Build Assembly and Instruction

OKAA Solutions (Team 5)

HotSeat

Carmel High School

Engineering Design & Development

Kelly Fulk, Olivia Hart, Ahmed Secen, Abram Weller

04/24/2025

V3

Table of Contents

Chapter 1: Scope

1.1: Application

The design specification should be applied as a standard for all other documents to reference. All dimensional, performance, and construction constraints should be listed in the specification. The specification should be applied in documents such as the test instruction, build and assembly instruction, and in deliverables such as the critical design review, by providing performance guidelines, dimension constraints, and a record of progress. The **SYSTEM** should be designed to assist patrons with locating open seating in a public space. Due to this criteria, the **SYSTEM** should be applied in a library setting. Its crowd control and open seating regulation capabilities lend themselves to use in an indoor, public setting with non assigned seating, such as a library.

1.2: Limitation

The **SYSTEM** will be limited by the budget of the project, the schedule and limited time of the project, and the method with which it collects and processes data. The budget for the project is 300 dollars total, with a limitation of 150 dollars allocated for each semester. The project was limited to a time frame of the standard academic year of 36 weeks, with 18 weeks per semester. The Raspberry Pi camera should be limited by its range and focal length. Onboard local processing may produce excess heat.

Chapter 2: Applicable Documents

2.1: Government Documents

2.1.1 40 CFR 761.20 Code of Federal Regulations, PART 761—Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution In Commerce, And Use Prohibitions.

https://www.ecfr.gov/current/title-40/section-761.20

2.1.2 CDC - Safe 3D Printing

https://blogs.cdc.gov/niosh-science-blog/2024/07/29/safe-3d-printing/

2.2: Specifications, Standards, and Handbooks

2.2.1. ISO 18434-1:2008: Condition monitoring and diagnostics of machines — Thermography

https://www.iso.org/standard/41648.html

2.2.2. ISO 10878:2013: Non-destructive testing — Infrared thermography

https://www.iso.org/standard/46265.html

2.3: Other government documents, drawings, and publications

2.3.1 National Vulnerability Database CVE-2021-38759 Raspberry Pi Software Weaknesses and Solutions

https://nvd.nist.gov/vuln/detail/CVE-2021-38759

2.4: Non-government publications

2.4.1: Raspberry Pi Ltd Rasberry Pi 5 8Gb Product Brief

https://cdn-shop.adafruit.com/product-files/5813/raspberry-pi-5-product-brief.pdf

2.4.2 Raspberry Pi Ltd Official Raspberry Pi 5 Active Cooler Product Description

https://www.adafruit.com/product/5815#description

2.4.3 Raspberry Pi Ltd Brass M2.5 Standoffs for Pi HATs - Black Plated Technical Details

https://www.adafruit.com/product/2336#technical-details

2.4.4 Raspberry Pi Ltd Raspberry Pi Camera Module 3 NoIR - 12MP 75 Degree Infrared Lens

2.4.4.1 Camera Module 3 Product Brief

https://cdn-shop.adafruit.com/product-files/5659/camera-module-3-product-brief.pdf

2.4.4.2 Mechanical Drawing

https://cdn-shop.adafruit.com/product-files/5659/camera-module-3-standard-mechanical-drawing.pdf

2.4.5 Raspberry Pi Ltd Raspberry Pi 5 FPC Camera Cable - 22-pin 0.5mm to 15-pin 1mm - 200mm long Technical Details

https://www.adafruit.com/product/5818#technical-details

2.4.6 Is PETG Food Safe? Inplex Custom Extruders

https://www.inplexllc.com/blog/is-petg-food-safe/#:~:text=As%20just%20discussed%20PETG%20material,food%20containers%20and%20beverage%20bottles

2.4.7 PETS University of Maryland Terrapin Works

https://terrapinworks.umd.edu/materials/petg#:~:text=PETG%20is%20an%20industrial%2Dgrade,and%20immune%20to%20UV%20light

2.4.8. What Is Infrared Thermography? NORIFT

https://www.reliableplant.com/infrared-thermography-31572

Chapter 3: Safety Precautions

3.1 Danger

3.1.1 Electrocution – Do not touch the raspberry pi while it is in operation, the current will cause electrocution which will result in serious injury or death.

3.2 Warning

3.2.1 Possible electrocution - Touching the device or tampering/opening the device while it is in operation could result in electrocution, which will result in serious injury or death.

