University of Moratuwa
Faculty of Engineering
Department of Electronic & Telecommunication Engineering

EN2160 - Electronic Design Realization

Project report

Kitchen safety monitor

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Abstraction

The Kitchen Safety Monitor is a state-of-the-art electronic device engineered to ensure enhanced safety and accident prevention in domestic kitchens. Utilizing MQ2 and MQ6 gas sensors, the system can efficiently detect smoke and LPG gas leaks, respectively. Upon detection, the device promptly sends real-time notifications to the user's WhatsApp, accompanied by a live video link for remote monitoring. The product integrates a dual power source system, employing a 9V adapter and a backup battery (7.4V) to guarantee uninterrupted functionality. This report provides a comprehensive overview of the product's design, specifications, and operational principles, presenting a reliable and user-friendly solution to address kitchen safety concerns effectively. The Kitchen Safety Monitor's innovative features make it an indispensable addition to modern kitchens, empowering users to mitigate potential hazards and ensure a secure cooking environment for their households.

Contents

1 Introduction

1.1 Problem statement

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Domestic kitchens pose inherent safety risks, primarily associated with the potential for smoke and LPG gas leaks. Accidents caused by these hazards can lead to property damage, injuries, and even fatalities. Conventional safety measures in kitchens often lack real-time detection and remote monitoring capabilities, leaving users unaware of potential dangers when they are away from the kitchen.

To address these safety concerns and enhance accident prevention, there is a critical need for an intelligent and proactive solution. The problem statement revolves around developing a cost-effective and reliable Kitchen Safety Monitor that can detect smoke and LPG gas leaks in real-time, notify users through WhatsApp, and provide live video access for remote monitoring. The device should integrate dual power sources to ensure continuous operation and be user-friendly, making it accessible to a wide range of homeowners.

The primary objectives of this project are to:

1. Design and implement a Kitchen Safety Monitor with MQ2 and MQ6 gas sensors to detect smoke and LPG gas, respectively.
2. Integrate real-time WhatsApp notifications to alert users instantly when smoke or gas is detected.
3. Provide live video streaming capability for users to assess the situation remotely and take immediate action.
4. Incorporate dual power sources, ensuring uninterrupted functionality even during power outages.
5. Create a user-friendly interface that allows easy setup and operation, catering to users with varying levels of technical expertise.

By addressing these objectives, the Kitchen Safety Monitor aims to significantly reduce kitchen safety hazards, increase accident prevention, and empower users to proactively safeguard their households from potential kitchen emergencies.

1.2 Proposed solution

The proposed solution is a sophisticated Kitchen Safety Monitor, designed to effectively detect and alert users about smoke and LPG gas leaks in real-time, ensuring the safety of domestic kitchens. This innovative product incorporates advanced technology, dual gas sensors, real-time communication, and user-friendly features to provide a comprehensive and proactive safety solution.

1.2.1 Key Features and Components:

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1. Dual Gas Sensors: The Kitchen Safety Monitor is equipped with high-precision MQ2 and MQ6 gas sensors for smoke and LPG gas detection, respectively. These sensors continuously monitor the kitchen environment.
2. Microcontroller and Communication: An ESP32 microcontroller serves as the brain of the system, responsible for processing data from the gas sensors and coordinating the device's functionalities. The product connects to the internet through WiFi for real-time communication.
3. Real-time WhatsApp Notifications: When smoke or LPG gas is detected, the Kitchen Safety Monitor instantly sends real-time notifications to the user's WhatsApp. This ensures that users are promptly alerted, enabling immediate action.
4. Live Video Streaming: The WhatsApp notification includes a link to access live video streaming of the kitchen. Users can remotely view their kitchen to visually assess the situation and respond effectively.

5. Alert System: Upon continuous smoke detection for 4 seconds, the device activates an alert system. An audible alarm through a buzzer and a visual alert using a blinking LED bulb provide clear indications of potential hazards.

6. Dual Power Sources: The product incorporates a dual power source system. The primary power is drawn from a 9V adapter, while a backup battery (7.4V) ensures continuous operation during power outages.

7. User-Friendly Interface: The device features a user-friendly interface, making it easy to set up, configure, and operate. Users can customize alert settings and monitor the system status effortlessly.

1.2.2 Proposed Implementation:

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1. Sensor Placement Optimization: Strategically place the MQ2 and MQ6 sensors in the kitchen to achieve maximum coverage and accurate gas detection.

2. Power Management System: Implement a voltage regulator circuit to provide a stable 3.3V supply for the ESP32 and a 5V supply for the camera module, MQ2, and MQ6 sensors, ensuring efficient power management.

3. WhatsApp Integration: Develop a communication module within the ESP32 to send real-time notifications to the user's WhatsApp account when smoke or LPG gas is detected.

4. Live Video Streaming Setup: Integrate a camera module capable of streaming live video to a secure server, enabling the generation of unique links for access through WhatsApp notifications.

1.2.3 Expected Benefits:

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1. Enhanced Kitchen Safety: The Kitchen Safety Monitor provides real-time detection of smoke and LPG gas leaks, enabling users to take immediate action, thereby reducing the risk of accidents and potential harm.

2. Remote Monitoring and Quick Response: With live video streaming, users can remotely assess the situation in their kitchen and respond effectively, even when they are away from home.

3. Proactive Safety Measures: Real-time WhatsApp notifications ensure that users are promptly alerted to potential hazards, enabling them to address the situation proactively.

4. Continuous Operation: The integration of dual power sources guarantees uninterrupted functionality, ensuring the device remains operational during power outages.

5. User-Friendly Design: The product's user-friendly interface and easy setup make it accessible to a wide range of homeowners, promoting its adoption and usability.

6. Cost-Effective and Eco-Friendly: By efficiently managing power consumption and utilizing advanced sensors, the proposed solution offers a cost-effective and environmentally friendly safety monitoring system for kitchens.

In conclusion, the Kitchen Safety Monitor is a comprehensive and intelligent solution designed to address kitchen safety hazards effectively. By incorporating advanced gas sensors, real-time communication, live video access, and user-friendly features, this product ensures a safer and more secure cooking environment, empowering users to proactively protect their households from potential kitchen emergencies.

1.3 Design approach

1.3.1 Block diagram

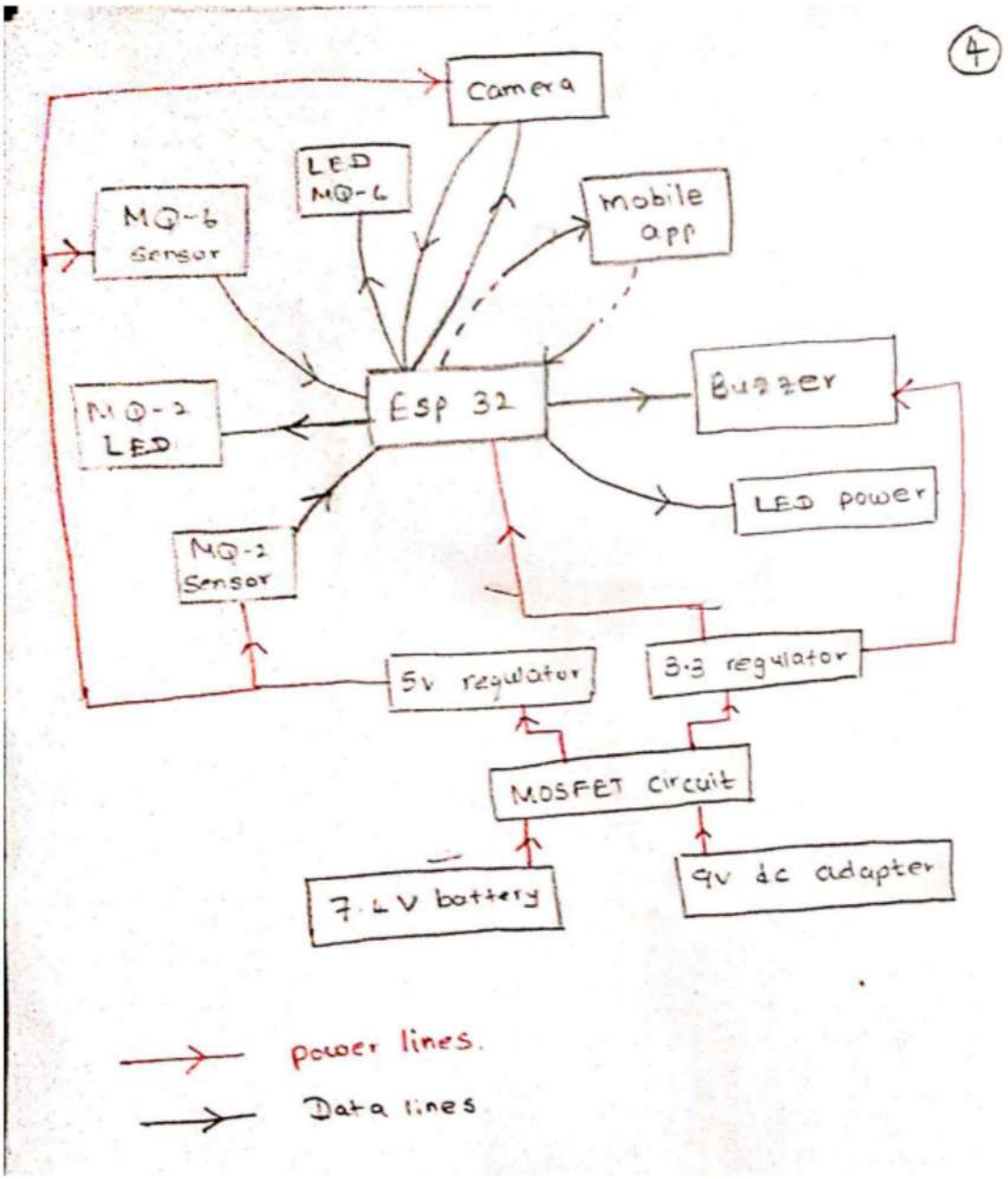


Figure 1: Block diagram

1.3.2 Enclosure sketch

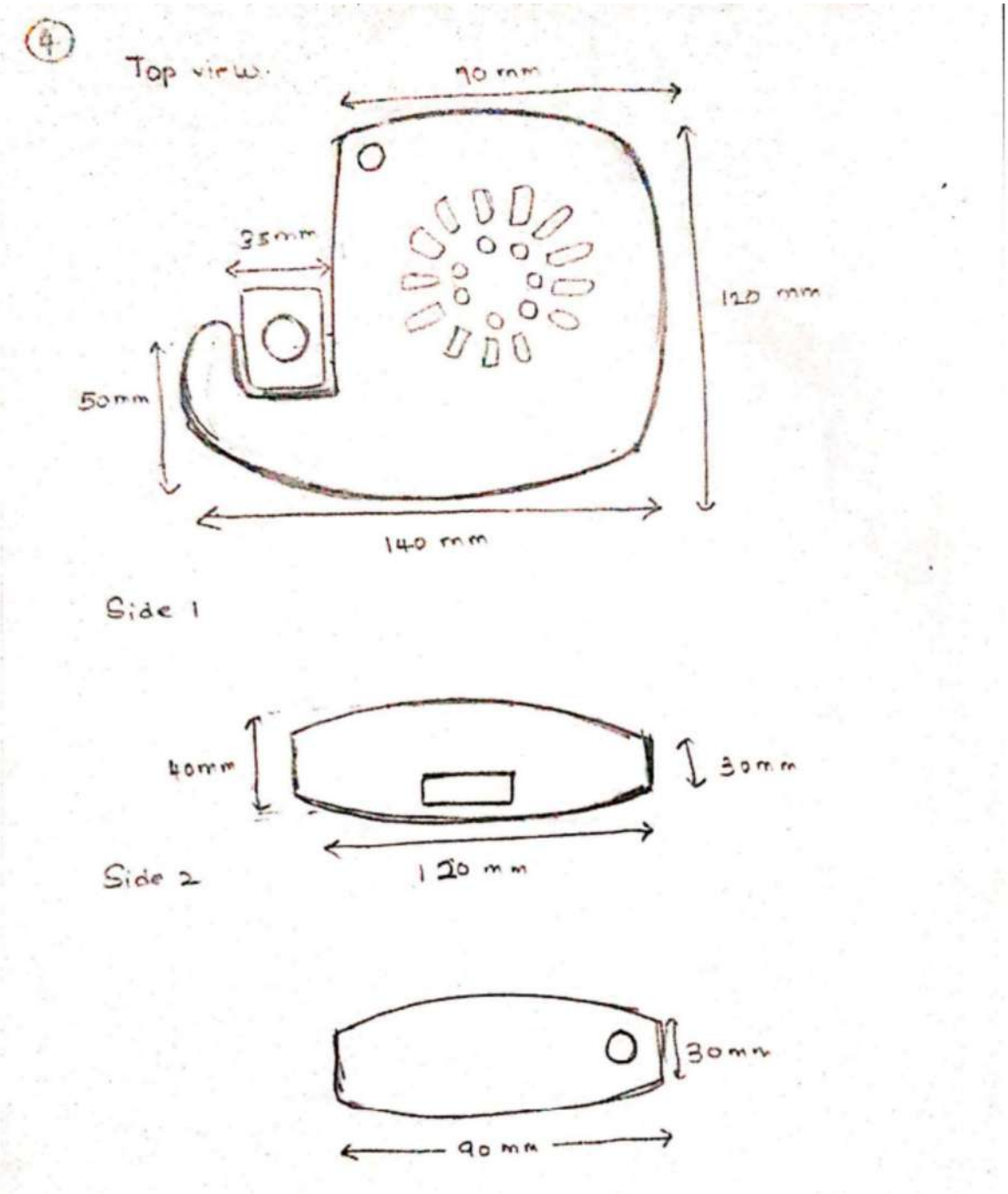


Figure 2: Hand sketch.

1.4 Product description

The Kitchen Safety Monitor is an innovative and intelligent device designed to enhance safety in domestic kitchens. Equipped with advanced sensors and cutting-edge technology, it detects the presence of smoke and LPG gas, promptly notifying users through WhatsApp in case of any potential hazards. This compact and user-friendly product ensures that users can remotely monitor their kitchen in real-time and take immediate action to prevent accidents. The Kitchen Safety Monitor is an indispensable addition to any modern kitchen, providing peace of mind and a proactive safety solution.

1.4.1 Key features

- Dual Gas Sensors: The product utilizes two high-quality sensors, MQ2 and MQ6, to detect smoke and LPG gas leaks, respectively. The combination of these sensors enhances the accuracy and reliability of gas detection.
- Real-Time WhatsApp Notifications: In the event of smoke or LPG gas detection, the Kitchen Safety Monitor instantly sends real-time notifications to the user's WhatsApp. This feature ensures that users are alerted immediately, even if they are away from their homes.
- Live Video Streaming: The WhatsApp notification includes a link that allows users to access live video streaming of their kitchen. This feature enables users to visually assess the situation and take appropriate action promptly.
- Buzzer and LED Alert: When smoke is continuously detected for 4 seconds, the product triggers an audible alarm through the buzzer and a visible alert through the blinking LED. This combination provides clear indications of potential hazards.
- Dual Power Sources: The Kitchen Safety Monitor operates on both a 9V adapter and a backup battery (7.4V). In the event of a power outage, the device automatically switches to the backup battery, ensuring continuous operation
- Power Management System: The product features voltage regulators (3.3V and 5V) to provide a stable power supply to the ESP32 chip, camera module, MQ2, and MQ6 sensors, enhancing the overall reliability and efficiency of the system.
- User-Friendly Interface: The device is designed with simplicity in mind, making it easy for users to set up and operate. The WhatsApp integration allows for effortless communication and control.

1.5 Product specifications

- Input voltage: 6V-10V .Input voltage is regulated by the circuit.
- Maximum Power :0.5 W.
- Microcontroller: ESP32
- Power Source: 9V Adapter (main power) with automatic switchover to 7.4V Backup Battery (when the adapter voltage drops below 7.2V).
- Voltage Regulators: 3.3V for ESP32 chip, 5V for camera module, MQ2 sensor, and MQ6 sensor.
- Sensors: MQ2 for smoke and MQ6 gas sensor for LPG gas detection.
- Alert System: Continuous smoke detection for four seconds triggers the buzzer and blinking LED bulb.
- Communication: WhatsApp alerts and live kitchen feed link for real-time monitoring.
- Dimensions: 14cm x 4cm x 11.5cm .Compact and wall-mountable design for easy installation.
- Backup Battery Life: 16 hours battery life . Sufficient capacity to ensure prolonged operation during power outages.

The Kitchen Safety Monitor is the perfect solution for homeowners seeking to enhance the safety and security of their kitchens. With its advanced features, real-time notifications, and live video access, this product empowers users to respond proactively to potential kitchen hazards, preventing accidents and ensuring a safe cooking environment.

