberry Pi	N/A	12MP,	<a href="https://www.adafruit.com/product/5657">https://www.adafruit.com/product/5657</a>

240	1/4"-20 1" Machine Screws	Home Depot	204274644	\$1.38	Everbilt	803481	1/4" Diameter, 20 TPI, 1" Length, Steel, Zinc Plated, Round head philips machine screw	<a href="https://www.homedepot.com/p/Everbilt-1-4-in-20-x-1-in-Zinc-Plated-Combo-Round-Head-Machine-Screw-4-Pack-803481/204274644">https://www.homedepot.com/p/Everbilt-1-4-in-20-x-1-in-Zinc-Plated-Combo-Round-Head-Machine-Screw-4-Pack-803481/204274644</a>
250	M2.5 10mm Machine Screws	Amazon	B0CRRCYZHS	\$10.86	qiwhuai	N/A	M2.5, 304 Stainless Steel, Lengths ranging from 4-25mm, 40 screws for each size, half flathead, half hex button	<a href="https://www.amazon.com/dp/B0CRRCYZHS/ref=twister_B0CHMKL1DF?encoding=UTF8&amp;th=1">https://www.amazon.com/dp/B0CRRCYZHS/ref=twister_B0CHMKL1DF?encoding=UTF8&amp;th=1</a>
260	M2 10mm Machine Screws	Amazon	B0B93G1H9L	\$9.99	Kadrick	N/A	M2, 304 Stainless Steel, Lengths ranging from 4mm to 16mm, 660 pc total	<a href="https://www.amazon.com/Kadrick-Assortment-Button-Stainless-Washers/dp/B0BX96SMW4?ref=ast_sto_dp&amp;th=1&amp;psc=1">https://www.amazon.com/Kadrick-Assortment-Button-Stainless-Washers/dp/B0BX96SMW4?ref=ast_sto_dp&amp;th=1&amp;psc=1</a>
270	M2 Nuts	Amazon	N/A	N/A	Kadrick	N/A	Comes in Kadrick M2 Kit, 220 pc count	
30	Micro HDMI to HDMI Cable	Adafruit	1322	\$8.95	Adafruit	N/A	2 meters length, HDMI 1.3 to MicroHDMI	<a href="https://www.adafruit.com/product/1322">https://www.adafruit.com/product/1322</a>
31	Power Supply 5.1V 3A w/ USB C	Adafruit	4298	\$7.95	Raspberry Pi	N/A	1.5 meters length, 5.1V, 3A Output, USB-C	<a href="https://www.adafruit.com/product/4298">https://www.adafruit.com/product/4298</a>