3.2.2 Small parts - During assembly, account for all magnets and keep away from children. Swallowing magnets could result in serious injury or death.

3.3 Caution

3.3.1 Pinching hazard - While closing the lid on the system, keep fingers outside the box to avoid pinching, which could cause minor injury.

3.3.2 Sharp edges - The system is 3D printed, so the edges of the device may have sharp fragments that can cause minor injury.

3.4 Notice

3.4.1 This device is not suitable for anyone under the age of eighteen.

3.4.2 A drill should not be used for installation of the tapping screws, as it could cause the casing to break.

3.4.3 Water should not come in contact with any electrical component of the device as it could subject it to breakage.

Chapter 4: Supporting and Test Equipment/Tools/Fixtures

4.1: Supporting Equipment

4.1.1 Screwdriver - A screwdriver must be used to insert the tapping screws that will attach the Raspberry Pi to the casing.

4.2: Test Equipment

4.2.1 Ruler - A ruler must be used to take dimensions of the 3D printed model and confirm the tolerances were followed.

4.2.2 Computer - A computer must be used to run all of the software diagnostics.

4.2.3 Scale - A scale must be used to weigh the assembly and confirm the 3D printed model is correct.

Chapter 5: Build and Assembly Procedures

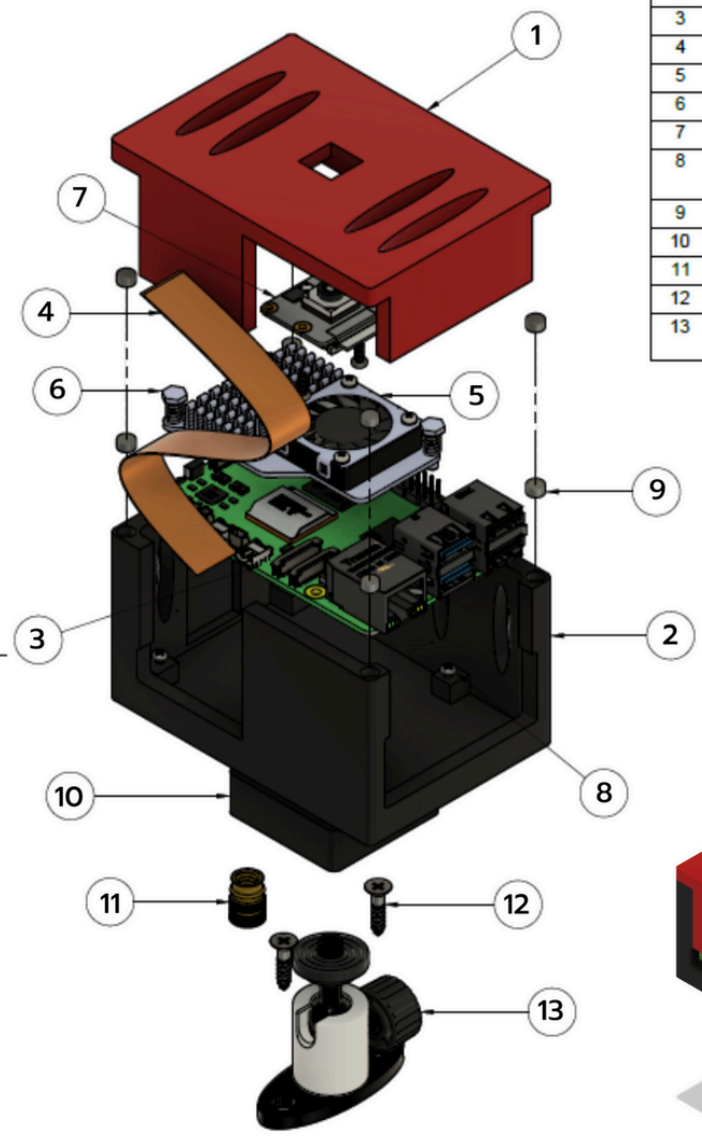
HotSeat

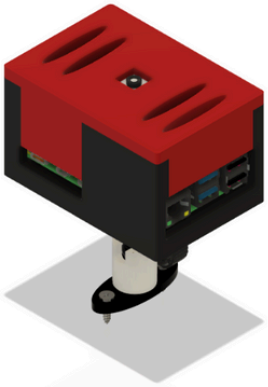
Build Assembly and Instruction

V4

Contents	
Parts List	1
Exploded View	1
Isometric View	1
Tools Required	1
Part Identification	2
Build Instructions	3-5