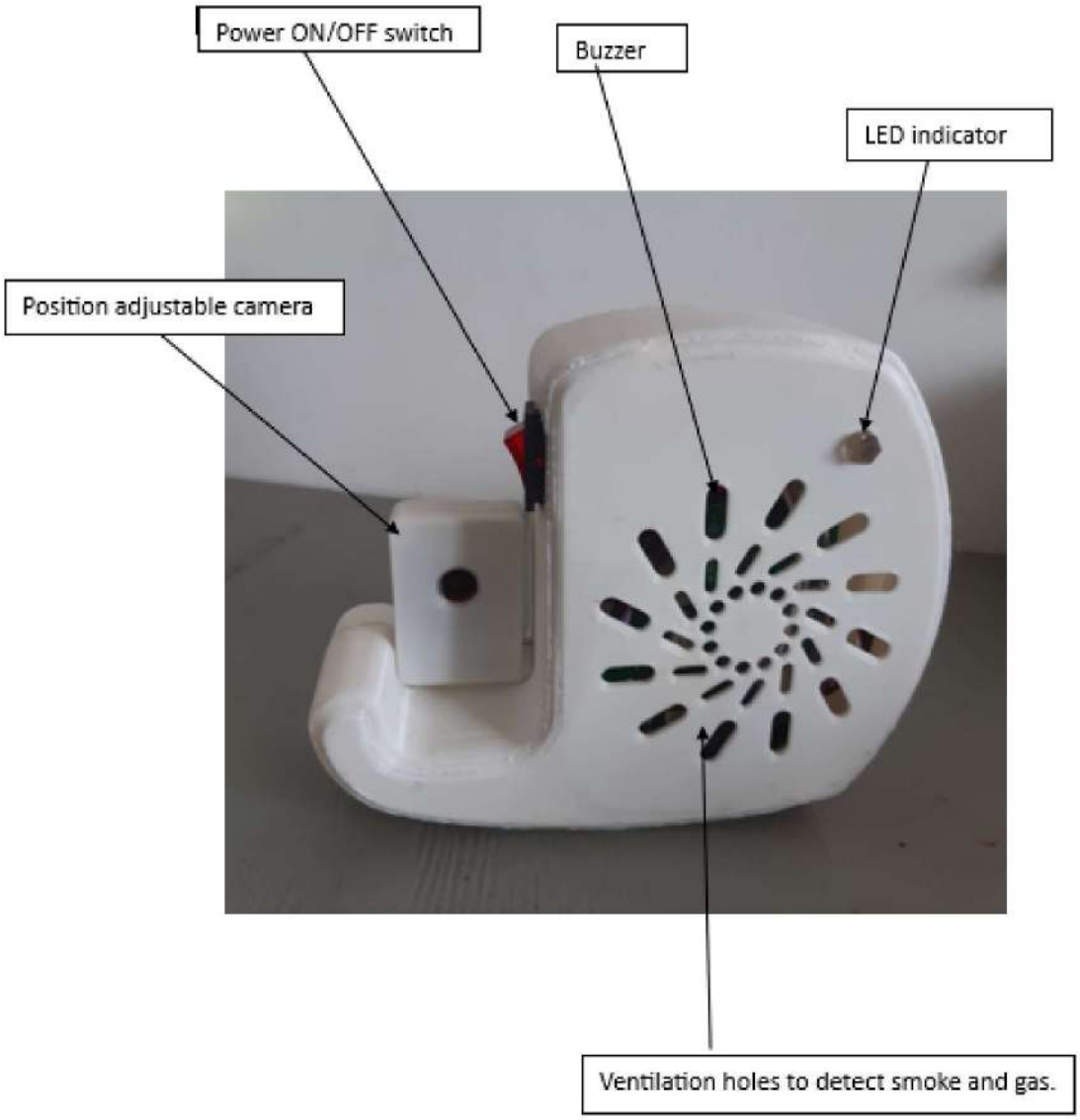


Figure 3: front side.

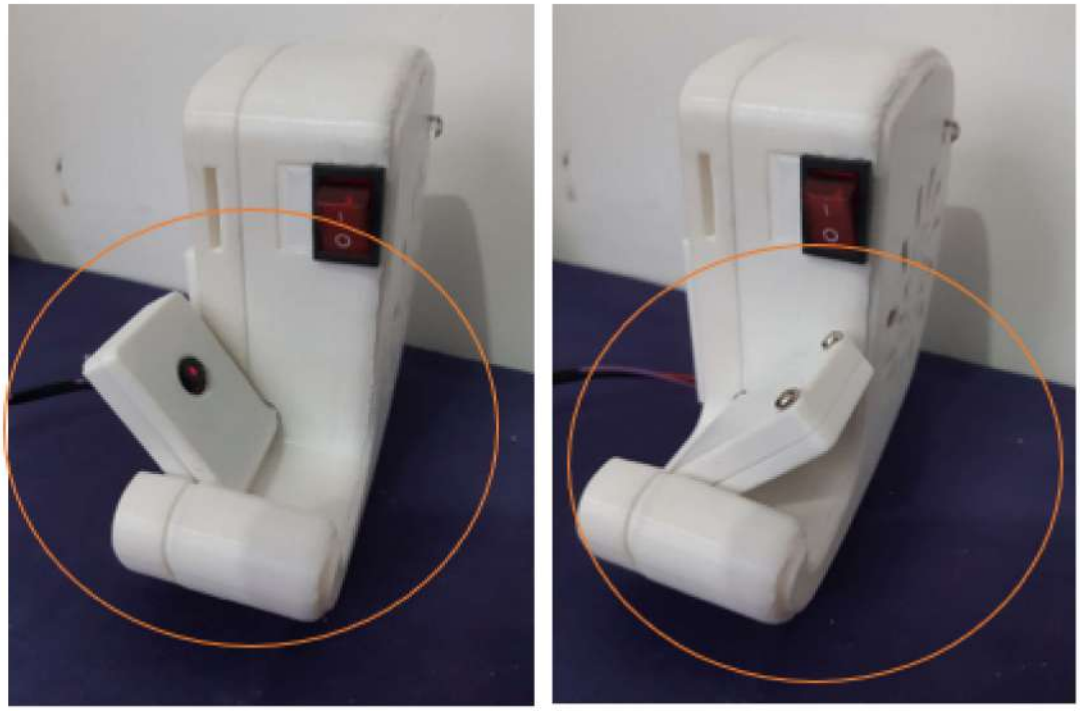


Figure 4: Adjustable camera

Figure 5: Battery

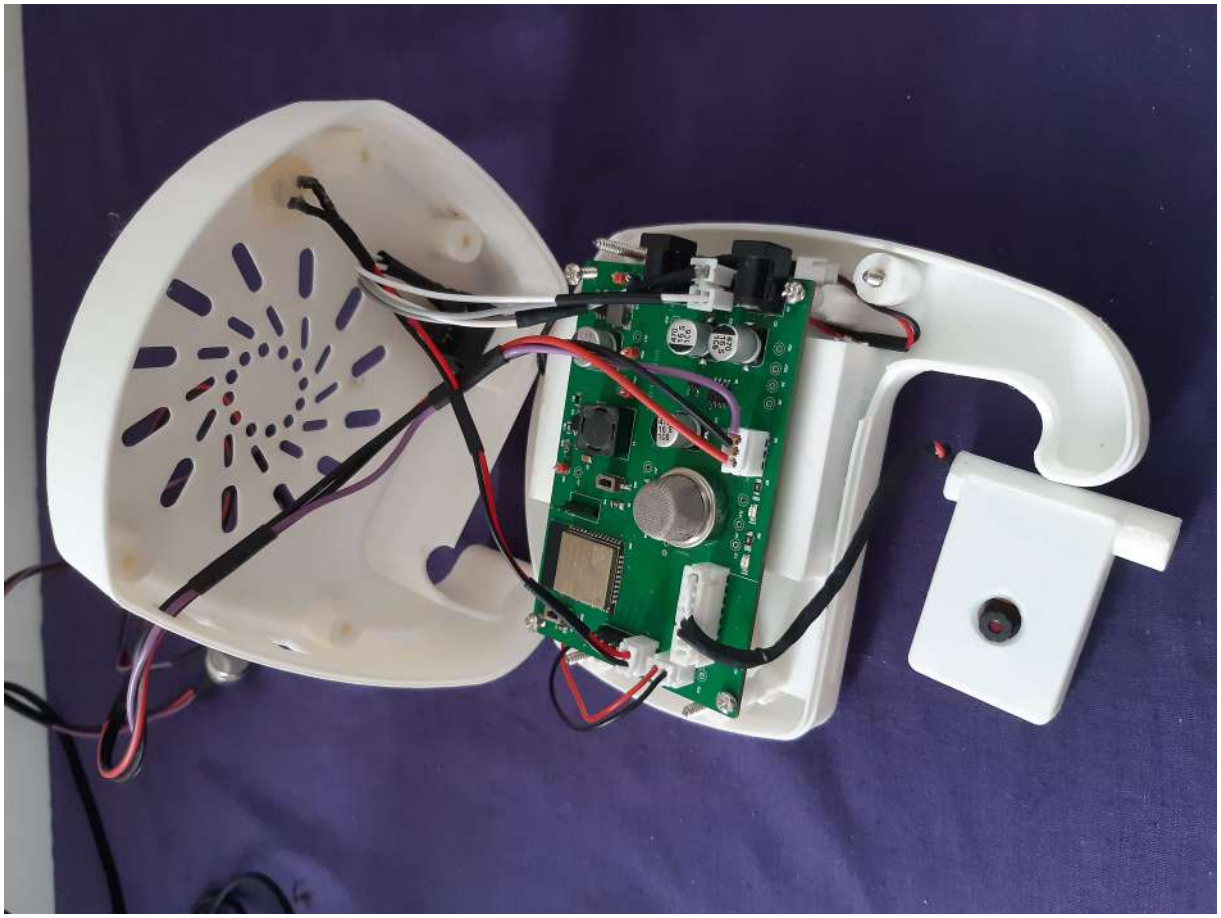


Figure 6: product.

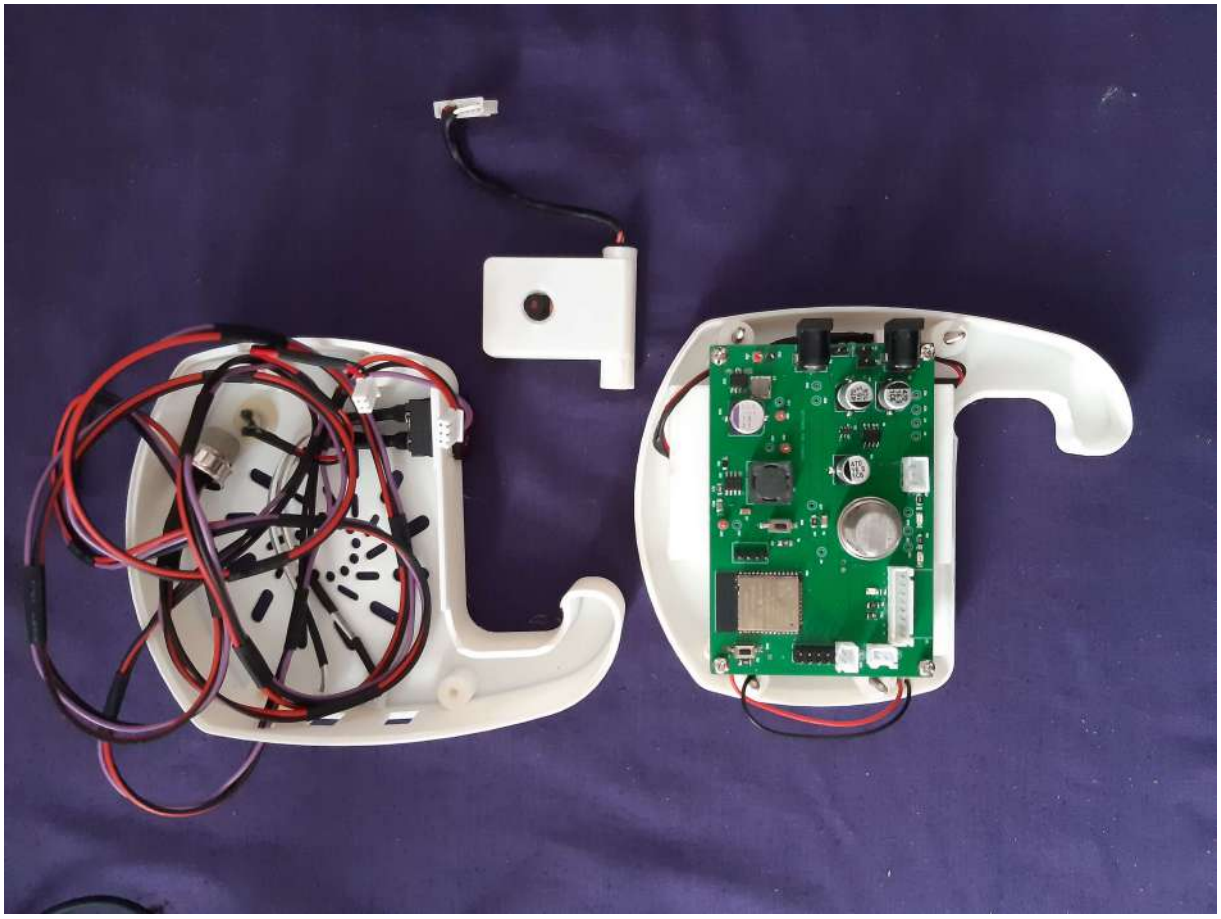


Figure 7: inside product.

Figure 8: working

Figure 9: Working

2 Component Selection for Kitchen Safety Monitor

The selection of components for the Kitchen Safety Monitor was a critical process, as it directly impacted the device's performance, reliability, and safety. Each component was carefully chosen based on specific criteria and considerations. Below is an explanation of the key components chosen for the product:

1. ESP32 Microcontroller:
Reason for Selection: The ESP32 is a versatile and powerful microcontroller that offers built-in Wi-Fi and Bluetooth connectivity. Its dual-core processor, ample memory, and rich peripherals make it suitable for handling the complex tasks of gas sensor data processing, real-time communication, and video streaming.

2. MQ2 Gas Sensor:
Reason for Selection: The MQ2 gas sensor is well-known for its ability to detect various gases, including smoke, LPG, propane, methane, and alcohol. Its affordability, sensitivity, and reliability made it a suitable choice for detecting potential fire and gas leak hazards in the kitchen.

3. MQ6 Gas Sensor:
Reason for Selection: The MQ6 gas sensor complements the MQ2 sensor, specifically targeting the detection of LPG gas. By using both sensors, the Kitchen Safety Monitor can distinguish between different types of gas leaks and provide accurate alerts.

4. ESP32 Camera Module:
Reason for Selection: The ESP32 camera module seamlessly integrates with the ESP32 microcontroller, enabling real-time video streaming. Its compact form factor and ease of integration made it ideal for capturing and transmitting live video of the kitchen environment.

5. LTC4412 Power Switching Circuit:
Reason for Selection: The LTC4412 is an ideal diode-OR controller, enabling seamless power switching between the 9V adapter and the backup battery. Its low voltage drop and fault protection features ensure a reliable and uninterrupted power supply to the Kitchen Safety Monitor.

6. LMR38020SDDAR (3.3V Regulator):
Reason for Selection: The LMR38020SDDAR is a low-dropout linear regulator capable of providing a stable 3.3V supply to power the ESP32 microcontroller. Its efficiency, low noise, and thermal performance ensure reliable operation of the microcontroller.

7. LMR14020SSQDDAQ1 (5V Regulator):
Reason for Selection: The LMR14020SSQDDAQ1 is a high-efficiency step-down switching regulator, supplying a stable 5V voltage for components like the camera module and gas sensors. Its small size, high current capability, and thermal protection were critical for efficient power management.

8. Capacitors and Resistors:
Reason for Selection: The capacitors and resistors were carefully chosen to meet the specific requirements of the circuit, including filtering, voltage regulation, and current limiting. High-quality components ensure accurate and stable performance. Each component's

selection was based on its functional specifications, compatibility with other components, cost-effectiveness, and availability. Rigorous testing and consideration of safety standards were carried out to ensure that the chosen components were reliable and suitable for the intended application of the Kitchen Safety Monitor.