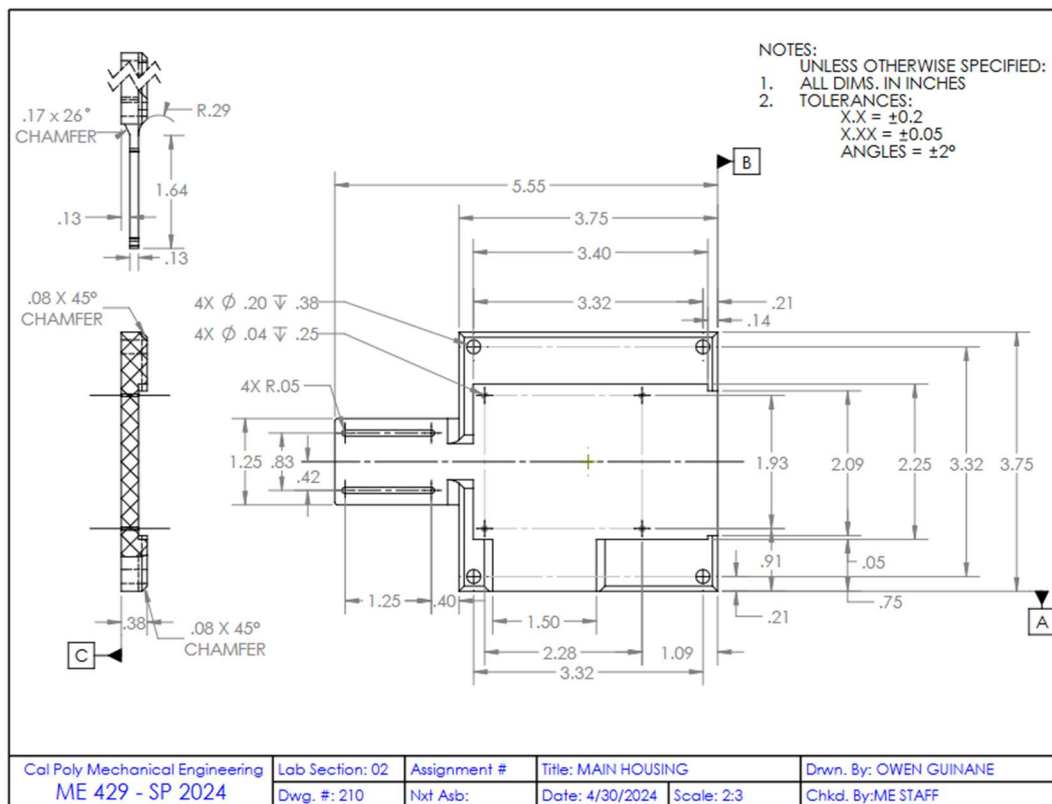
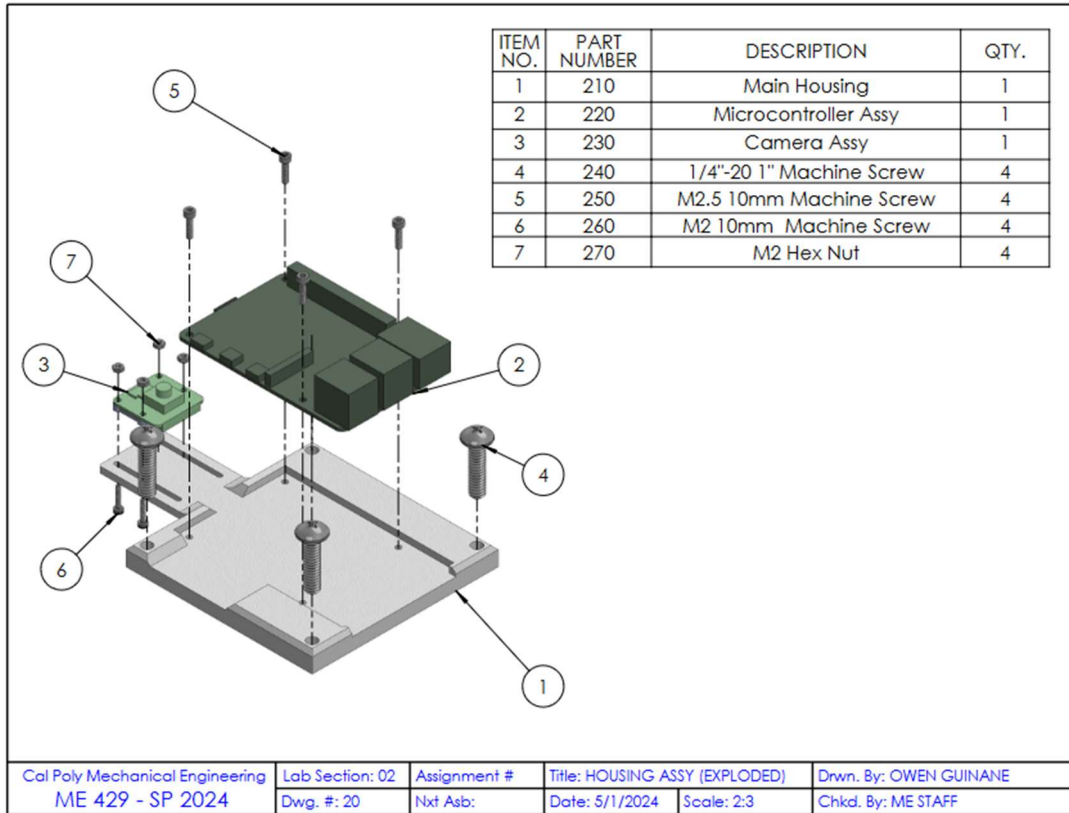
*Main Assembly Drawing*