Parts List		
Item	Qty	Part Name
1	1	Casing (Lid)
2	1	Casing (Base)
3	1	Rasberry Pi 5
4	1	FPC Ribbon Cable
5	1	Heatsink Module
6	2	Heatsink Module Pins
7	1	Camera Module
8	6	¼" No. 2 thread-cutting screws
9	8	5mm magnets
10	1	Base Plate
11	1	1/5" Brass threaded insert
12	2	0.15" Wood Screws
13	1	Ball Joint Mounting Module





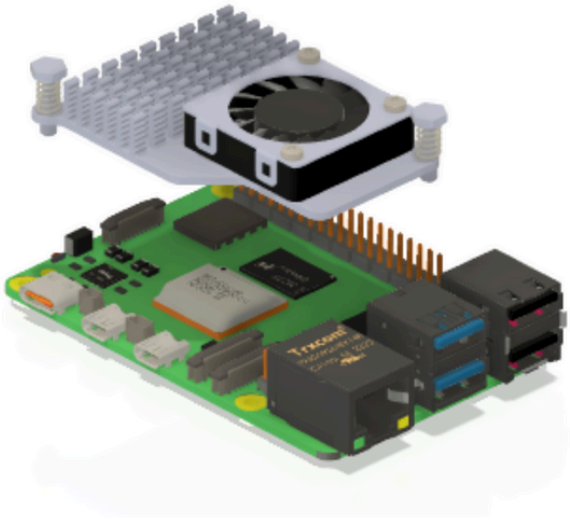
Note:
All assembly should be done in a clean working environment. Working environment should not carpeted surfaces.

All dimensions are in mm*

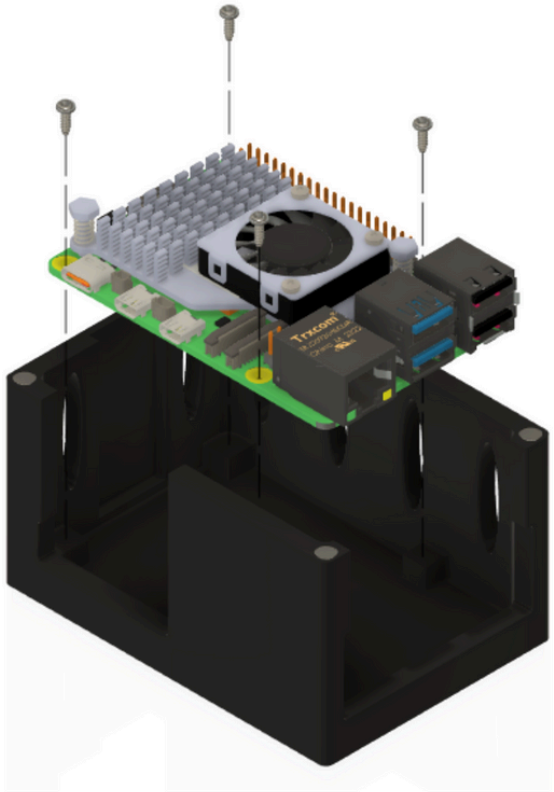
Dept.	Technical reference	Created by: Ahmed Secen 4/2/2025	Approved by: Olivia Hart 4/2/2025
		Document type	Document status
		Title: Assembly Drawing w/ parts list	DWG No.
			Rev. / Date of issue / Sheet: 1/1

Step 1:
Press fit 4 magnets (#9) into holes on the corners of the casing (#2).

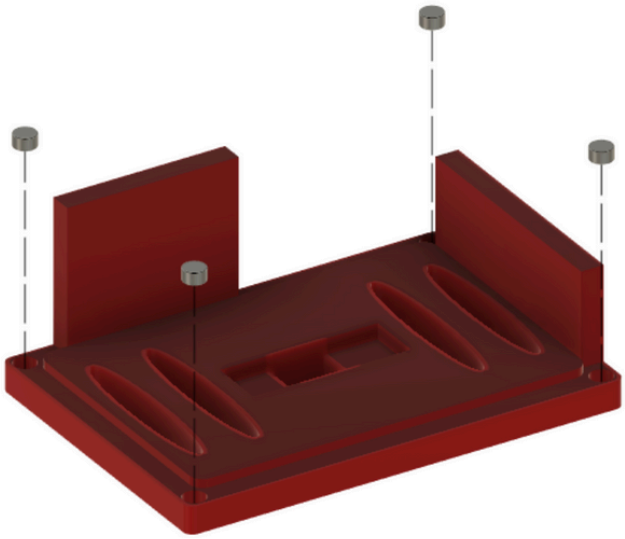
Step 2:
Use the heatsink module pins (#6) to attack the heatsink module to the Raspberry Pi (#3)