3 Schematics

3.1 ESP controller circuit

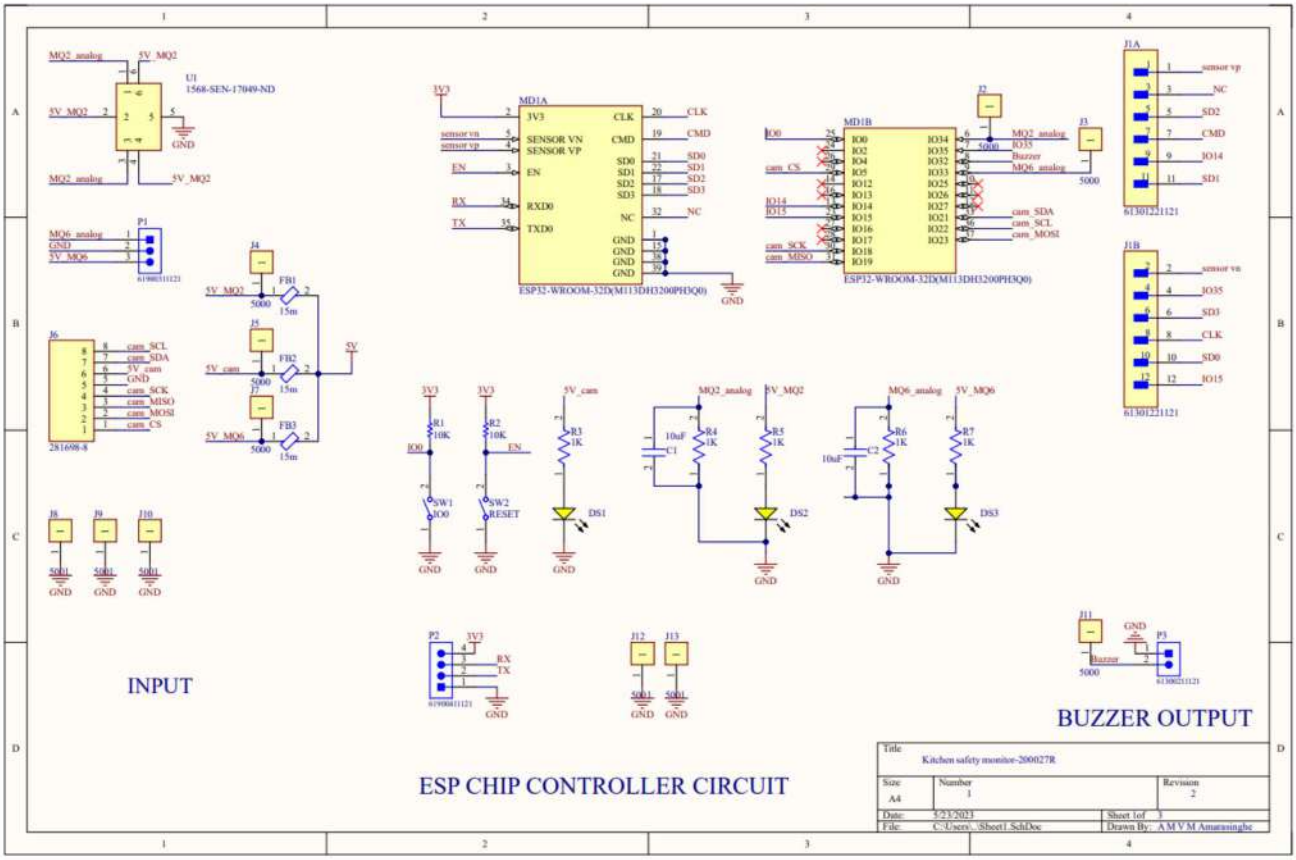


Figure 10: Schematic 1 ESP controller circuit

3.2 Power in circuit

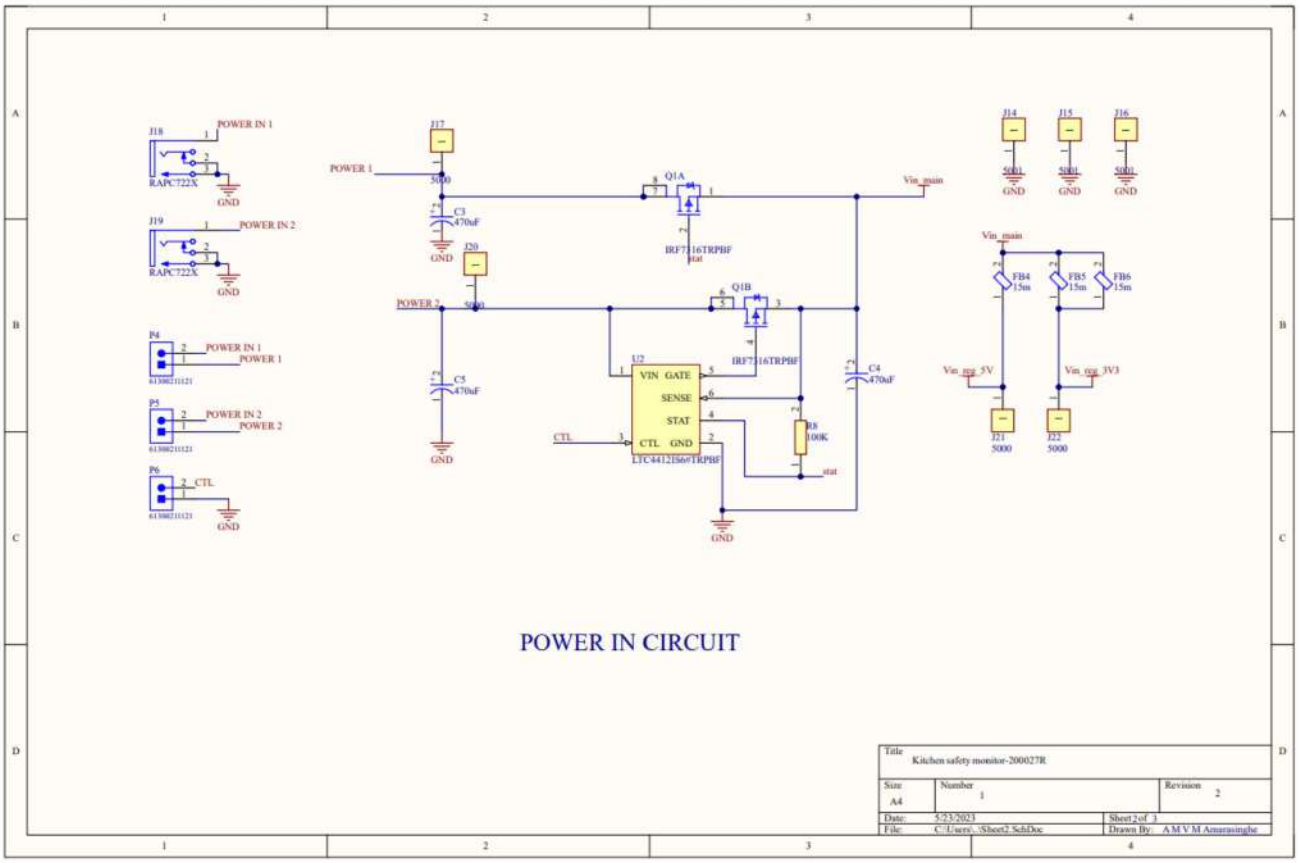


Figure 11: Schematic 2 Power in circuit

3.3 Regulator Circuits

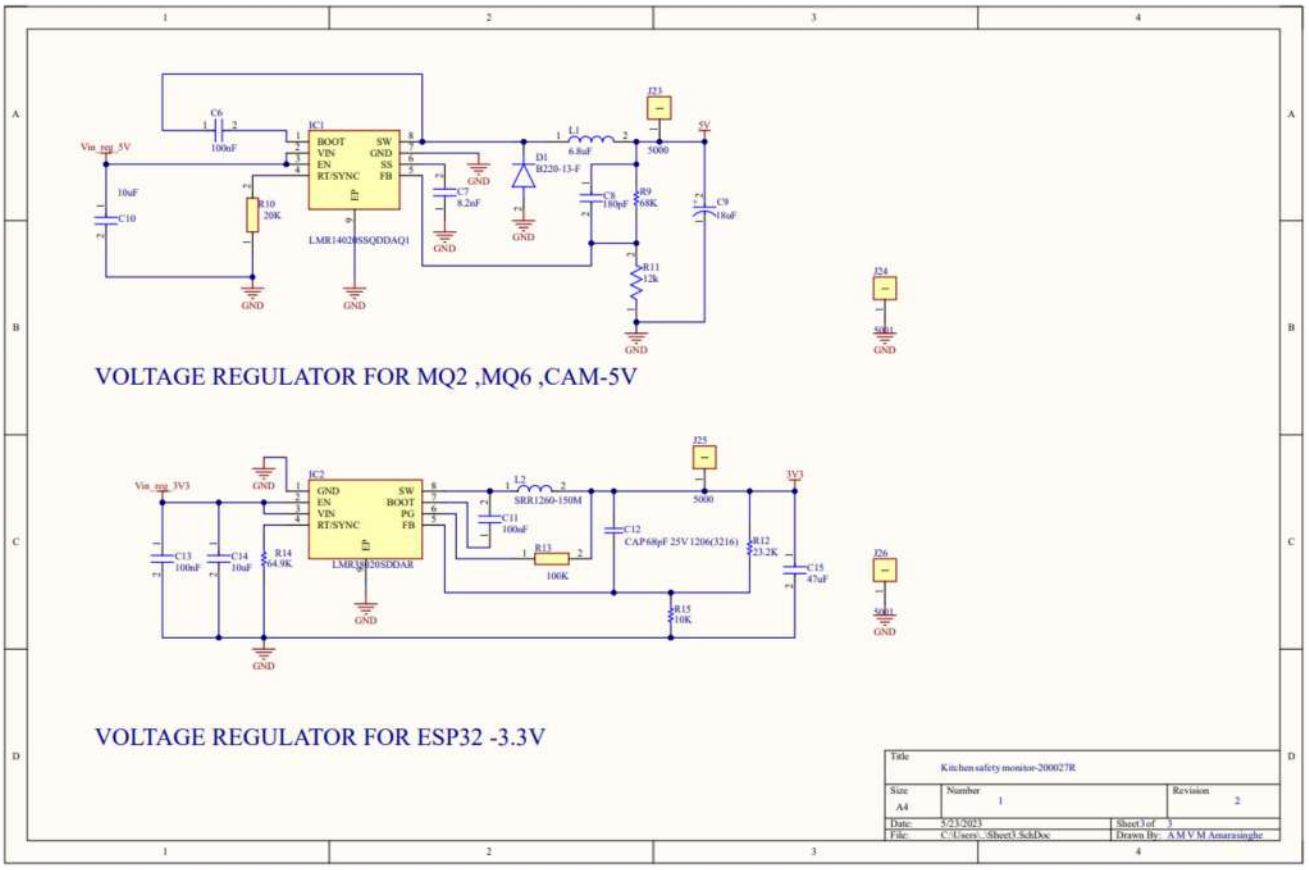


Figure 12: Schematic 3 Voltage regulator circuits

4 BOM -Bill of materials

Comment	Description	Designator	Footprint	LibRef	Quantity	Manufacturer
10uF	None	C1, C2	FP-1206-L_3_2_0_15-W_1_6-IPC_B	CMP-14477-002340-2	2	
470uF	CAP ALUM 470UF 20% 25V SMD	C3, C4, C5	FP-FTF-MFG	CMP-05427-000040-1	3	
100nF	CAP CER 0.1UF 25V X7R 0805	C6	FP-CC0805-0_85-MFG	CMP-1036-04410-2	1	Yageo
100nF	Capacitor	C7	CAPC3216X90N	885012008022	1	
CAP 68pF 25V 1206(3216)	CAP 68pF 25V ±5% 1206 (3216 Metric) Thickness 1mm SMD	C8	CAPC1206(3216)100_L	CMP-1037-01428-1	1	
100nF	0.1uF ±10% 250V Ceramic Capacitor X7R 1206 (3216 Metric)	C9	FP-GCJ31C-0_2-MFG	CMP-06035-042311-1	1	
10uF	Chip Multilayer Ceramic Capacitors for General Purpose, 1206, 10uF, X7R, 15%, 10%, 25V	C10	FP-GRM31C-0_2-e0_3_0_8-MFG	CMP-06035-003589-1	1	
10uF	Chip Multilayer Ceramic Capacitors for General Purpose, 0805, 10uF, X5R, 15%, 20%, 25V	C11	FP-GRM21B-0_15-IPC_A	CMP-06035-013048-1	1	
47uF	None	C12	FP-1206-L_3_2_0_3-W_1_6_0-MFG	CMP-14477-000191-2	1	
8.2nF	Capacitor	C13	C0805	C0805C822K4RACTU	1	
180pF	CAP CER 180PF 50V 10% NP0 0805	C14	FP-C0805C-DN-MFG	CMP-1036-02226-3	1	KEMET
18uF	Conductive Polymer Aluminum Solid Capacitors (OS-CON) 18uF ±20% 35V RADIAL SMT 10x7.9mm	C15	FP-OS-CON-SMT-F8-MFG	CMP-05428-000216-1	1	
B220-13-F	Diode	D1	DIOM5336X250N	B220-13-F	1	
SML-LX1206YC-TR	Yellow LED, Water Clear Len, 585 nm, 2.1 V, -40 to 85 degC, 2-Pin SMD, RoHS, Tape and Reel	DS1, DS2, DS3	LUMX-SML-LX1206YC-TR_V	CMP-2000-07124-1	3	Lumex
15m	Chip Ferrite Bead, 0805, 30Ω @ 100MHz, 0.014Ω, , 4A	FB1, FB2, FB3, FB6, FB7, FB8	FP-BLM21-0_2-t0_85-e0_5-d-IPC_B	CMP-06046-001820-1	6	
LMR38020SDDAR	Integrated Circuit	IC1	SOIC127P600X170-9N	LMR38020SDDAR	1	
LMR14020SSQDDAQ1	Integrated Circuit	IC2	SOIC127P600X170-9N	LMR14020SSQDDAQ1	1	
61301221121	CONN HEADER VERT 12POS 2.54MM	J1	FP-61301221121-MFG	CMP-1502-01088-2	1	
281698-8	Connector	J2	281698-8	281698-8	1	

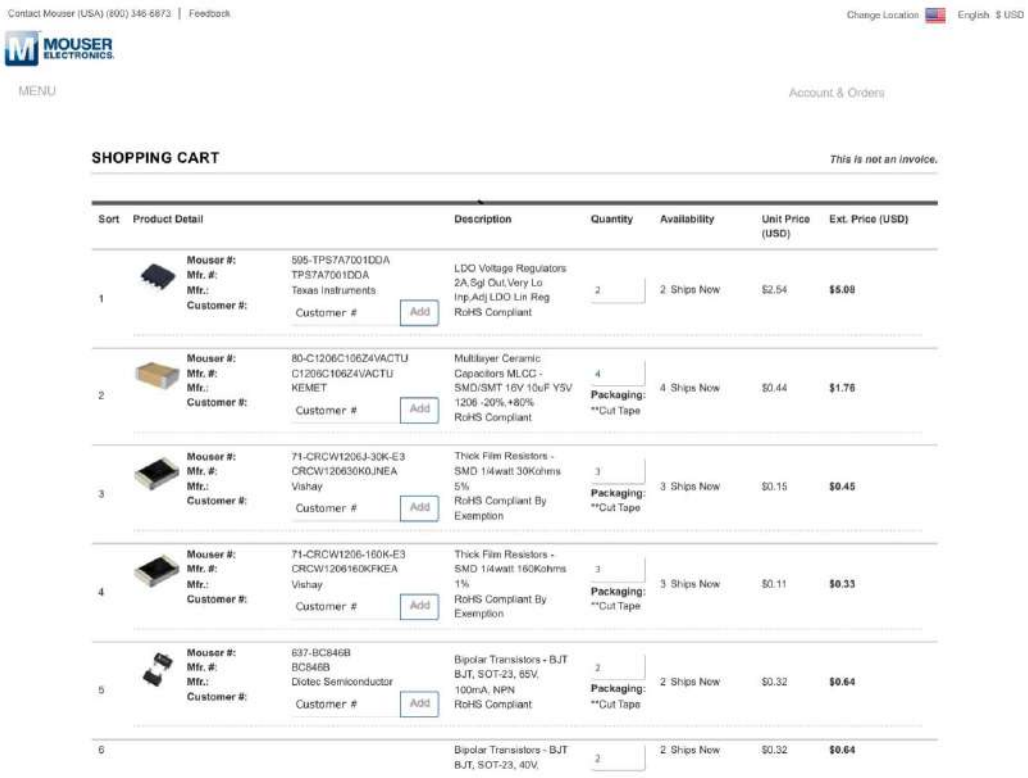
RAPC722X	Power Jack, 5 A, 3-Pin THD, RoHS, Bulk	J3, J4	SWITCH-RAPC712X-3_V	CMP-2000-05384-1	2	Switchcraft
5001	PC TEST POINT MINIATURE BLACK	J5, J6, J14, J16, J17, J19, J20, J21, J27, J28	FP-5001-MFG	CMP-2000-05181-2	10	
5000	PC TEST POINT MINIATURE RED	J8, J9, J11, J12, J13, J15, J18, J22, J23, J24, J25, J26	FP-5000-MFG	CMP-19636-000027-1	12	
SRR1260-150M	FIXED IND 15UH 5A 27 MOHM SMD	L1	FP-SRR1260-MFG	CMP-2000-07146-2	1	
6.8uF	Inductor	L2	SRN6045	SRN6045-6R8Y	1	
ESP32-WROOM-32D(M113DH3200PH3Q0)	RX TXRX MOD WIFI TRACE ANT SMD	MD1	FP-ESP32-WROOM-32D_M113DH-0	CMP-194065-000014-1	1	
61900311121	Male Locking Header WR-WTB, THT, Vertical, pitch 2.54 mm, 1 x 3 position	P1	61900311121	CMP-1502-00585-1	1	Wurth Elektronik
61900411121	Male Locking Header WR-WTB, THT, Vertical, pitch 2.54 mm, 1 x 4 position	P2	61900411121	CMP-1502-00586-1	1	Wurth Elektronik
61300211121	THT Vertical Pin Header WR-PHD, Pitch 2.54 mm, Single Row, 2 pins	P3, P4, P5, P6	61300211121	CMP-1712-00002-4	4	Wurth Elektronik

IRF7316TRPBF	MOSFET 2P-CH 30V 4.9A 8-SOIC	Q1	FP-PG-DSO-8-IPC_B	CMP-32901-000528-1	1	
10K	Chip Resistor, 10 KOhm, +/- 1%, 0.25 W, -55 to 155 degC, 1206 (3216 Metric), RoHS, Tape and Reel	R1, R2	RESC3116X65X40ML10T20	CMP-1014-00623-2	2	Yageo
1K	CRGP 1206 1K0 1%	R3, R4, R5, R6, R7	FP-CRGP1206-IPC_C	CMP-03211-004596-1	5	TE
100K	Resistor	R8, R9	RESC3116X65N	CRM1206QFX-1003ELF	2	
23.2K		R10	RESC3216X70X50LL05T20	CMP-2003-00231-1	1	Panasonic
64.9K		R11	RESC3216X70X50NL05T20	CMP-2003-00459-1	1	Panasonic
68K		R12	RESC2013X70X40NL20T20	CMP-2001-00568-1	1	Panasonic
20K	Resistor	R13	RESC2012X65N	SFR10EZPF2002	1	
10K		R14	RESC3216X70X50LL05T20	CMP-2003-00018-1	1	Panasonic
12k	SMD Chip Resistor, Thin Film, 680Ω, 100 V, 0805 [2012 Metric], 100 mW, 0.1%, RN73 Series	R15	FP-RN732A-MFG	CMP-03211-008443-1	1	TE Connectivity

IO0	FSMSM Push Button Switch, 50 mA, -35 to 85 degC, 2-Pin SMD, RoHS, Bulk	SW1	TECO-FSMSM-2_V	CMP-2000-07511-1	1	TE Connectivity
RESET	FSMSM Push Button Switch, 50 mA, -35 to 85 degC, 2-Pin SMD, RoHS, Bulk	SW2	TECO-FSMSM-2_V	CMP-2000-07511-1	1	TE Connectivity
SEN-17049	Smoke Sensor - MQ-2	U1	SEN-17049	SEN-17049	1	SparkFun
LTC4412IS6#TRPBF	Low Loss PowerPath(TM) Controller, 2.5 to 28 V Vin, 6-pin SOT23 (S6-6), -40 to 85 degC, Pb-Free, Tape and Reel	U2	LT-S6-6-TSOT-23_L	CMP-0479-00439-1	1	Linear Technology

4.1 Mouser Bills

we ordered our components as a group of 3 students



Contact Mouser (USA) (800) 346-6873 | Feedback

Change Location English $ USD

MOUSER ELECTRONICS

MENU

Account & Orders

SHOPPING CART

This is not an invoice.