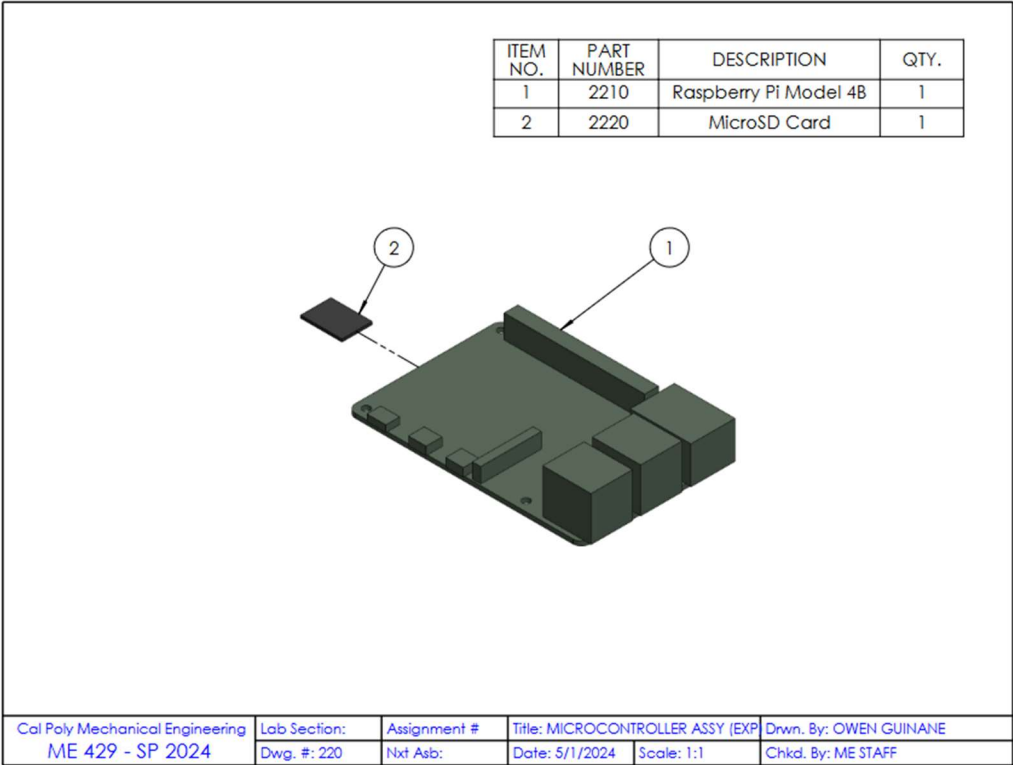
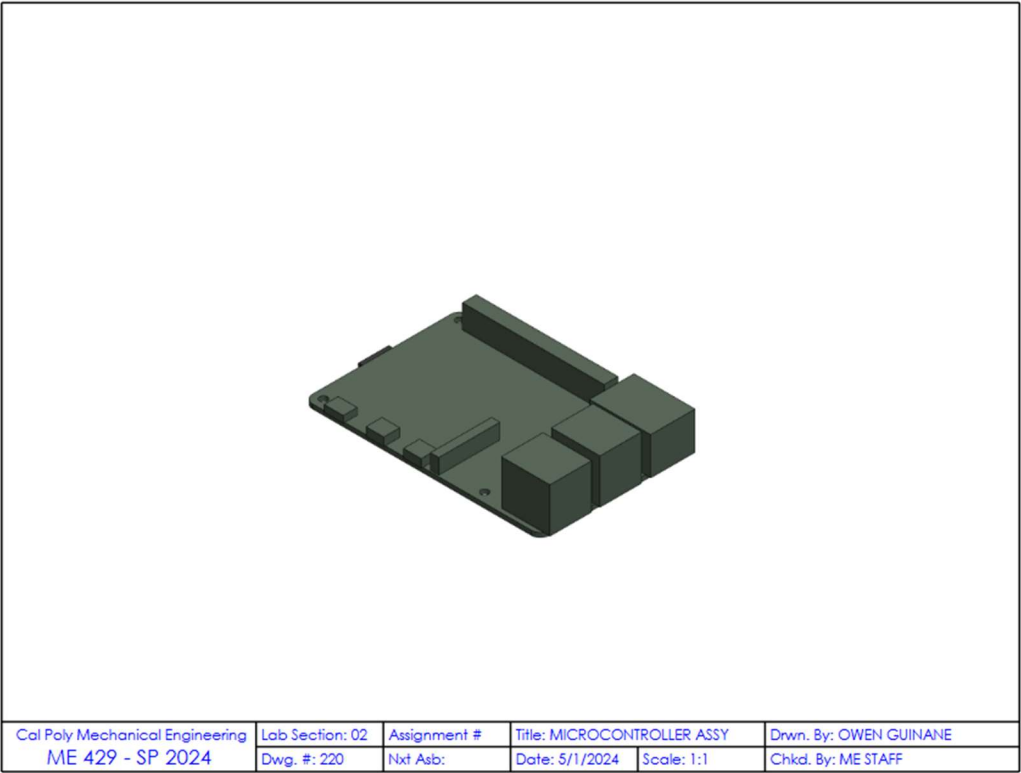
Ceiling Tile Assy