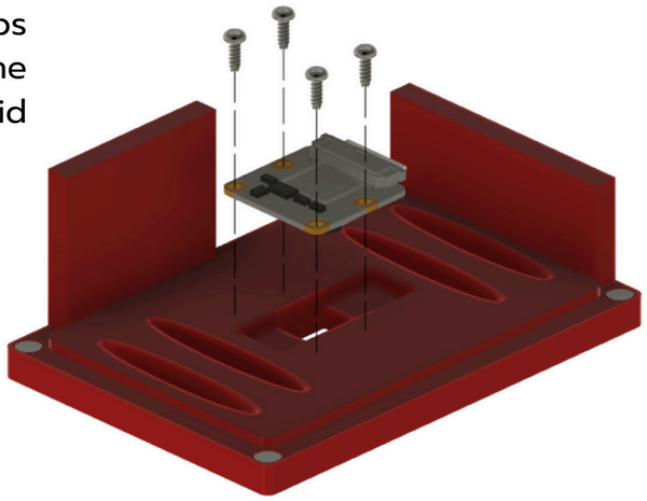
Step 3:
Attach the Raspberry Pi 5 (#3) to the base casing (#2) with 4 thread-cutting screws (#8). Use a Phillips head screwdriver to screw the screws in the drilled holes in the base casing (#2).



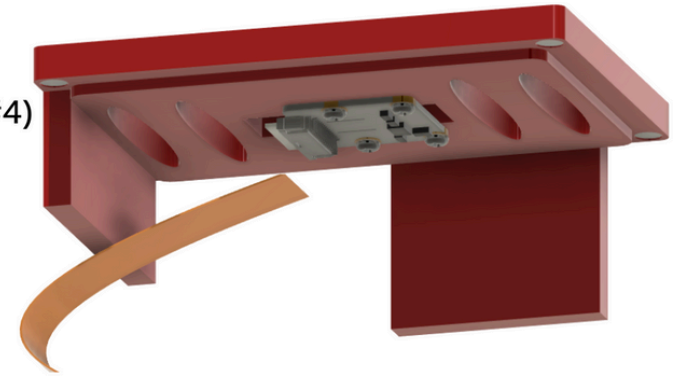
Step 4:
Press fit 4 magnets (#9) into holes on the corners of the lid (#1).



Step 5:
Attach the Camera Module (#7) to the Lid Casing (#1) with 4 thread-cutting screws (#8). Use a Phillips head screwdriver to screw the screws in the drilled holes in the Lid Casing (#1).

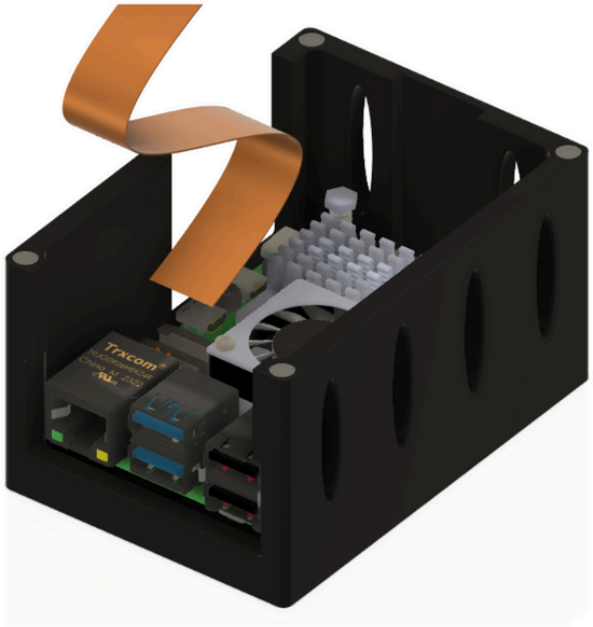


Step 6:
Carefully clip the ribbon cable (#4) into the camera module (#7)



Step 7:

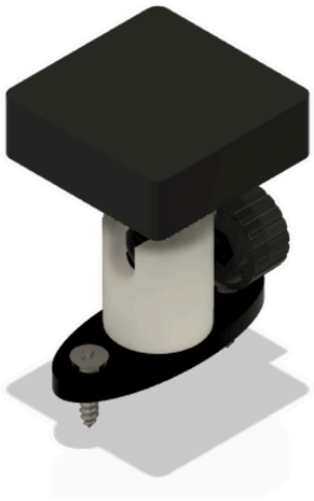
Carefully insert the ribbon cable (#4) into the ribbon cable port on the Raspberry pi 5 (#3).