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
1	Mouser #: 595-TPS7A7001DDA Mfr. #: TPS7A7001DDA Mfr.: Texas Instruments Customer #: Customer # Add		LDO Voltage Regulators 2A,Sgl Out,Very Lo Inp,Adj LDO Lin Reg RoHS Compliant	2	2 Ships Now	$2.54	**$5.08**
2	Mouser #: 80-C1206C106Z4VACTU Mfr. #: C1206C106Z4VACTU Mfr.: KEMET Customer #: Customer # Add		Multilayer Ceramic Capacitors MLCC - SMD/SMT 16V 10uF Y5V 1206 -20%,+80% RoHS Compliant	4 Packaging: **Cut Tape	4 Ships Now	$0.44	**$1.76**
3	Mouser #: 71-CRCW1206J-30K-E3 Mfr. #: CRCW120630K0JNEA Mfr.: Vishay Customer #: Customer # Add		Thick Film Resistors - SMD 1/4watt 30Kohms 5% RoHS Compliant By Exemption	3 Packaging: **Cut Tape	3 Ships Now	$0.15	**$0.45**
4	Mouser #: 71-CRCW1206-160K-E3 Mfr. #: CRCW1206160KFKEA Mfr.: Vishay Customer #: Customer # Add		Thick Film Resistors - SMD 1/4watt 160Kohms 1% RoHS Compliant By Exemption	3 Packaging: **Cut Tape	3 Ships Now	$0.11	**$0.33**
5	Mouser #: 637-BC846B Mfr. #: BC846B Mfr.: Diotec Semiconductor Customer #: Customer # Add		Bipolar Transistors - BJT BJT, SOT-23, 65V, 100mA, NPN RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.32	**$0.64**
6			Bipolar Transistors - BJT BJT, SOT-23, 40V,	2	2 Ships Now	$0.32	**$0.64**

Figure 13: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
	Mouser #: Mfr. #: Mfr.: Customer #:	637-MMBT3904 MMBT3904 Diotec Semiconductor Customer # Add	200mA, NPN RoHS Compliant	Packaging: **Cut Tape			
7	Mouser #: Mfr. #: Mfr.: Customer #:	71-CRCW1206J-4.7K-E3 CRCW12064K70JNEA Vishay Customer # Add	Thick Film Resistors - SMD 1/4watt 4.7Kohms 5% RoHS Compliant By Exemption	2 Packaging: **Cut Tape	2 Ships Now	$0.15	$0.30
8	Mouser #: Mfr. #: Mfr.: Customer #:	621-1N4148W-13-F 1N4148W-13-F Diodes Incorporated Customer # Add	Diodes - General Purpose, Power, Switching 400mW 100Vrrm 4ns RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.19	$0.38
9	Mouser #: Mfr. #: Mfr.: Customer #:	710-691102710002 691102710002 Wurth Elektronik Customer # Add	Fixed Terminal Blocks WR-TBL 300VAC 15A 2P Straight RoHS Compliant By Exemption	4	4 Ships Now	$0.73	$2.92
10	Mouser #: Mfr. #: Mfr.: Customer #:	647-RSA1A121MCN1GS RSA1A121MCN1GS Nichicon Customer # Add	Aluminum Organic Polymer Capacitors 10V 120uF 20% Tol RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.88	$1.76
11	Mouser #: Mfr. #: Mfr.: Customer #:	581-08053C104K 08053C104KAT2A KYOCERA AVX Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 25V 0.1uF X7R 0805 10% RoHS Compliant By Exemption	10 Packaging: **Cut Tape	10 Ships Now	$0.034	$0.34
12	Mouser #: Mfr. #: Mfr.: Customer #:	647-UCM1E471MNL1GS UCM1E471MNL1GS Nichicon Customer # Add	Aluminum Electrolytic Capacitors - SMD 25V 470uF TOL 20% AEC-Q200 RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.75	$1.50
13					10 Ships Now	$0.074	$0.74

Figure 14: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
	Mouser #: Mfr. #: Mfr.: Customer #:	187-CL21A106KOQNNNF CL21A106KOQNNNF Samsung Electro-Mechanics Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 10uF +/-10% 16V X5R 2 0805 RoHS Compliant	10 Packaging: **Cut Tape			
14	Mouser #: Mfr. #: Mfr.: Customer #:	603-RC0805FR-0710KL RC0805FR-0710KL YAGEO Customer # Add	Thick Film Resistors - SMD 10 kOhms 125 mW 0805 1% RoHS Compliant By Exemption	100 Packaging: **Cut Tape	100 Ships Now	$0.014	$1.40
15	Mouser #: Mfr. #: Mfr.: Customer #:	710-865080443008 865080443008 Wurth Elektronik Customer # Add	Aluminum Electrolytic Capacitors - SMD WCAP-ASLI 56uF 25V 20% SMD/SMT RoHS Compliant	2	2 Ships Now	$0.27	$0.54
16	Mouser #: Mfr. #: Mfr.: Customer #:	603-AC0805FR-7W3K3L AC0805FR-7W3K3L YAGEO Customer # Add	Thick Film Resistors - SMD 3.3kOhms 1/4W 0805 1 % AEC-Q200 Double Power Version RoHS Compliant By Exemption	100 Packaging: **Cut Tape	100 Ships Now	$0.034	$3.40
17	Mouser #: Mfr. #: Mfr.: Customer #:	603-RC1206FR-07133KL RC1206FR-07133KL YAGEO Customer # Add	Thick Film Resistors - SMD 133 kOhms 250 mW 1206 1% RoHS Compliant By Exemption	4 Packaging: **Cut Tape	4 Ships Now	$0.10	$0.40
18	Mouser #: Mfr. #: Mfr.: Customer #:	603-RT0805BRD076K73L RT0805BRD076K73L YAGEO Customer # Add	Thin Film Resistors - SMD 1/8W 6.73K Ohms 0.1% RoHS Compliant By Exemption	2 Packaging: **Cut Tape	2 Ships Now	$0.36	$0.72
19	Mouser #: Mfr. #: Mfr.: Customer #:	926-LM26003MHX/NOPB LM26003MHX/NOPB Texas Instruments Customer # Add	Switching Voltage Regulators 3A Switching Regulator with High Efficiency Sleep Mode 20-HTSSOP -40 to 125 RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$3.94	$7.88

Figure 15: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
20	Mouser #: 506-FSMSM Mfr. #: FSMSM Mfr.: TE Connectivity Customer #: Customer # Add		Tactile Switches 3.5X6 SMT TACT TACT SWITCH RoHS Compliant	6	6 Ships Now	$0.33	$1.98
21	Mouser #: 512-SS36FA Mfr. #: SS36FA Mfr.: onsemi Customer #: Customer # Add		Schottky Diodes & Rectifiers 60V 3A Schottky Barrier Rectifier RoHS Compliant By Exemption	3 Packaging: **Cut Tape	3 Ships Now	$0.53	$1.59
22	Mouser #: 963-EMK316BBJ476ML-T Mfr. #: EMK316BBJ476ML-T Mfr.: TAIYO YUDEN Customer #: Customer # Add		Multilayer Ceramic Capacitors MLCC - SMD/SMT 1206 16VDC 47uF 20% X5R RoHS Compliant	5 Packaging: **Cut Tape	5 Ships Now	$0.58	$2.90
23	Mouser #: 806-KLDX-0202-AC Mfr. #: KLDX-0202-AC Mfr.: Kycon Customer #: Customer # Add		DC Power Connectors 2mm PCB JACK CRIMPED-CRIMPED LEADS RoHS Compliant	6	6 Ships Now	$0.70	$4.20
24	Mouser #: 621-AP22815AWU-7 Mfr. #: AP22815AWU-7 Mfr.: Diodes Incorporated Customer #: Customer # Add		Power Switch ICs - Power Distribution 3.0A ADJ SINGLE CH PWR DIST SWITCH RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.94	$1.88
25	Mouser #: 667-ERJ-6ENF2052V Mfr. #: ERJ-6ENF2052V Mfr.: Panasonic Customer #: Customer # Add		Thick Film Resistors - SMD 0805 20.5Kohms 1% AEC-Q200 RoHS Compliant By Exemption	10 Packaging: **Cut Tape	10 Ships Now	$0.084	$0.84
26	Mouser #: 512-2N3904TFR Mfr. #: 2N3904TFR Mfr.: onsemi Customer #: Customer # Add		Bipolar Transistors - BJT NPN Transistor General Purpose RoHS Compliant	2	2 Ships Now	$0.38	$0.76
27			MOSFET MOSFT DUAL PCh -30V 4.9A	4	4 Ships Now	$1.25	$5.00

Figure 16: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
	Mouser #: 942-IRF7316TRPBF Mfr. #: IRF7316TRPBF Mfr.: Infineon Customer #: Customer # Add		RoHS Compliant	Packaging: **Cut Tape			
28	Mouser #: 356-ESP32WROOM-32D Mfr. #: ESP32-WROOM-32D-N4 Mfr.: Espressif Customer #: Customer # Add		Multiprotocol Modules SMD Module, ESP32-D0WD, 32Mbits SPI flash, UART mode, PCB antenna	4 Packaging: **Cut Tape	4 Ships Now	$4.08	$16.32
29	Mouser #: 652-SRP7028A-150M Mfr. #: SRP7028A-150M Mfr.: Bourns Customer #: Customer # Add		Power Inductors - SMD 15uH 20% SMD 7028 AEC-Q200 RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$1.38	$2.76
30	Mouser #: 667-ERJ-8ENF1542V Mfr. #: ERJ-8ENF1542V Mfr.: Panasonic Customer #: Customer # Add		Thick Film Resistors - SMD 1206 15.4Kohms 1% AEC-Q200 RoHS Compliant By Exemption	4 Packaging: **Cut Tape	4 Ships Now	$0.18	$0.72
31	Mouser #: 71-CRCW1206-205K-E3 Mfr. #: CRCW1206205KFKEA Mfr.: Vishay Customer #: Customer # Add		Thick Film Resistors - SMD 1/4watt 205Kohms 1% RoHS Compliant By Exemption	10 Packaging: **Cut Tape	10 Ships Now	$0.072	$0.72
32	Mouser #: 810-CGA1A2C0G1E680J Mfr. #: CGA1A2C0G1E680J030BA Mfr.: TDK Customer #: Customer # Add		Multilayer Ceramic Capacitors MLCC - SMD/SMT CGA 0201 25V 68pF C0G 5% AEC-Q200 RoHS Compliant	1 Packaging: **Cut Tape	1 Ships Now	$0.10	$0.10
33	Mouser #: 652-SRR1260-150M Mfr. #: SRR1260-150M Mfr.: Bourns Customer #: Customer # Add		Power Inductors - SMD 15uH 20% SMD 1260 RoHS Compliant	4 Packaging: **Cut Tape	4 Ships Now	$1.26	$5.04
	View Additional Product Info						
34					5 Ships Now	$0.18	$0.90

Figure 17: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
	Mouser #: Mfr. #: Mfr.: Customer #:	667-ERJ-8ENF6492V ERJ-8ENF6492V Panasonic Customer # Add	Thick Film Resistors - SMD 1206 64.9Kohms 1% AEC-Q200 RoHS Compliant By Exemption	5 Packaging: **Cut Tape			
35	Mouser #: Mfr. #: Mfr.: Customer #:	667-ERJ-8ENF2322V ERJ-8ENF2322V Panasonic Customer # Add	Thick Film Resistors - SMD 1206 23.2Kohms 1% AEC-Q200 RoHS Compliant By Exemption	10 Packaging: **Cut Tape	10 Ships Now	$0.118	**$1.18**
36	Mouser #: Mfr. #: Mfr.: Customer #:	595-LMR38020SDDAR LMR38020SDDAR Texas Instruments Customer # Add	Switching Voltage Regulators SIMPLE SWITCHER power converter 4.2-V to 80-V, 2-A, synchronous buck with 40-uA IQ RoHS Compliant	4 Packaging: **Cut Tape	4 Ships Now	$1.90	**$7.60**
37	Mouser #: Mfr. #: Mfr.: Customer #:	584-LTC4412ES6TRMPBF LTC4412ES6#TRMPBF Analog Devices Inc. Customer # Add	Power Management Specialized - PMIC L Loss PwrPath Cntr in SOT RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$4.68	**$9.36**
38	Mouser #: Mfr. #: Mfr.: Customer #:	485-1655 1655 Adafruit Customer # Add	Adafruit Accessories SK6812 LEDs w/driverchip-10pack RoHS Compliant	3 Packaging:	3 Ships Now	$4.50	**$13.50**
39	Mouser #: Mfr. #: Mfr.: Customer #:	80-C1206C104K5RACTM C1206C104K5RACTM KEMET Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 50V 0.1uF X7R 1206 10% RoHS Compliant	60 Packaging: **Cut Tape	60 Ships Now	$0.056	**$3.36**
40	Mouser #: Mfr. #: Mfr.: Customer #:	667-ERJ-8ENF3401V ERJ-8ENF3401V Panasonic Customer # Add	Thick Film Resistors - SMD 1206 3.4Kohms 1% AEC-Q200 RoHS Compliant By Exemption	5 Packaging: **Cut Tape	5 Ships Now	$0.18	**$0.90**

Figure 18: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
41	Mouser #: Mfr. #: Mfr.: Customer #:	81-BLM21P300S BLM21PG300SN1D Murata Customer # Add	Ferrite Beads 30 OHM 25% Alternate Sizing Guide Below RoHS Compliant	32 Packaging: **Cut Tape	32 Ships Now	$0.063	**$2.02**
42	Mouser #: Mfr. #: Mfr.: Customer #:	603-RC1206FR-0730KL RC1206FR-0730KL YAGEO Customer # Add	Thick Film Resistors - SMD 30 kOhms 250 mW 1206 1% RoHS Compliant By Exemption	2 Packaging: **Cut Tape	2 Ships Now	$0.10	**$0.20**
43	Mouser #: Mfr. #: Mfr.: Customer #:	755-ESR18EZPF1202 ESR18EZPF1202 ROHM Semiconductor Customer # Add	Thick Film Resistors - SMD 1206 12Kohm 1% Anti Surge AEC-Q200 RoHS Compliant By Exemption	2 Packaging: **Cut Tape	2 Ships Now	$0.19	**$0.38**
44	Mouser #: Mfr. #: Mfr.: Customer #:	710-885012008022 885012008022 Wurth Elektronik Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT WCAP-CSGP 68pF 1206 5% 25V MLCC RoHS Compliant	4 Packaging: **Cut Tape	4 Ships Now	$0.14	**$0.56**
45	Mouser #: Mfr. #: Mfr.: Customer #:	584-LTC4412IS6#TRPBF LTC4412IS6#TRPBF Analog Devices Inc. Customer # Add	Power Management Specialized - PMIC L Loss PwrPath Cntr in SOT RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$5.00	**$10.00**
46	Mouser #: Mfr. #: Mfr.: Customer #:	595-LMR14020SSQDDAQ1 LMR14020SSQDDAQ1 Texas Instruments Customer # Add	Switching Voltage Regulators SIMPLE SWITCHER Automotive 40-V, 2-A, 2.2-MHz step-down converter with 40-uA IQ 8-SO PowerPAD -40 to 125 RoHS Compliant	2	2 Ships Now	$3.57	**$7.14**
47	Mouser #: Mfr. #: Mfr.: Customer #:	652-CR1206FX-2322ELF CR1206-FX-2322ELF Bourns Customer # Add	Thick Film Resistors - SMD 23.2K 1% RoHS Compliant By Exemption	3 Packaging: **Cut Tape	3 Ships Now	$0.10	**$0.30**