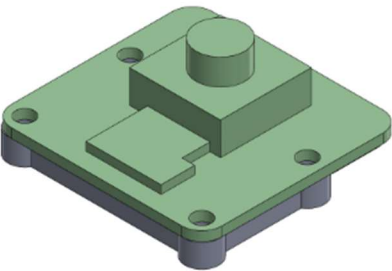


Microcontroller Assy



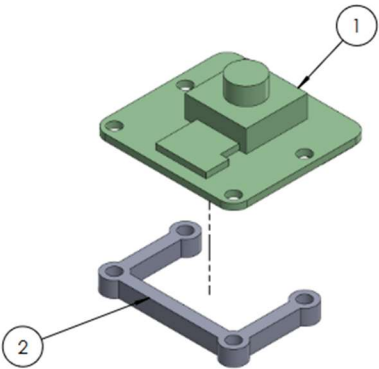


Camera Assembly

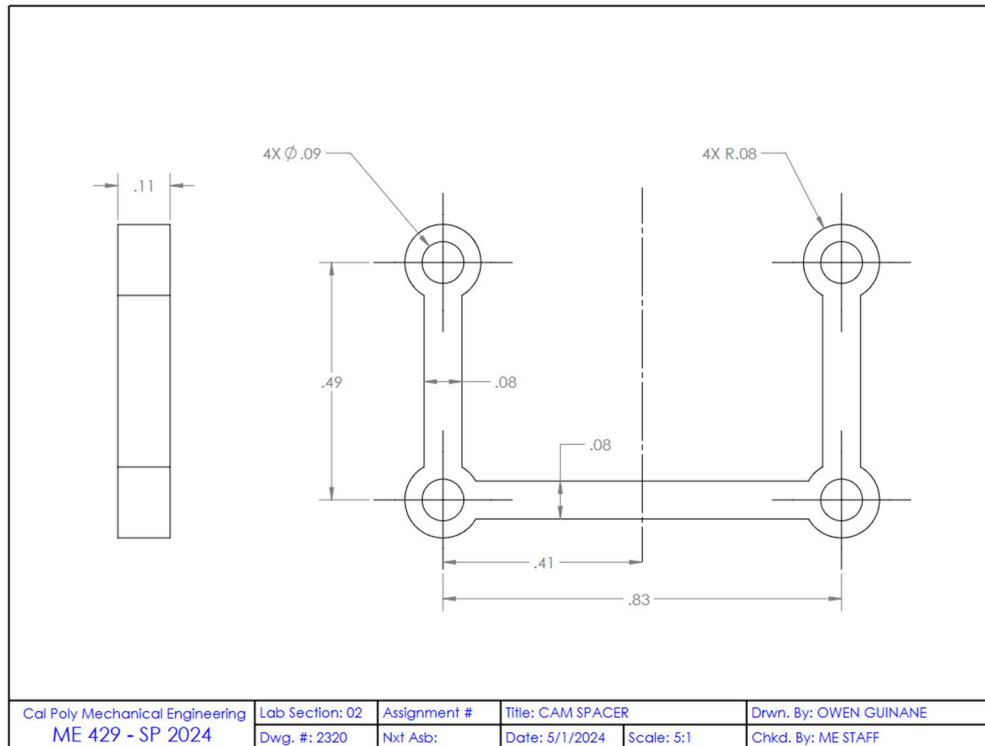


Cal Poly Mechanical Engineering ME 429 - SP 2024	Lab Section: 02 Dwg. #: 230	Assignment # Nxt Asb:	Title: CAMERA ASSY Date: 5/1/2024	Scale: 3:1	Drwn. By: OWEN GUINANE Chkd. By: ME STAFF
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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2310	Raspberry Pi Camera Module 3	1
2	2320	Camera Spacer	1



Cal Poly Mechanical Engineering ME 429 - SP 2024	Lab Section: 02 Dwg. #: 230	Assignment # Nxt Asb:	Title: CAMERA ASSY (EXPLODED) Date: 5/1/2024	Scale: 3:1	Drwn. By: OWEN GUINANE Chkd. By: ME STAFF
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## *Manufacturing Steps*

### Ceiling Tile Assembly

#### Ceiling Tile (110)

##### 11/16" Drill Bit with Cordless Drill

1. Drill four holes that are 11/16" in diameter on the top (floor-facing) side of the ceiling tile to allow the threaded inserts to screw in.
2. Screw 1/4"-20 Zinc Plated inserts into drilled holes. These will connect the main housing to the ceiling tile.

### Housing Assembly

#### Main Housing (210)

##### 3D Printer

1. Using the provided file "MainHousing.STL", use a 3D printer to print the housing. Refer to printer documentation for instructions on how to print an STL file.

##### **1/4"-20 Tap drill bit and Tap**

2. On the larger outer 4 holes and center hole, tap these holes all the way through. These holes will secure the housing to the ceiling tile.