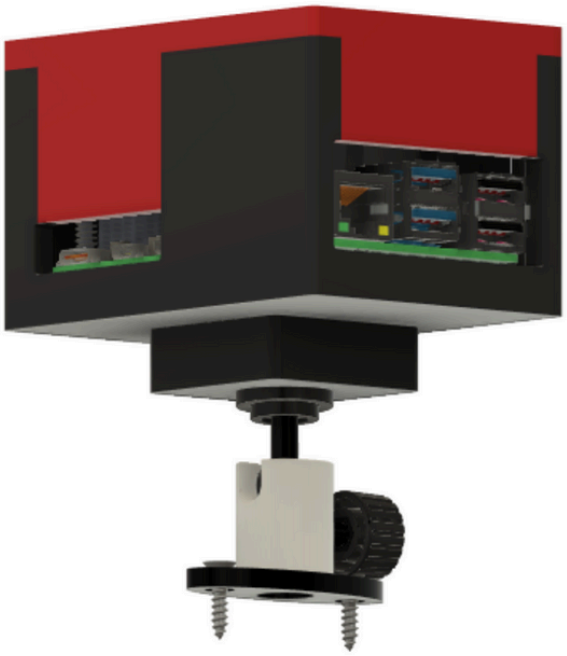
Step 8:

Attach the threaded insert (#11) into the base plate (#10) by applying slight pressure. Do not twist the insert. Note that the base plate (#10) is connected to the casing (#2).

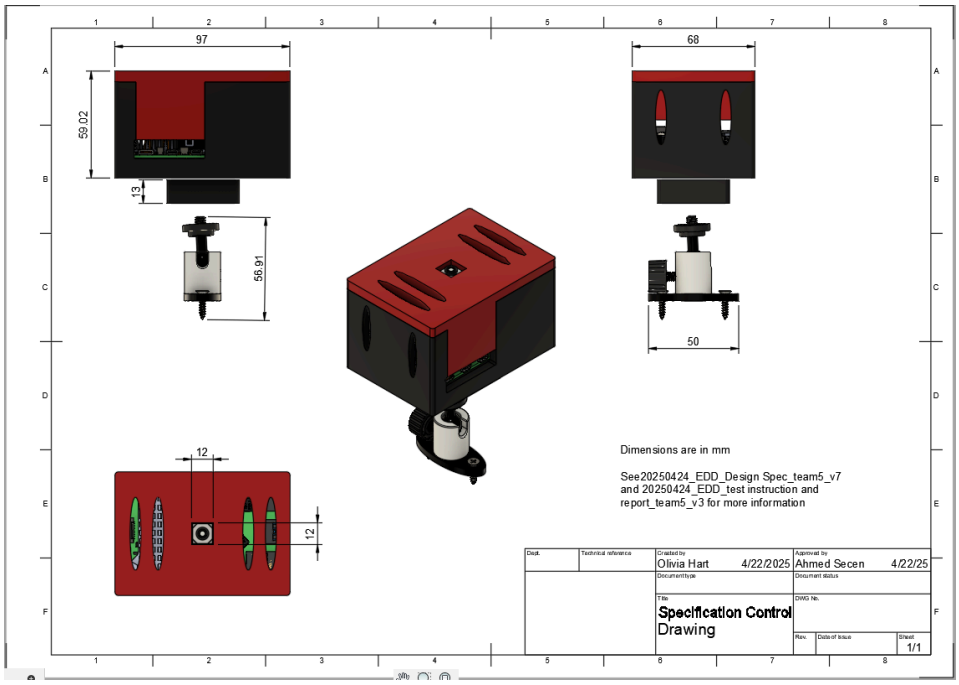
Step 9:
Screw the ball joint mounting module (#13) into the base plate using the previously attached threaded insert (#11).