Figure 19: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
48	Mouser #: Mfr. #: Mfr.: Customer #:	71-CRCW1206-64.9K-E3 CRCW120664K9FKEA Vishay Customer # Add	Thick Film Resistors - SMD 1/4watt 64.9Kohms 1% RoHS Compliant By Exemption	2 Packaging: **Cut Tape	2 Ships Now	$0.11	$0.22
49	Mouser #: Mfr. #: Mfr.: Customer #:	603-RC0805FR-1320KL RC0805FR-1320KL YAGEO Customer # Add	Thick Film Resistors - SMD 20 kOhms 250 mW 0805 1% RoHS Compliant By Exemption	10 Packaging: **Cut Tape	10 Ships Now	$0.029	$0.29
50	Mouser #: Mfr. #: Mfr.: Customer #:	603-RC1206FR-1310KL RC1206FR-1310KL YAGEO Customer # Add	Thick Film Resistors - SMD 10 kOhms 250 mW 1206 1% RoHS Compliant By Exemption	10 Packaging: **Cut Tape	10 Ships Now	$0.06	$0.60
51	Mouser #: Mfr. #: Mfr.: Customer #:	187-CL21B104KAFNNNE CL21B104KAFNNNE Samsung Electro-Mechanics Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 100nF+/-10% 25V X7R 0805 RoHS Compliant	10 Packaging: **Cut Tape	10 Ships Now	$0.035	$0.35
52	Mouser #: Mfr. #: Mfr.: Customer #:	652-CRM1206QFX-1003E CRM1206QFX-1003ELF Bourns Customer # Add	Thick Film Resistors - SMD ResPowerQ 1206 100k 1% 1/2W TC100 RoHS Compliant	4 Packaging: **Cut Tape	4 Ships Now	$0.22	$0.88
53	Mouser #: Mfr. #: Mfr.: Customer #:	667-ERJ-6ENF6802V ERJ-6ENF6802V Panasonic Customer # Add	Thick Film Resistors - SMD 0805 68Kohms 1% AEC-Q200 RoHS Compliant By Exemption	4 Packaging: **Cut Tape	4 Ships Now	$0.10	$0.40
54	Mouser #: Mfr. #: Mfr.: Customer #:	81-GRM31CR71E106KA12 GRM31CR71E106KA12L Murata Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 10 uF 25 VDC 10% 1206 X7R RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.32	$0.64
55					2 Ships Now	$0.19	$0.38

Figure 20: Mouser bills

Sort	Product Detail		Description	Quantity	Availability	Unit Price (USD)	Ext. Price (USD)
	Mouser #: Mfr. #: Mfr.: Customer #:	81-GRM21BR61E106MA3L GRM21BR61E106MA73L Murata Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 10 uF 25 VDC 20% 0805 X5R RoHS Compliant	2 Packaging: **Cut Tape			
56	Mouser #: Mfr. #: Mfr.: Customer #:	80-C0805C822K4R C0805C822K4RACTU KEMET Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 16V 8200pF X7R 0805 10% RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.28	$0.56
57	Mouser #: Mfr. #: Mfr.: Customer #:	80-C0805C181K5RACTU C0805C181K5RACTU KEMET Customer # Add	Multilayer Ceramic Capacitors MLCC - SMD/SMT 50V 180pF X7R 0805 10% RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$0.30	$0.60
58	Mouser #: Mfr. #: Mfr.: Customer #:	667-35SVPD18M 35SVPD18M Panasonic Customer # Add	Aluminum Organic Polymer Capacitors 35volts 18uF 60mohm 10x8mm OSCON RoHS Compliant	2 Packaging: **Cut Tape	2 Ships Now	$2.16	$4.32
59	Mouser #: Mfr. #: Mfr.: Customer #:	474-SEN-17049 SEN-17049 SparkFun Electronics Customer # Add	Air Quality Sensors Smoke Sensor - MQ-2	2	2 Ships Now	$5.38	$10.76
60	Mouser #: Mfr. #: Mfr.: Customer #:	474-SEN-09405 SEN-09405 SparkFun Electronics Customer # Add	Air Quality Sensors LPG Gas Sensor MQ-6	1	1 Ships Now	$5.38	$5.38

By submitting your order you agree to these terms and conditions.
For additional information on availability, click on the Mouser Part #.

**All MouseReel™ items are non-cancellable and non-returnable.

Merchandise:		$158.77
Shipping:	DHL International Express	$40.00
	+ More Shipping Options	
Subtotal:		$198.77

Figure 21: Mouser bills

5 PCB design

5.1 Description of PCB Design Process for Kitchen Safety Monitor

In this project, the PCB design was accomplished using Altium Designer, a powerful electronic design automation software. The design process involved several essential steps to create a functional and manufacturable printed circuit board. The following description outlines the key steps followed in the PCB design process using Altium:

5.1.1 Schematic Design

The initial step was to create a comprehensive schematic diagram of the electronic circuit. Altium's user-friendly schematic editor allowed for easy placement and interconnection of components. Each component was carefully selected based on project requirements, and their corresponding symbols were added to the schematic.

5.1.2 Component Selection:

Before proceeding with the PCB layout, all components were carefully chosen, ensuring that they met the project's specifications and were readily available for purchase. Additionally, the component libraries were organized and imported into Altium to facilitate the design process.

5.1.3 PCB Footprint Assignment

For each component in the schematic, the next crucial step was to assign suitable PCB footprints that matched the physical dimensions and pin arrangements of the actual components. Altium's extensive library of pre-built footprints made this task efficient, and any custom footprints were created as needed.

5.1.4 PCB Layout

With the schematic and footprints prepared, the PCB layout phase began. Altium's intuitive PCB layout editor enabled the components to be arranged on the PCB board, taking into account the circuit's functionality, physical constraints, and best practices for signal integrity.

5.1.5 Routing Traces

The manual routing process was carried out, connecting the various components through traces on the PCB. Altium provided a range of routing tools, allowing for precise trace routing and impedance control.

5.1.6 Plane and Copper Pour

To ensure proper power distribution and reduce EMI, power and ground planes were incorporated into the design using dedicated planes or copper pours. This step significantly improved the circuit's performance and stability.

5.1.7 Design Rule Check (DRC)

The PCB design underwent a thorough design rule check (DRC) to identify and rectify any rule violations. This check ensured that the PCB design adhered to the specified design constraints, such as trace clearances and widths.

5.1.8 Netlist Generation

Upon completing the PCB layout, a netlist was generated, containing the connectivity information of the design. This netlist played a crucial role in subsequent steps such as assembly and manufacturing.

5.1.9 3D Visualization

Altium's 3D visualization tool was utilized to inspect the PCB in a three-dimensional model. This feature allowed for visual verification of mechanical clearances and potential interference issues.

5.1.10 Design Validation:

To validate the design's functionality and performance, simulations or other validation methods were employed. This step ensured that the PCB design met the intended specifications.

5.1.11 Gerber File Generation

Once the PCB layout was finalized and verified, Gerber files were generated. These files contained all the necessary information required by the PCB fabrication house to manufacture the physical PCB.

In conclusion, the PCB design process using Altium Designer involved a meticulous approach to schematic design, component selection, PCB layout, routing, and thorough verification steps. The resulting PCB design files are a culmination of these efforts, ready for manufacturing and assembly. The uploaded PCB design files reflect the diligent design process undertaken to create a functional, reliable, and efficient printed circuit board for the intended electronic application.