##### **M2.5 x .45 Tap drill bit and Tap**

3. On the smaller inner 4 holes, tap these holes all the way through. These will be used to secure the Raspberry Pi 4 to the housing.

## Camera Assembly

### Camera Spacer (2320)

#### 3D Printer

1. Using the provided file “CamSpacer.STL”, use a 3D printer to print the spacer. Refer to printer documentation for instructions on how to print an STL file.

## *Assembly instructions*

1. Screw the Camera Spacer (2320) to the slots of the Main Housing (210) using four M2 10mm Machine Screws (250) so that camera spacer is on the top side of the part and the threads are facing upward.
2. Insert the MicroSD Card (2220) into the Raspberry Pi 4 (2210) to make the Microcontroller Assembly.
3. Screw the Microcontroller Assembly (220) into the main housing with four M2.5 10mm Machine Screws (250) until it is finger tight. Over-tightening the screw may cause damage to the board.
4. Insert the Raspberry Pi Camera Module 3 (2310) on the threads of the M2 Machine Screws. Use M2 Nuts (270) to secure the camera to the spacer.
5. Connect the camera module to the Raspberry Pi 4 using the module’s ribbon cable.
6. Use a 6mm hex key to screw the threaded inserts (120) into the ceiling tile to make the Ceiling Tile Assy (10).
7. Using the four 1/4” – 20 1” Machine Screws (240), screw the Main Housing to the holes in the Ceiling Tile Assy (10) to create the Final Assembly (1).
8. Install the Final Assembly in place of a similar ceiling tile or empty ceiling tile frame over desired tracking area.
9. Connect Power Supply (31) and Micro HDMI (30) cables as needed.