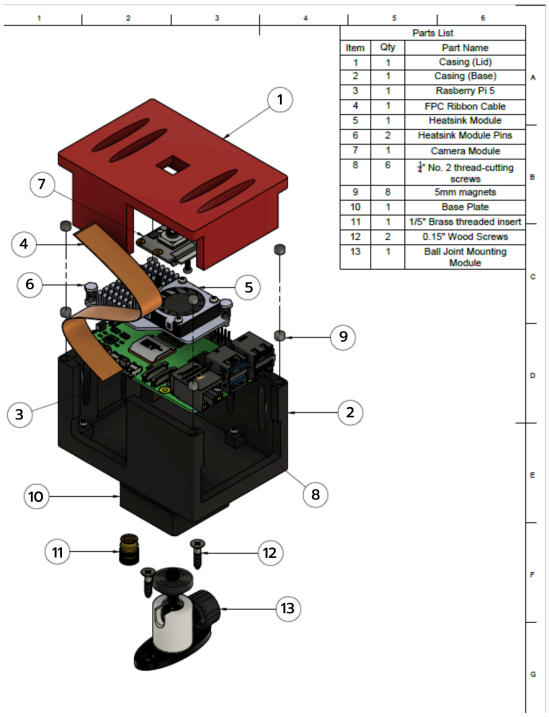


Step 10:
Verify your system matches the picture. HotSeat assembly is complete.