5.2 PCB Gerber files

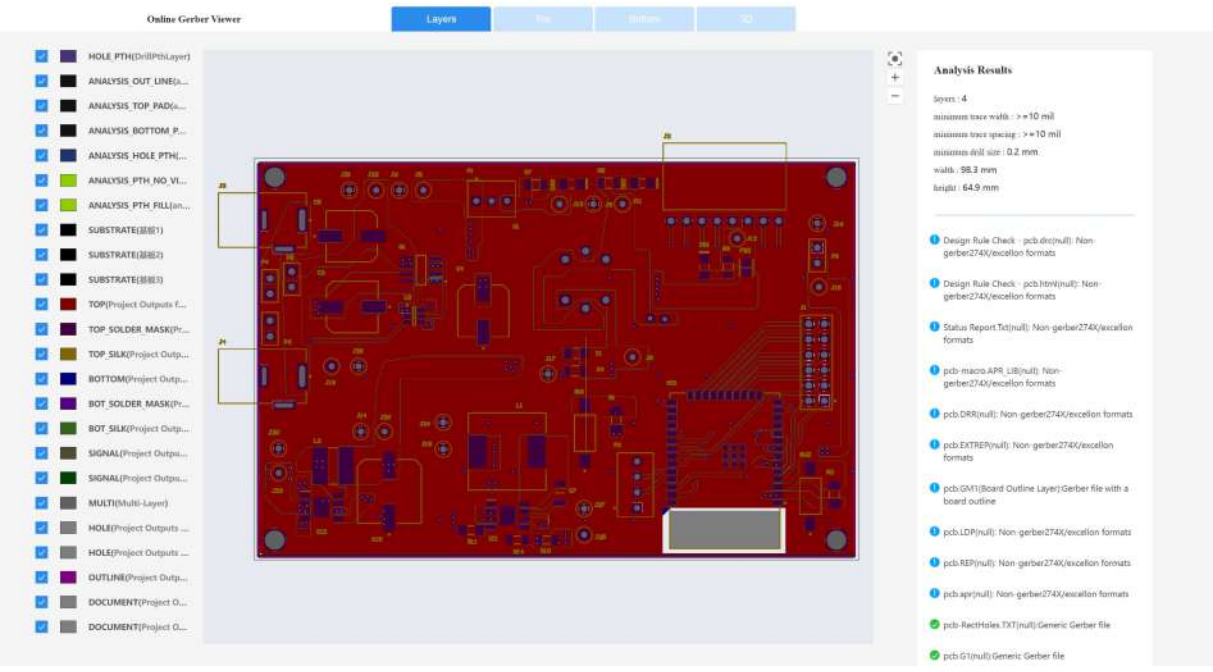


Figure 22: Gerber Layer View

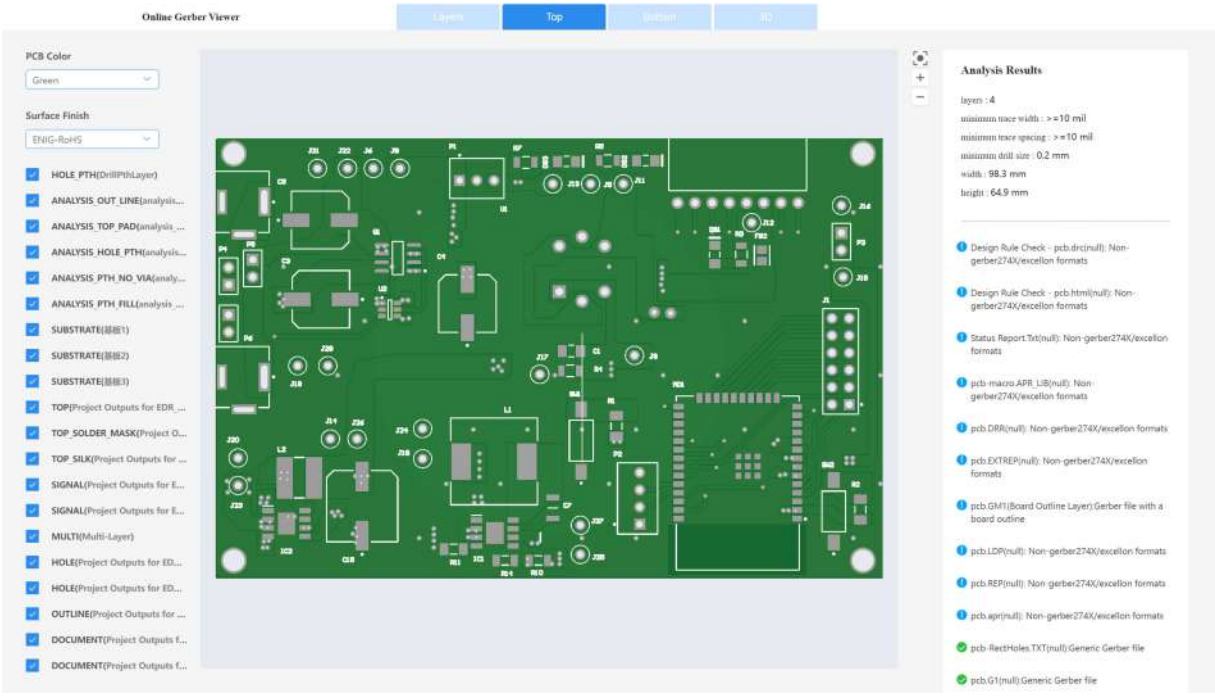


Figure 23: Gerber Top View

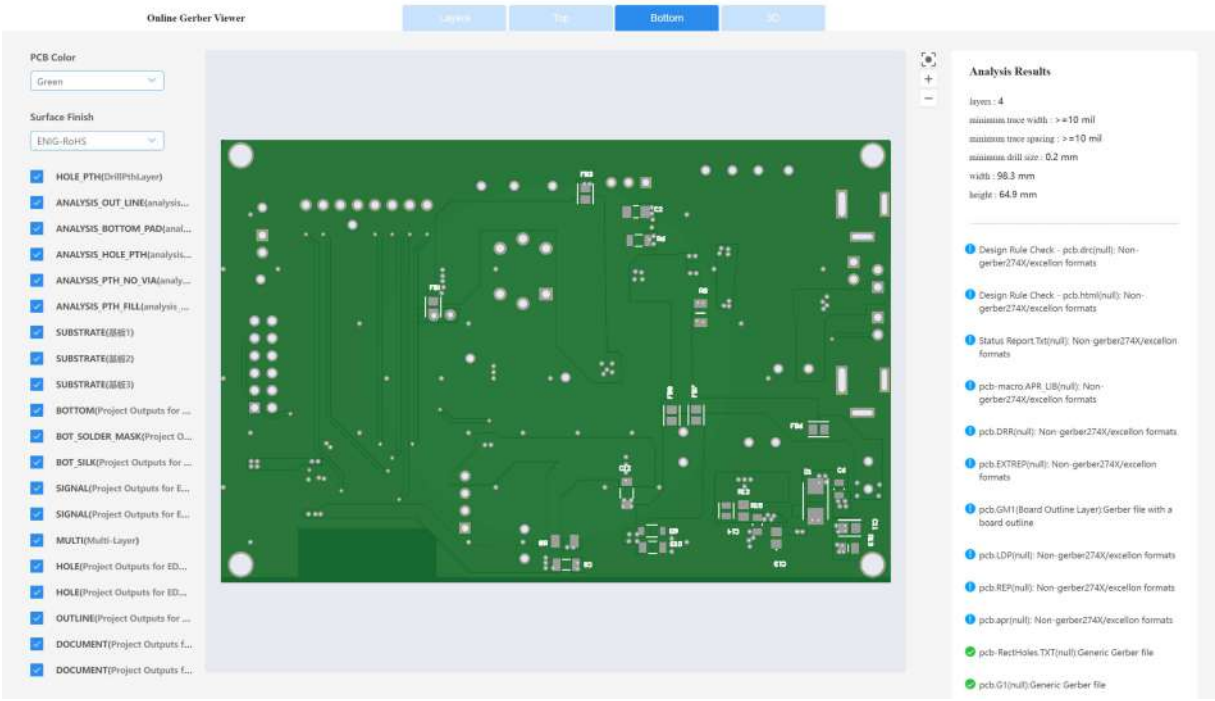


Figure 24: Gerber Bottom View

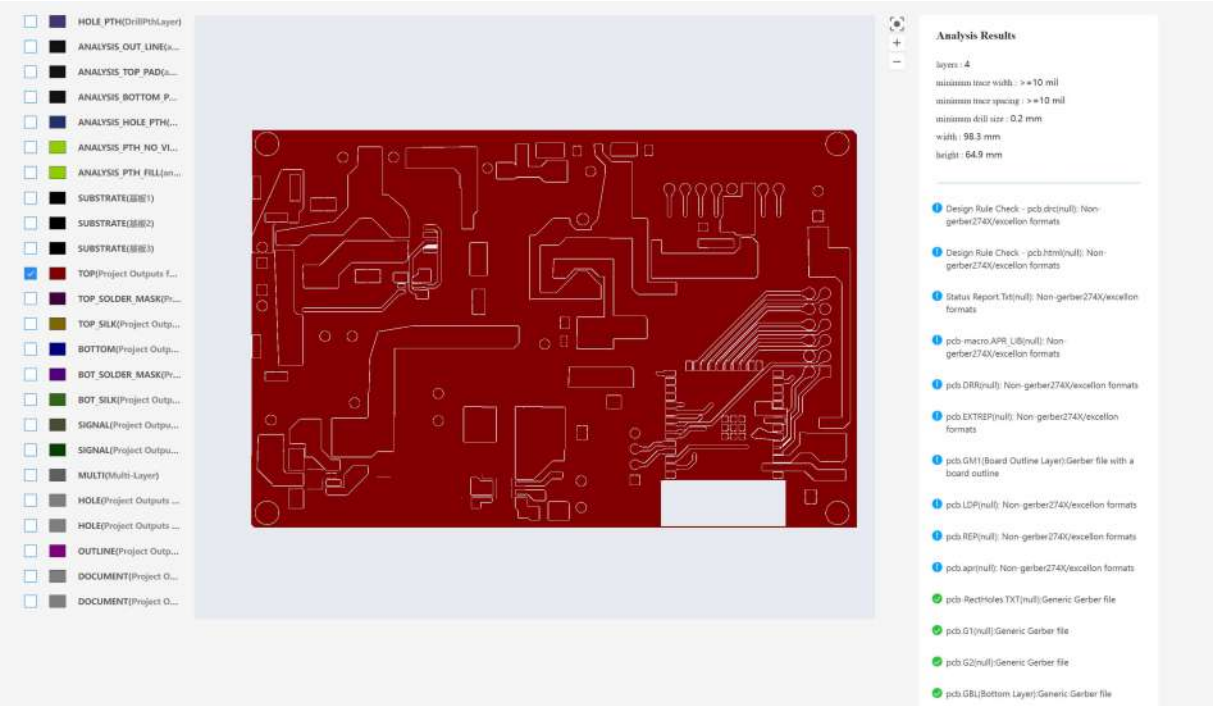


Figure 25: Gerber Layer 1 Top

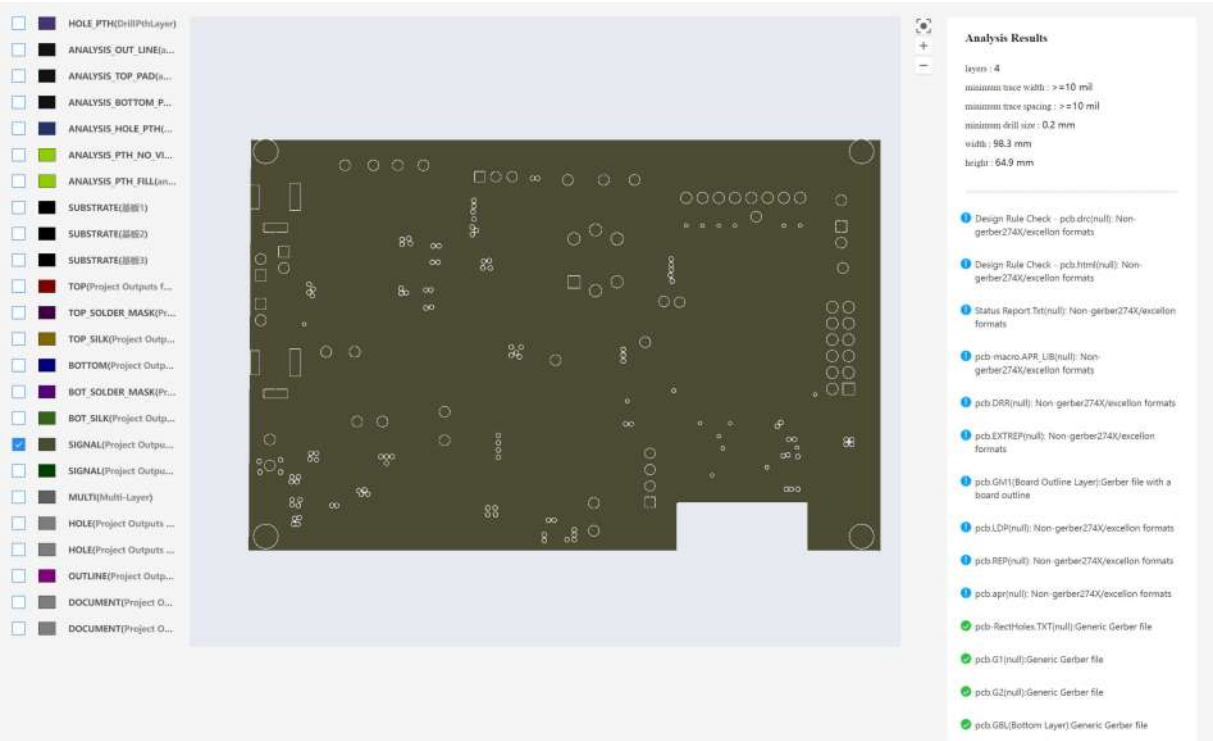


Figure 26: Gerber Layer 2

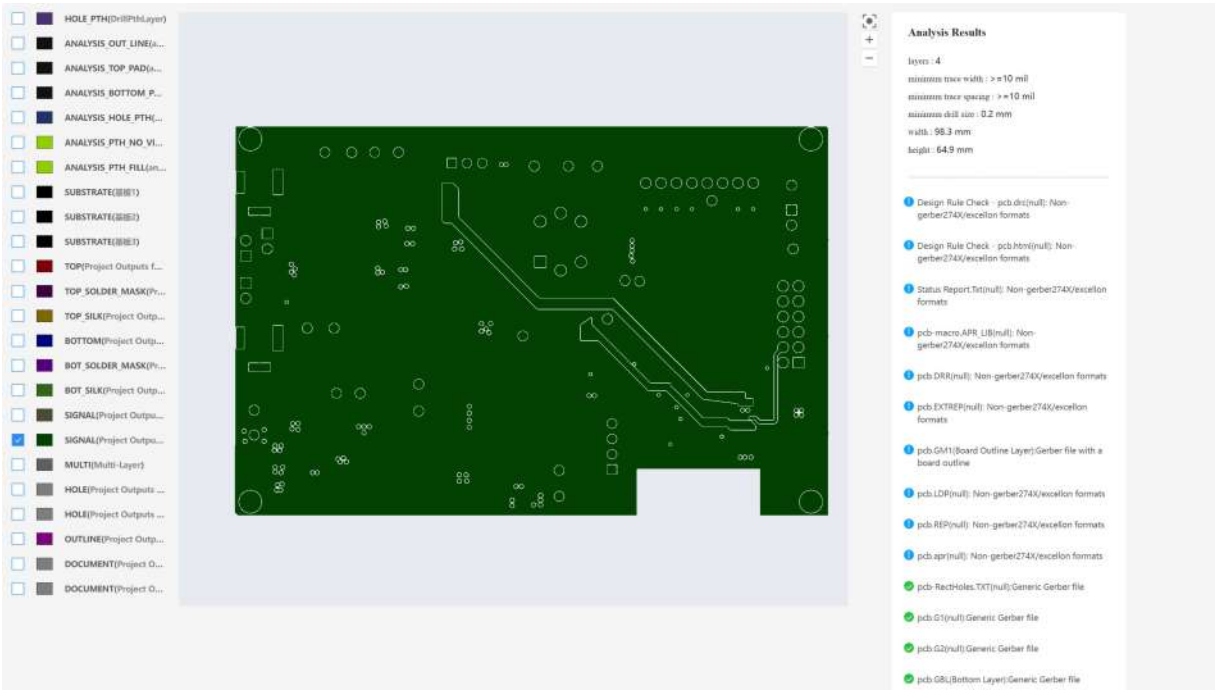


Figure 27: Gerber Layer 3

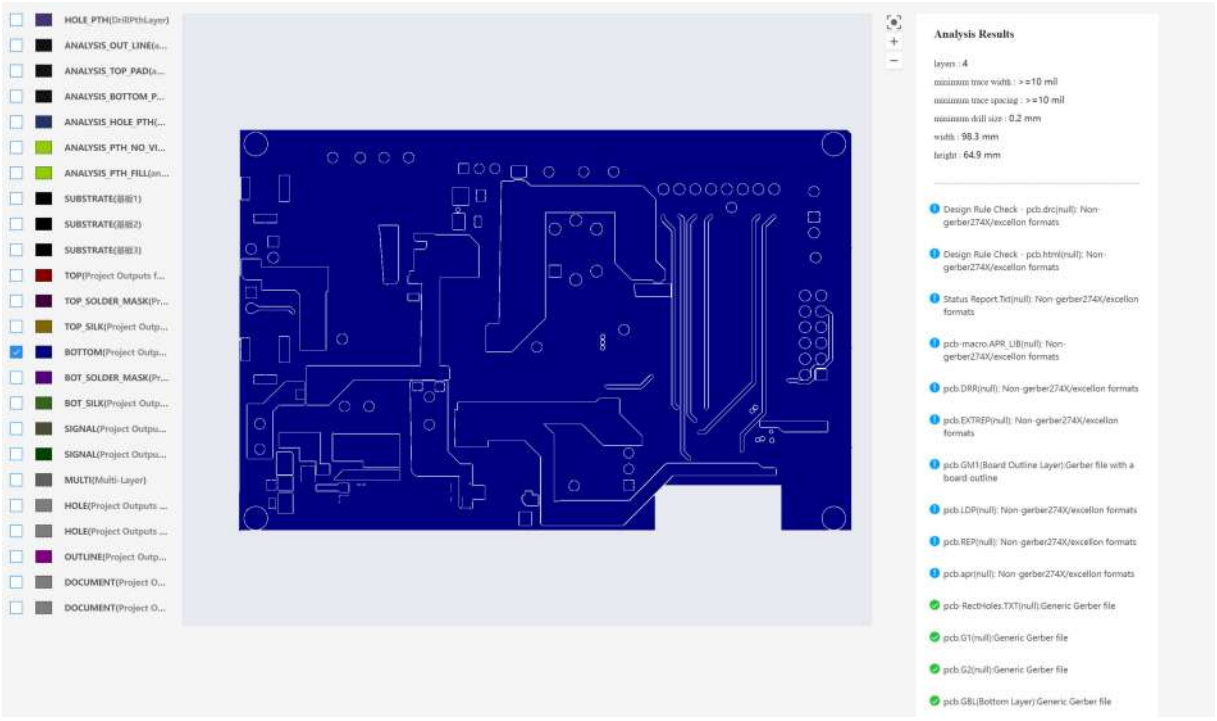


Figure 28: Gerber Layer 4 Bottom

References : https://jlcpcb.com/help/article/8-How-to-export-Altium-PCB-to-gerber-files

Altium Designer

Design Rule Verification Report

Date:	7/30/2023		
Time:	12:28:12 AM	**Warnings:**	0
Elapsed Time:	00:00:01	**Rule Violations:**	9
Filename:	C:\Users\pahan\Downloads\Venuri EDR\EDR_smoke_detector_venuri_new_final\pcb.PcbDoc		

Summary

Warnings	Count
Total	**0**

Rule Violations	Count
Clearance Constraint (Gap=0.102mm) (All),(All)	0
Short-Circuit Constraint (Allowed=No) (All),(All)	0
Un-Routed Net Constraint ((All))	0
Modified Polygon (Allow modified: No), (Allow shelved: No)	0
Width Constraint (Min=0.102mm) (Max=1816.048mm) (Preferred=0.102mm) (All)	0
Power Plane Connect Rule(Direct Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm) (Entries=4) (InPadClass('PowerPads'))	0
Power Plane Connect Rule(Relief Connect)(Expansion=0.3mm) (Conductor Width=0.102mm) (Air Gap=0.102mm) (Entries=4) (All)	0
Minimum Annular Ring (Minimum=0.076mm) (All)	0
Hole Size Constraint (Min=0.2mm) (Max=6.3mm) (All)	0
Hole To Hole Clearance (Gap=0.25mm) (All),(All)	0
Minimum Solder Mask Sliver (Gap=0mm) (All),(All)	0
Silk To Solder Mask (Clearance=0.102mm) (IsPad),(All)	0
Silk to Silk (Clearance=0mm) (All),(All)	0
Net Antennae (Tolerance=0mm) (All)	0
Board Clearance Constraint (Gap=0mm) (All)	9
Height Constraint (Min=0mm) (Max=1816.048mm) (Prefered=12.7mm) (All)	0
Total	**9**

Figure 29: Design rule check

here the 9 vialations are perent due to present of the silk screen out side the board . (violating Board clearance rules and they are not very critical)