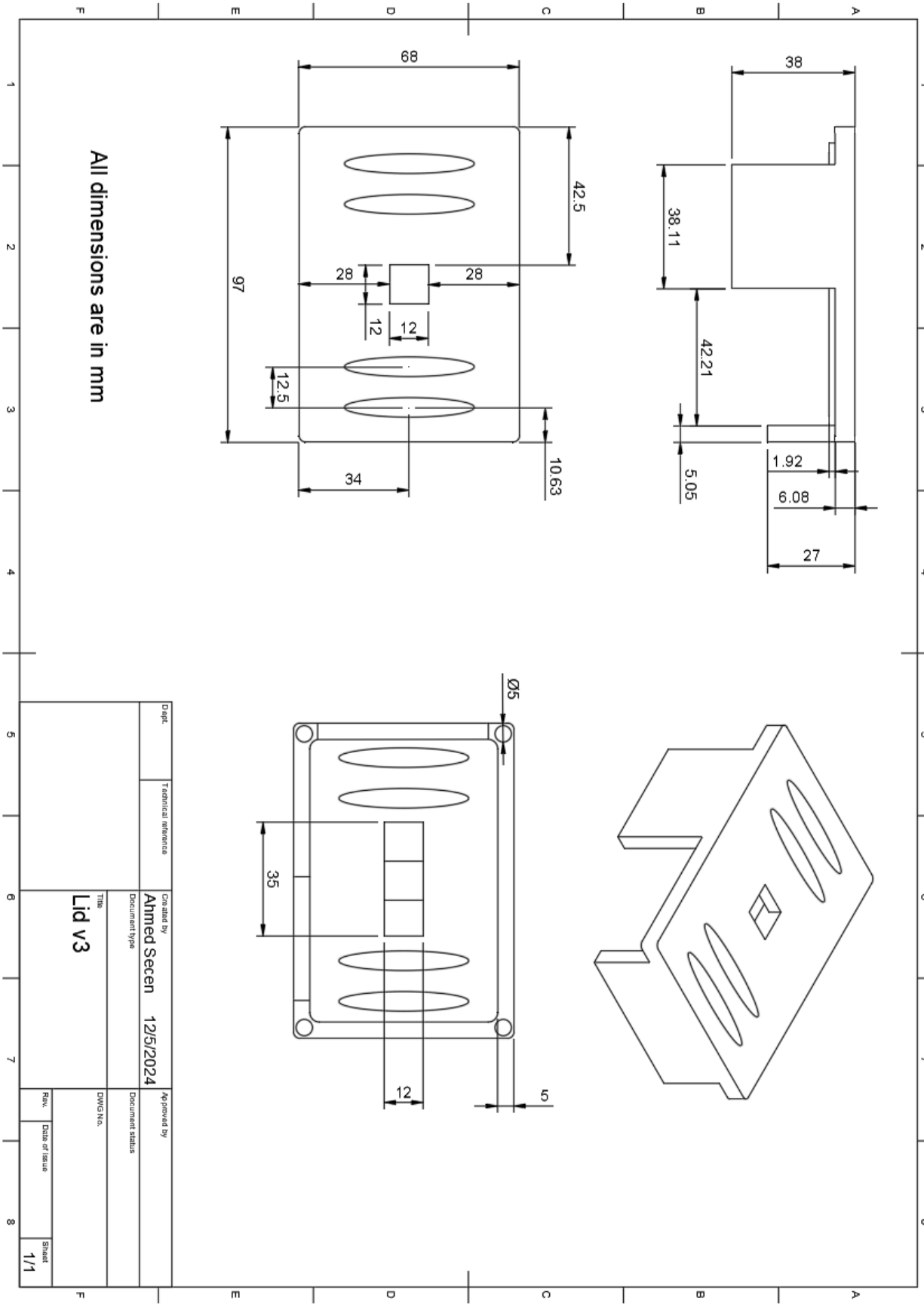


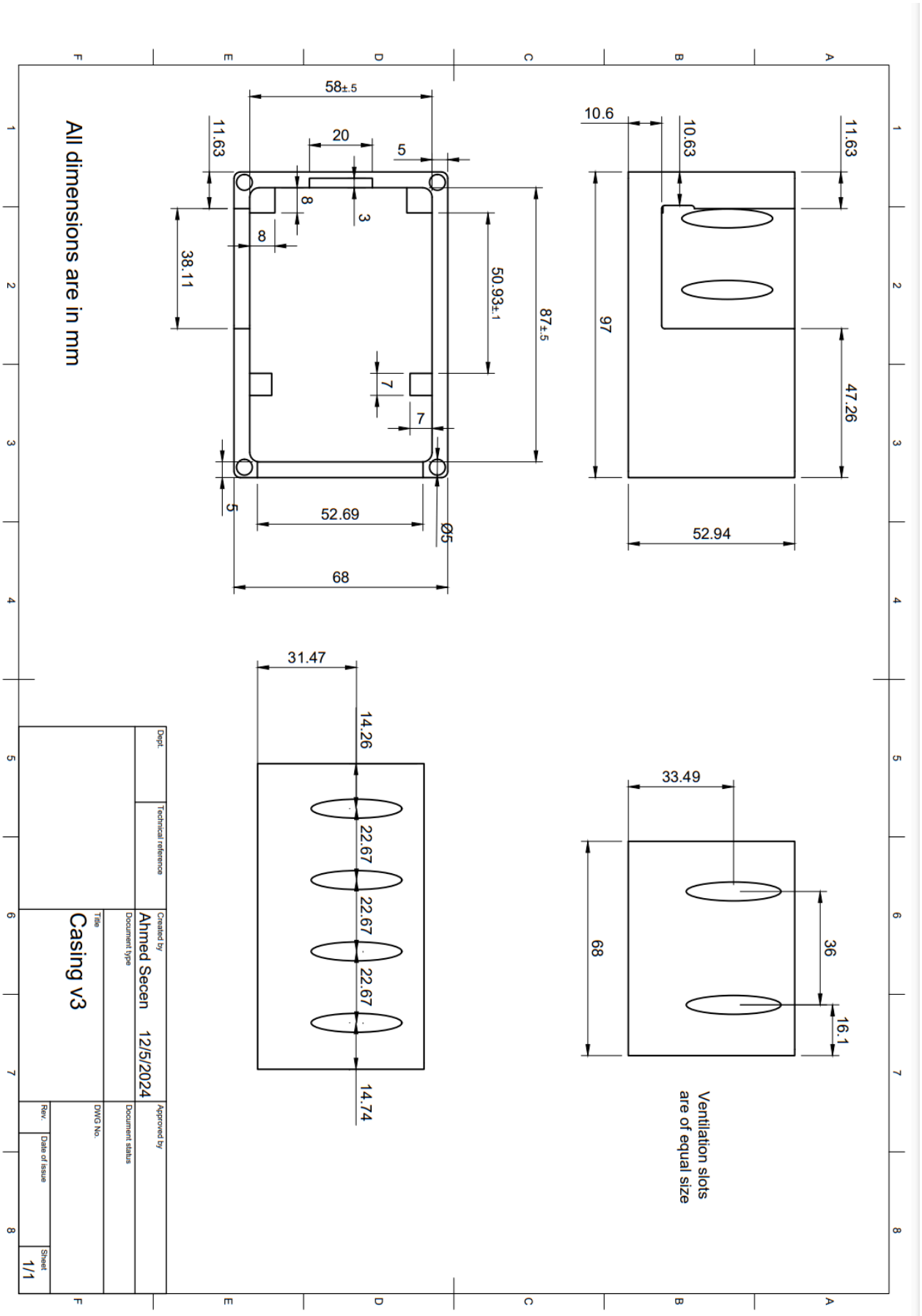
Chapter 6: Specification Control Drawings





Parts List		
Item	Qty	Part Name
1	1	Casing (Lid)
2	1	Casing (Base)
3	1	Rasberry Pi 5
4	1	FPC Ribbon Cable
5	1	Heatsink Module
6	2	Heatsink Module Pins
7	1	Camera Module
8	6	¼" No. 2 thread-cutting screws
9	8	5mm magnets
10	1	Base Plate
11	1	1/5" Brass threaded insert
12	2	0.15" Wood Screws
13	1	Ball Joint Mounting Module


All dimensions are in mm
68
42.5
97
28
28
12
12
12.5
34
10.63
38
38.11
42.21
5.05
1.92
6.08
27
Ø5
35
12
5
Dept.
Technical reference
Created by
Ahmed Secen
12/5/2024
Document type
Title
Lid v3
Approved by
Document status
DWG No.
Rev.
Date of issue
Sheet
1/1


All dimensions are in mm
58±.5
20
5
11.63
8
3
8
38.11
50.93±.1
87±.5
7
7
5
52.69
Ø5
68
10.6
10.63
11.63
97
47.26
52.94
31.47
14.26
22.67
22.67
22.67
14.74
33.49
68
36
16.1
Ventilation slots
are of equal size
Dept.
Technical reference
Created by
Ahmed Secen
12/5/2024
Document type
Approved by
Document status
Title
Casing v3
DWG No.
Rev.
Date of issue
Sheet
1/1

Chapter 7: Parts List

7.1 5 mm diameter 2.5 mm depth circular magnets (8)

7.2 5mm thick 3D printed PETG plastic case 97 x 68 x 53 mm (1)

7.3 5mm thick 3D printed PETG plastic lid 97x 68 mm (1)

7.4 56 x 85 mm Raspberry Pi Ltd Rasberry Pi 5 8Gb (1)

7.5 30 x 58 mm Raspberry Pi Ltd Official Raspberry Pi 5 Active Cooler (1)

7.6 23 x 25 mm Raspberry Pi Ltd Raspberry Pi Camera Module 3 NoIR - 12MP 75 Degree Infrared Lens (1)

7.7 Raspberry Pi Ltd Raspberry Pi 5 FPC Camera Cable - 22-pin 0.5mm to 15-pin 1mm - 200mm long (1)

7.8 .25” thread-cutting self-tapping screws (8)

7.9 Wall Power Supply Unit USB C (1)

7.10 USB A to Micro B cable (1)

References

40 CFR 761.20 -- Prohibitions and exceptions. (n.d.). eCFR :. https://www.ecfr.gov/current/title-40/section-761.20

(n.d.). cdn-shop.adafruit.com https://cdn-shop.adafruit.com/product-files/5659/camera-module-3-standard-mechanical-drawing.pdf

Cve-2021-38759. (2024, November 21). NVD. https://nvd.nist.gov/vuln/detail/CVE-2021-38759

Industries, A. (n.d.). Raspberry Pi 5 FPC camera cable - 22-pin 0.5mm to 15-pin 1mm. Adafruit Industries, Unique & fun DIY electronics and kits. https://www.adafruit.com/product/5818#technical-details

Infrared thermography explained. (2019, July 2). Reliable Plant. https://www.reliableplant.com/infrared-thermography-31572

Is PETG food safe? Find out with Inplex custom extruders, LLC. (2023, January 25). Inplex Custom Extruders, LLC. https://www.inplexllc.com/blog/is-petg-food-safe/#:~:text=As%20just%20discussed%20PETG%20material,food%20containers%20and%20beverage%20bottles

ISO 10878:2013. (n.d.). ISO. https://www.iso.org/standard/46265.html

ISO 18434-1:2008. (n.d.). ISO. https://www.iso.org/standard/41648.html

Petg. (n.d.). Terrapin Works. https://terrapinworks.umd.edu/materials/petg#:~:text=PETG%20is%20an%20industrial%2Dgrade,and%20immune%20to%20UV%20light

Safe 3D printing is for everyone, everywhere. (2024, November 25). CDC Blogs | Blogs | CDC. https://blogs.cdc.gov/niosh-science-blog/2024/07/29/safe-3d-printing/