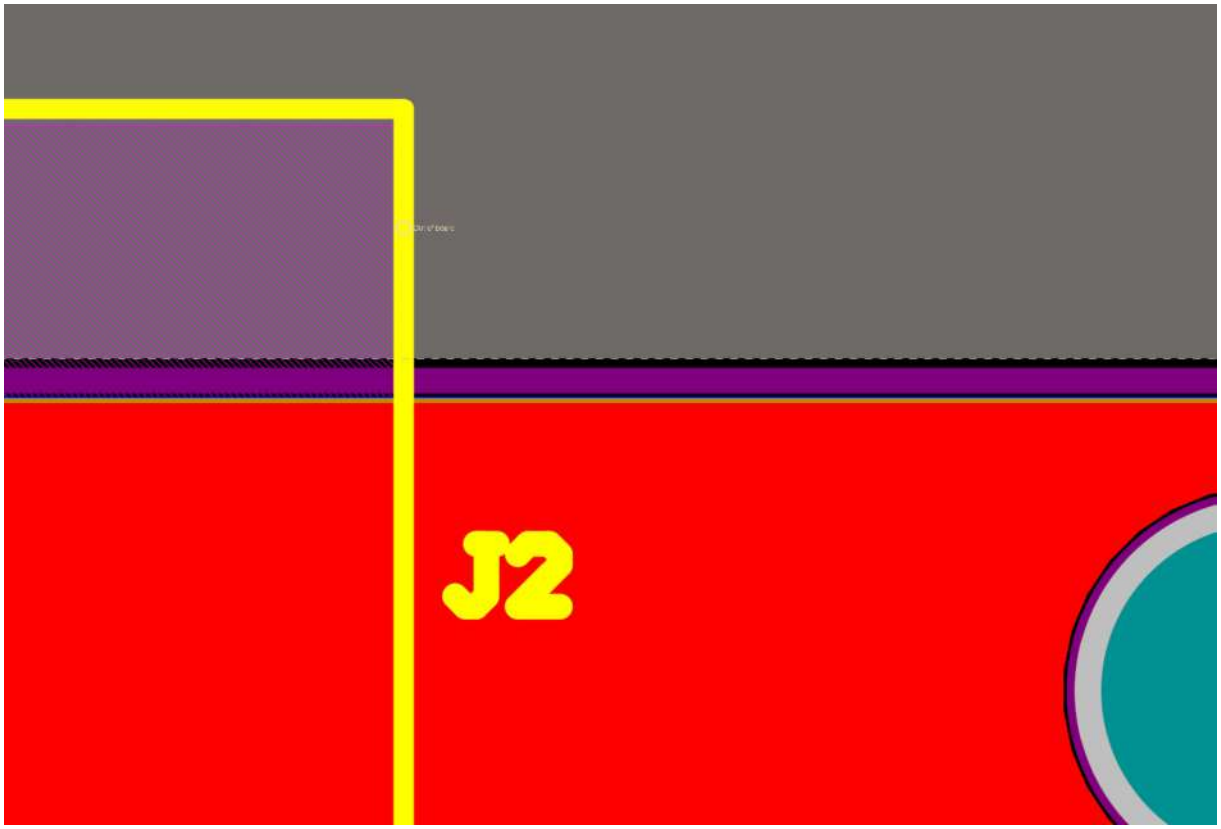


Figure 30: Example of vialation

5.3 PCB design files

5.3.1 PCB

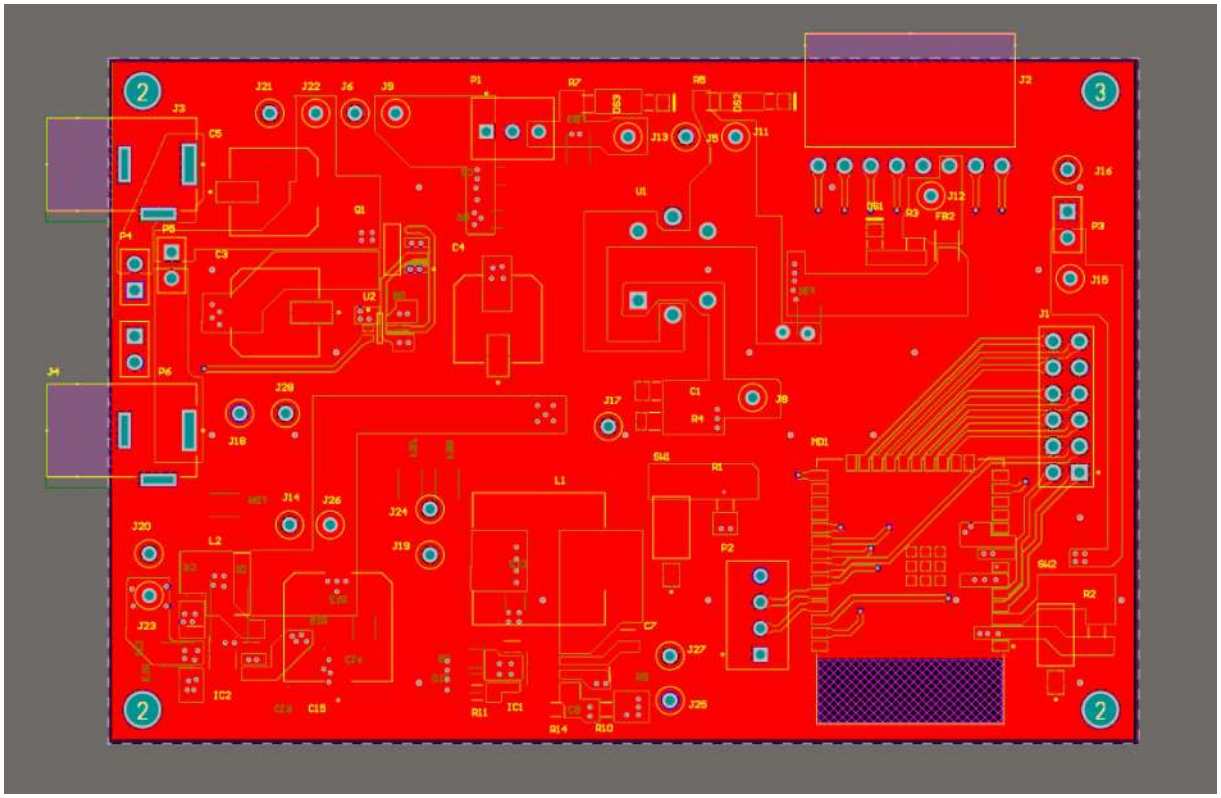


Figure 31: PCB

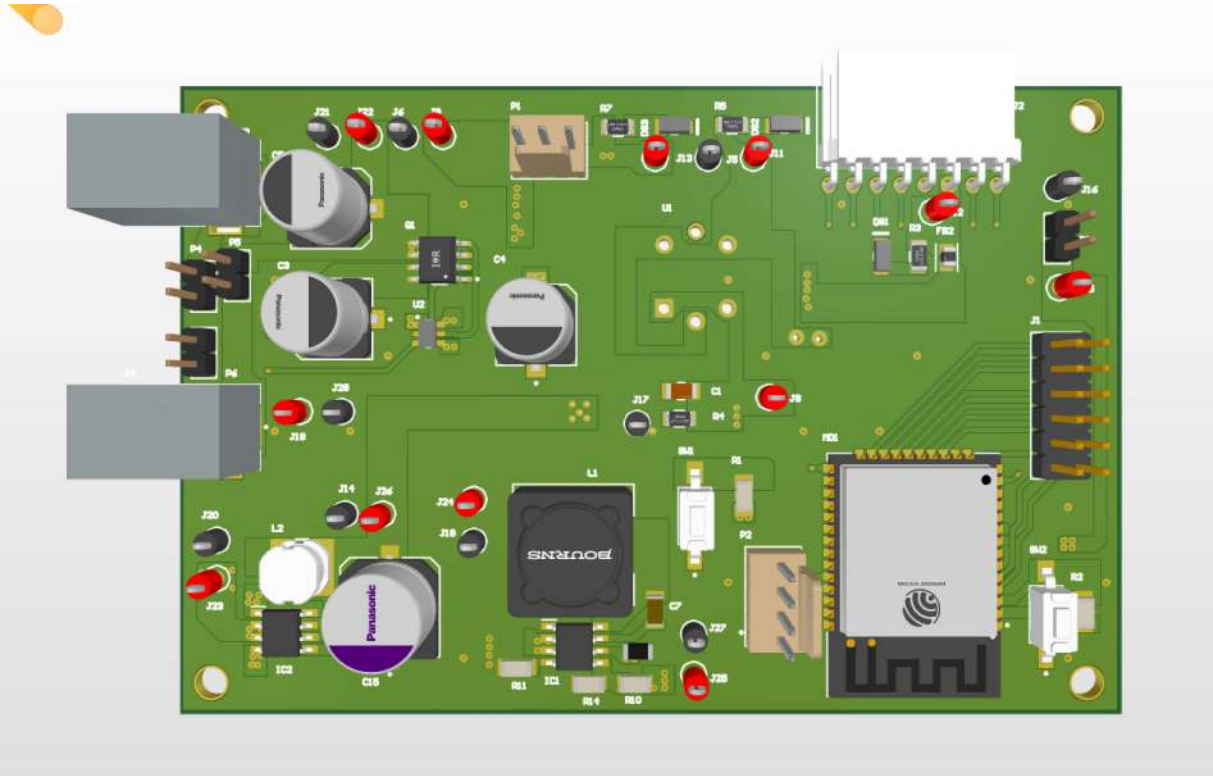


Figure 32: PCB-3D view

5.3.2 PCB-Layers

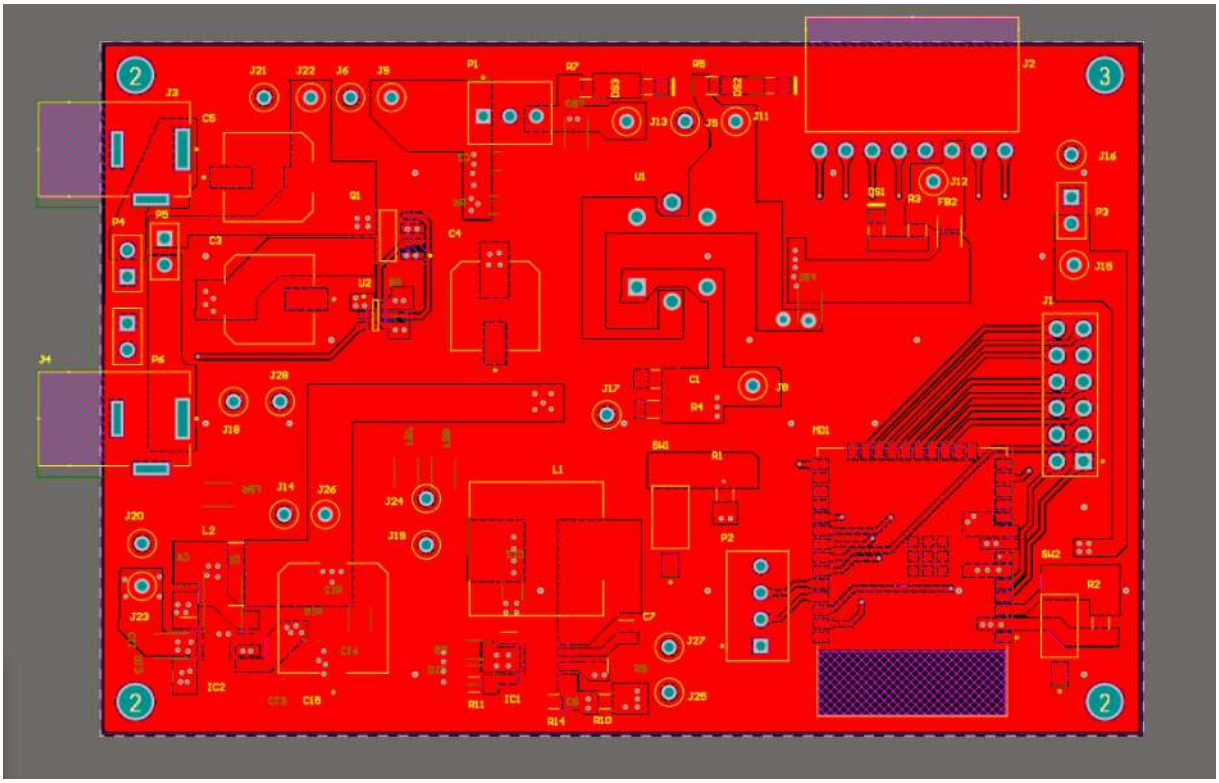


Figure 33: PCB-Top layer

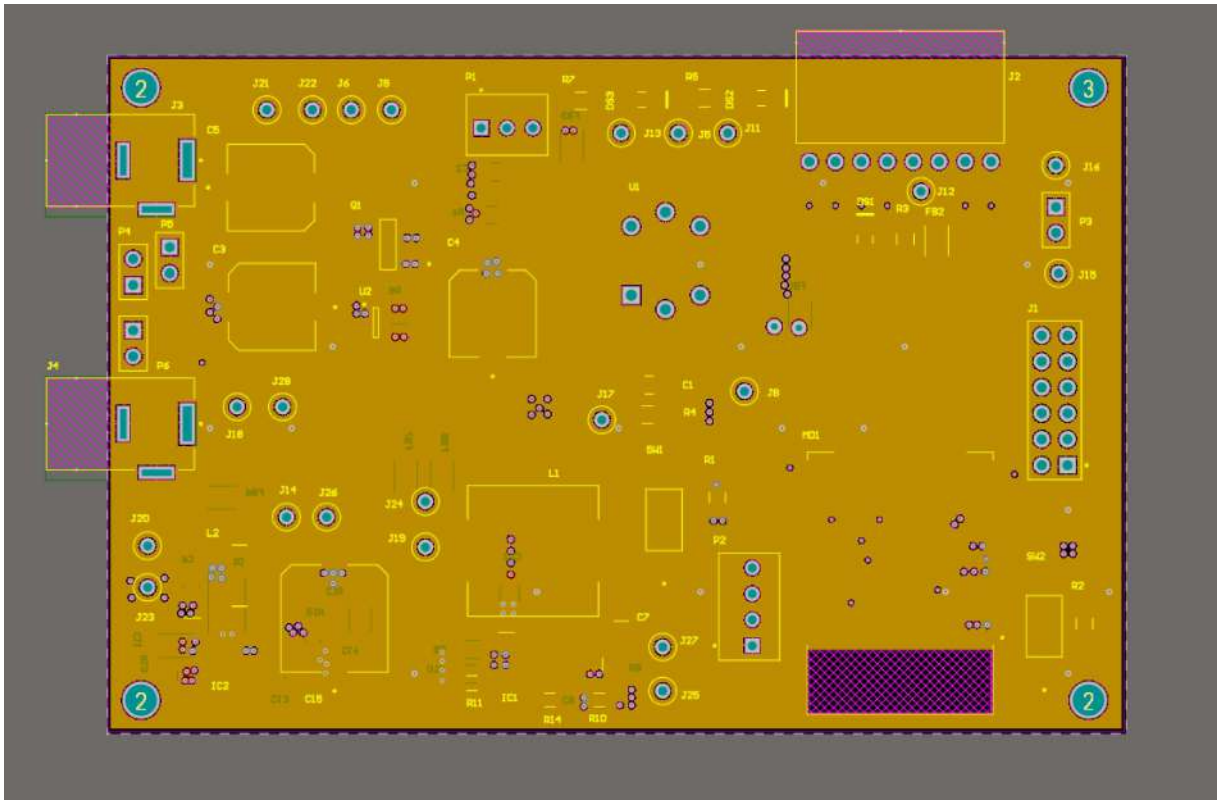


Figure 34: PCB-Mid layer 1

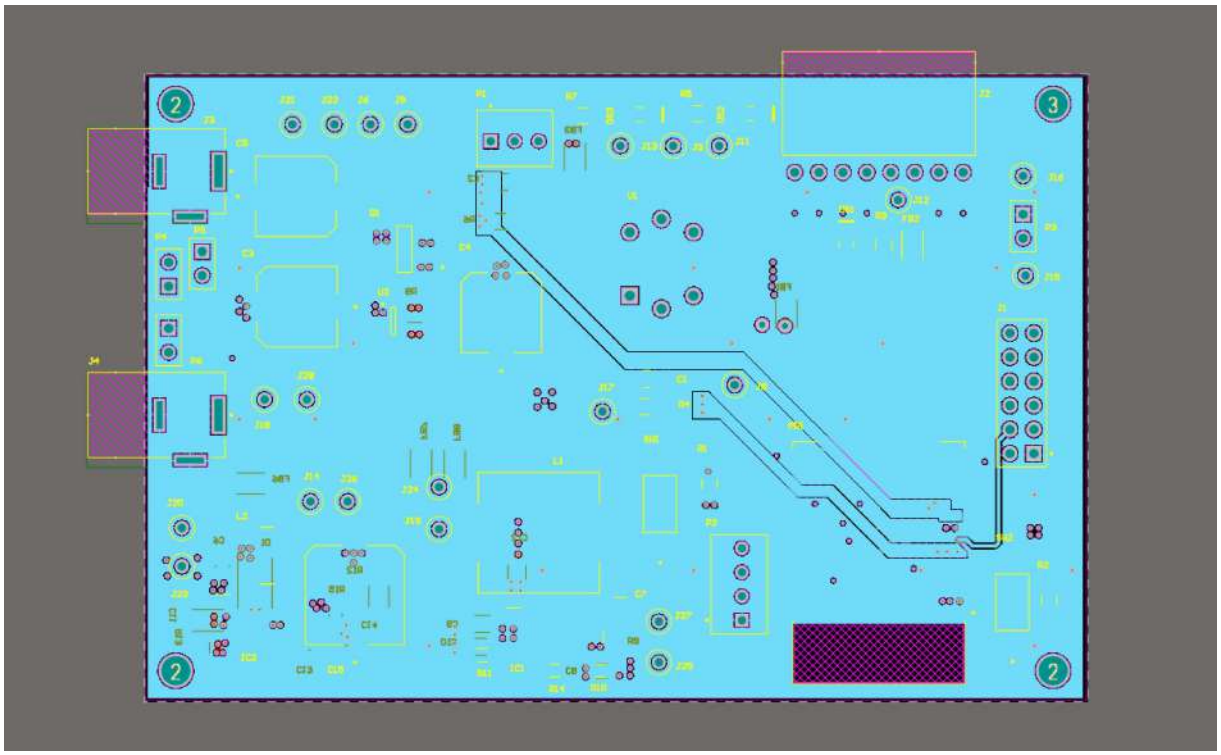


Figure 35: PCB-Mid layer 2

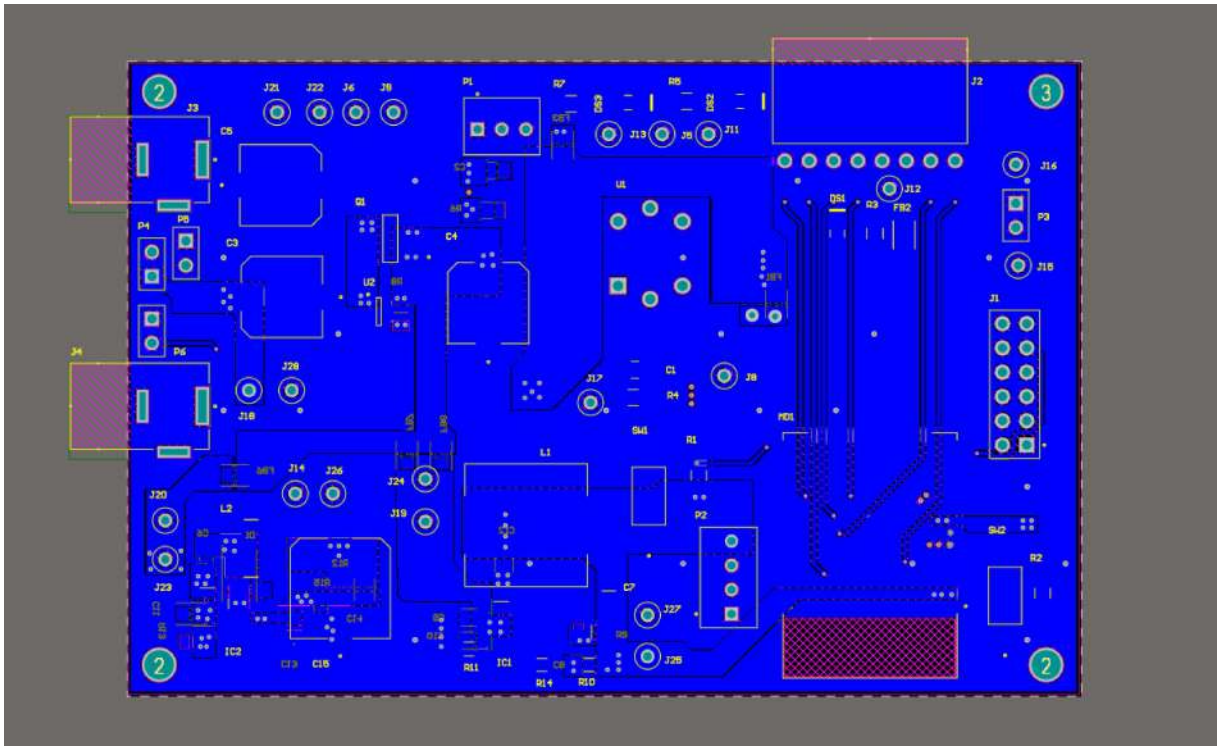


Figure 36: PCB-Bottom layer

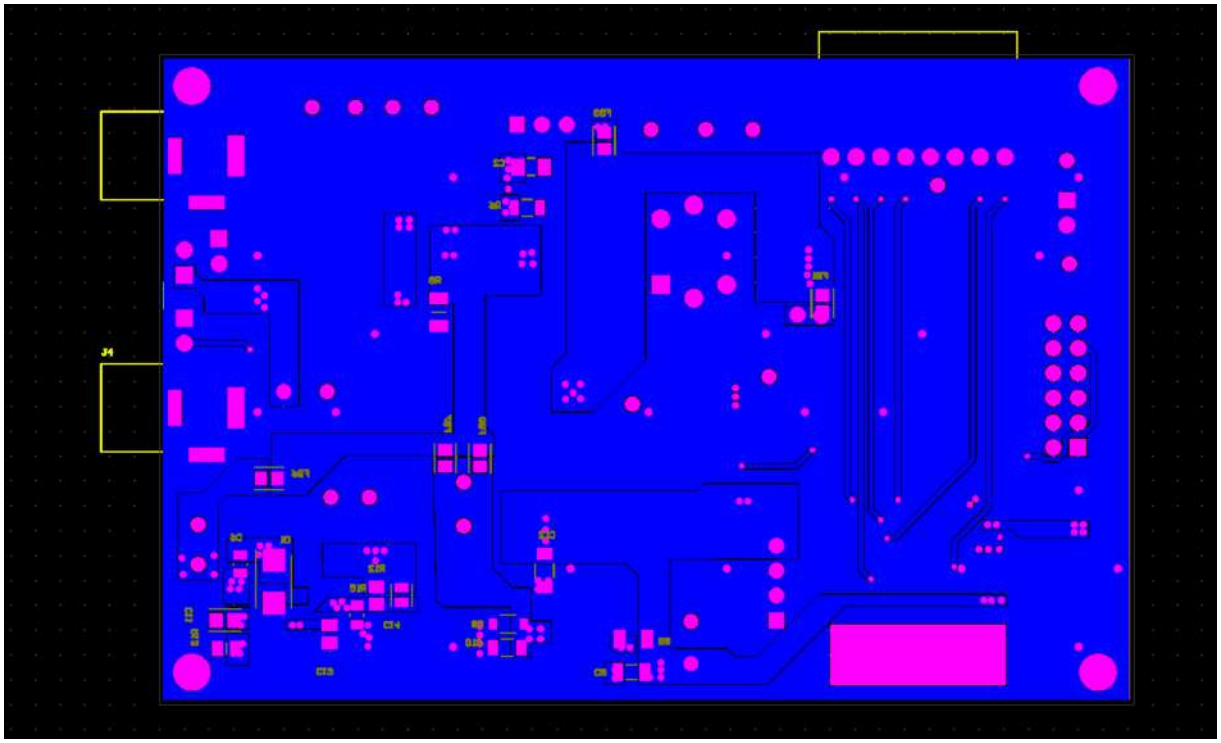


Figure 37: Gerber file

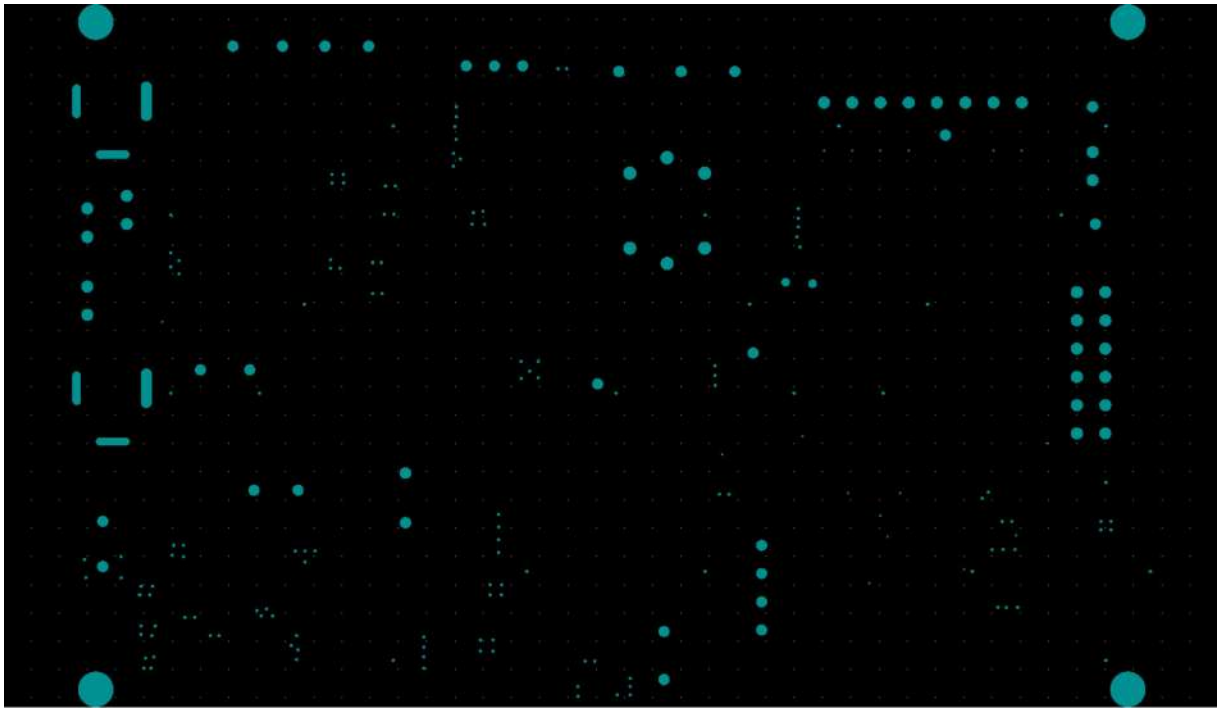


Figure 38: NC drill file

5.4 PCB

Figure 39: PCB -front side.

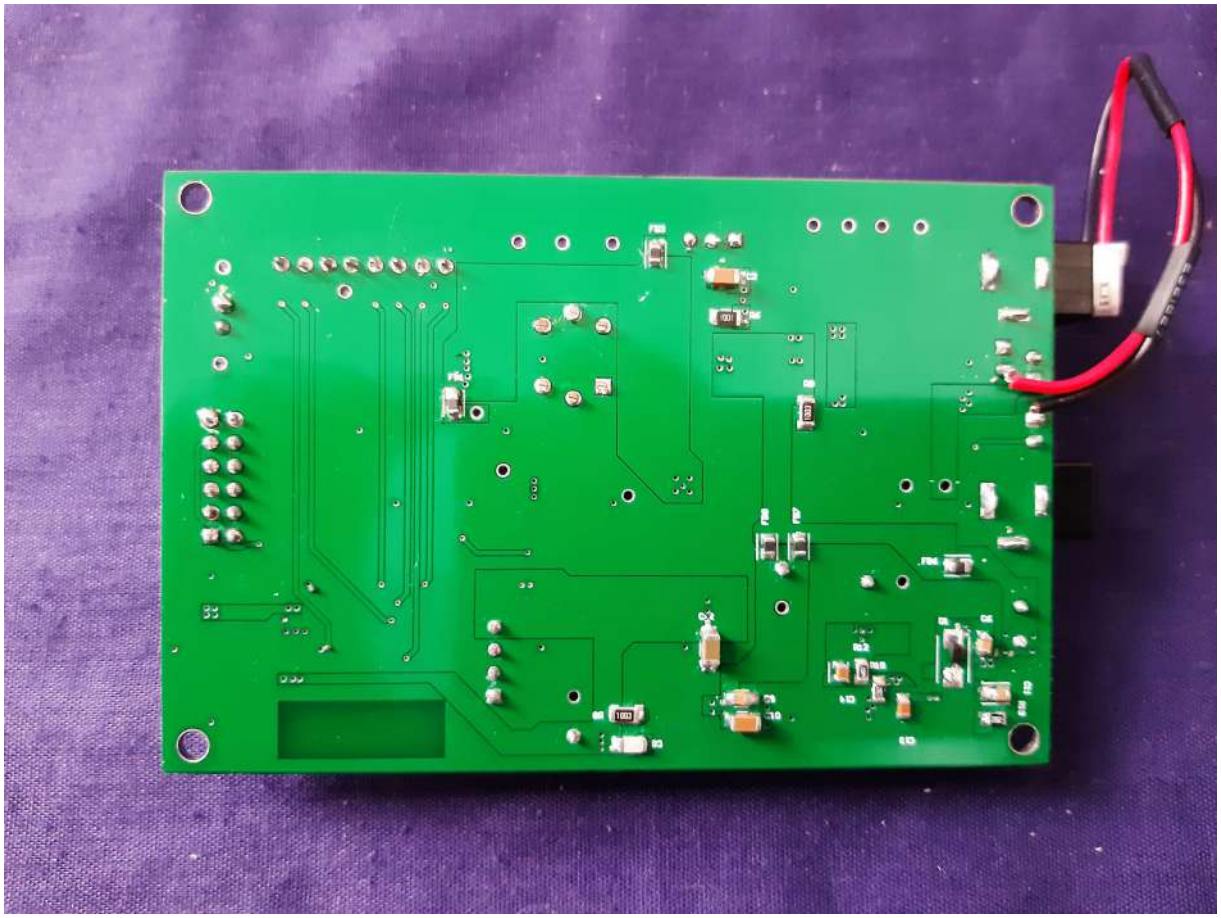


Figure 40: PCB -back side.

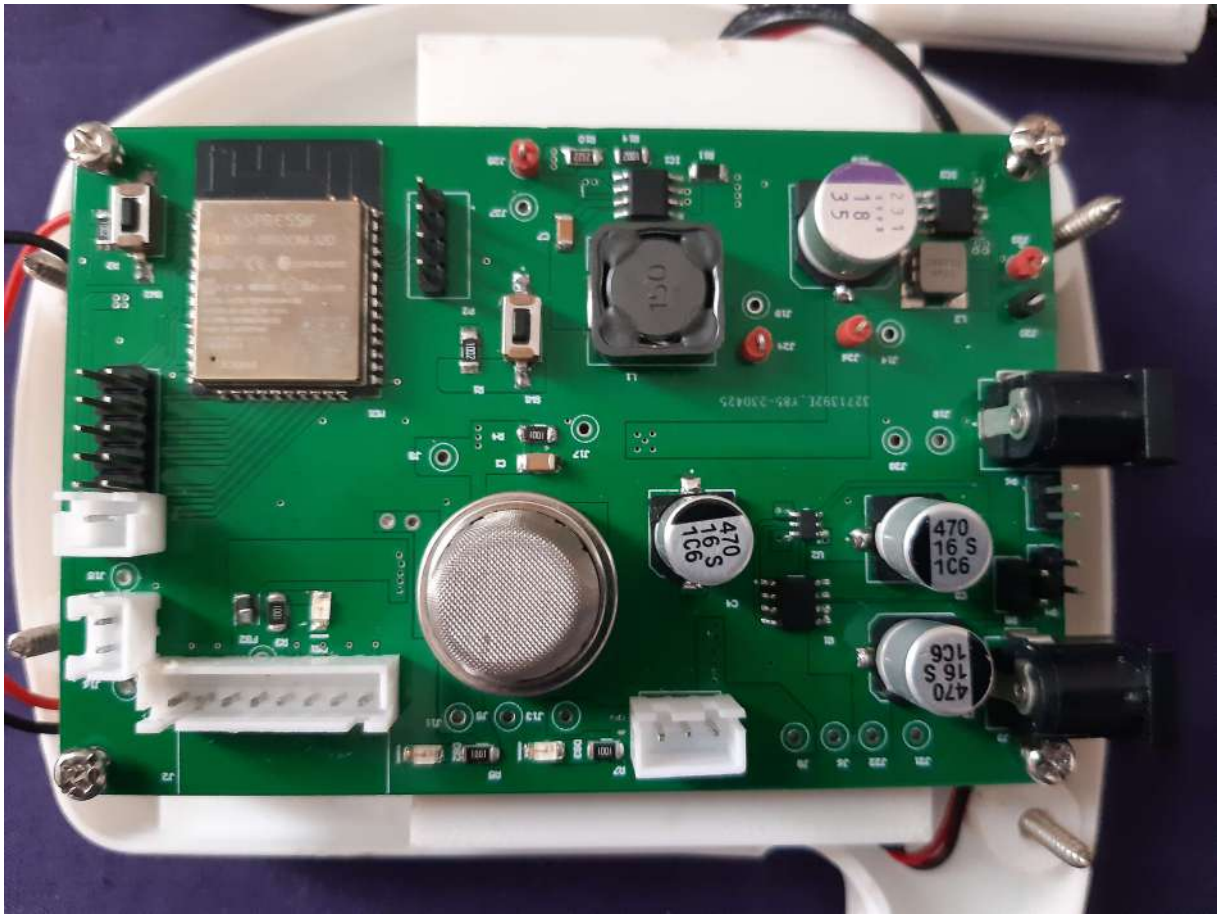


Figure 41: PCB mounting.

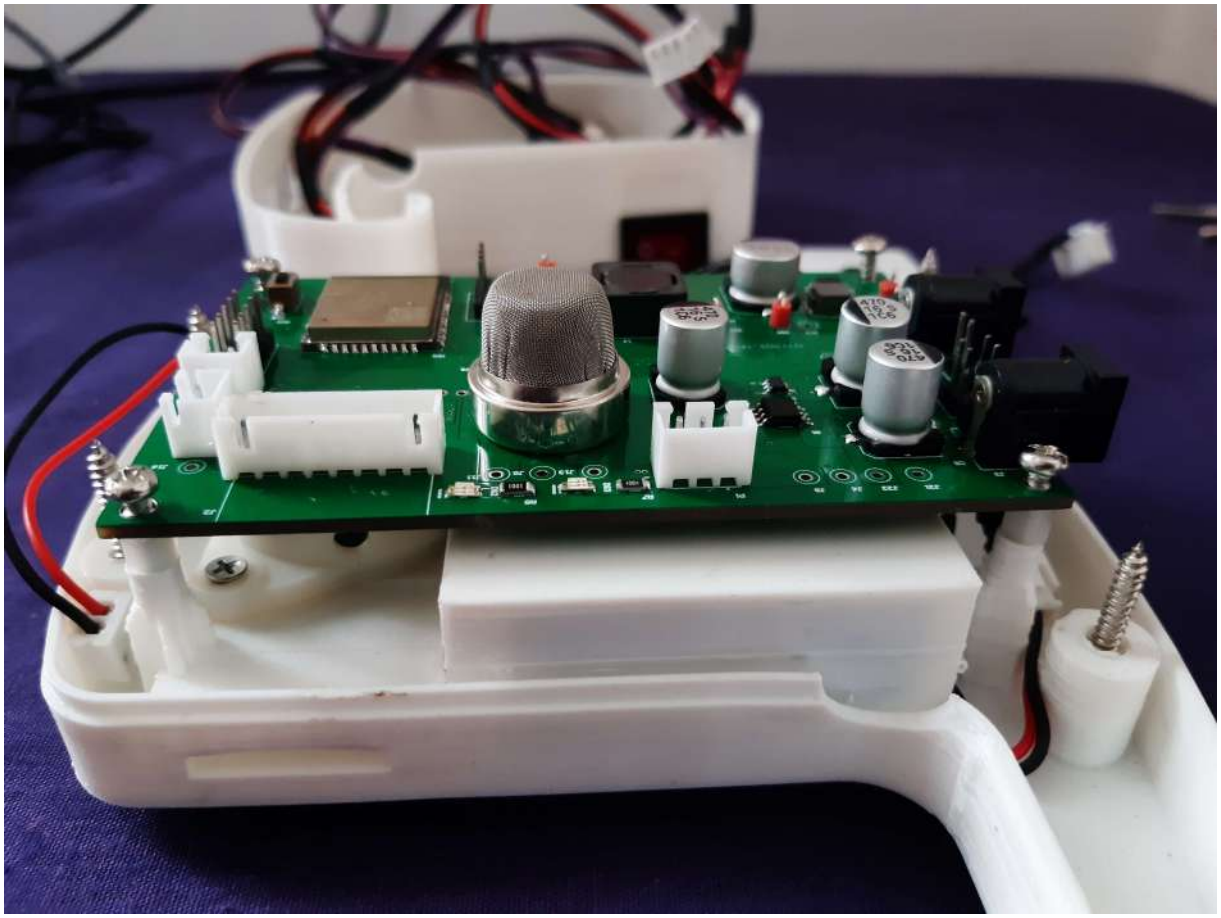


Figure 42: PCB side view

6 Enclosure Design

The enclosure design is a critical aspect of product development, as it provides a protective housing for electronic components, ensuring their safety, functionality, and aesthetics. SolidWorks, a leading 3D computer-aided design (CAD) software, offers powerful tools for creating precise and detailed enclosure designs.

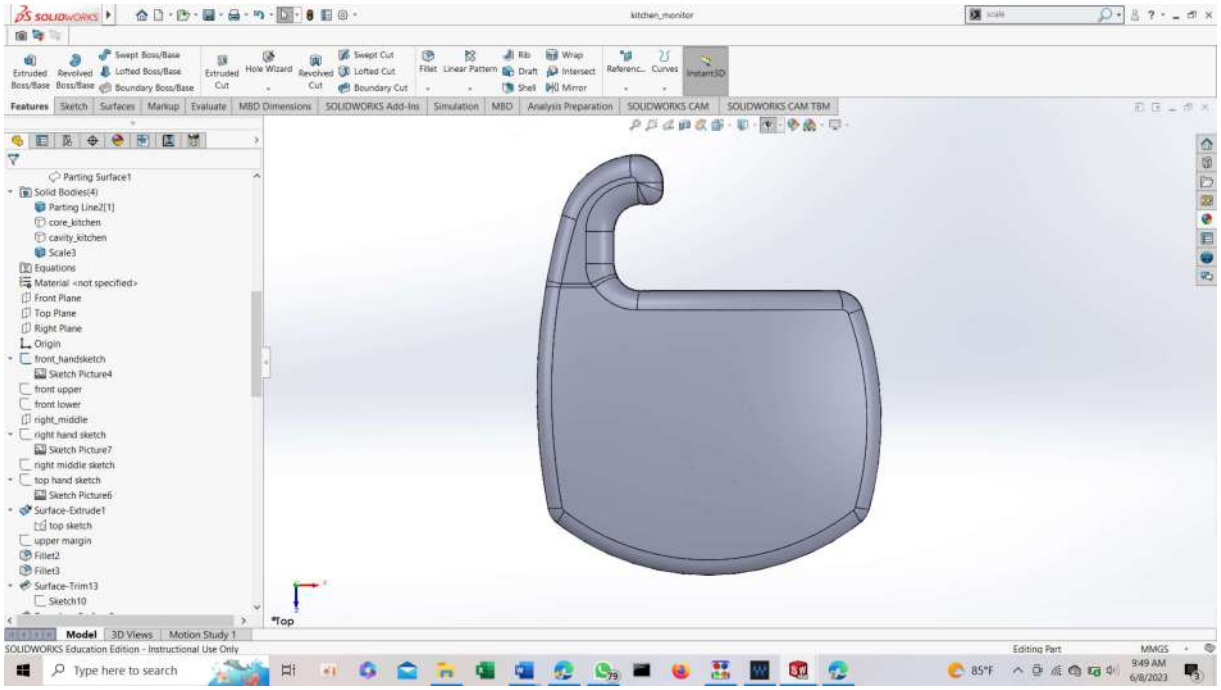


Figure 43: lower part

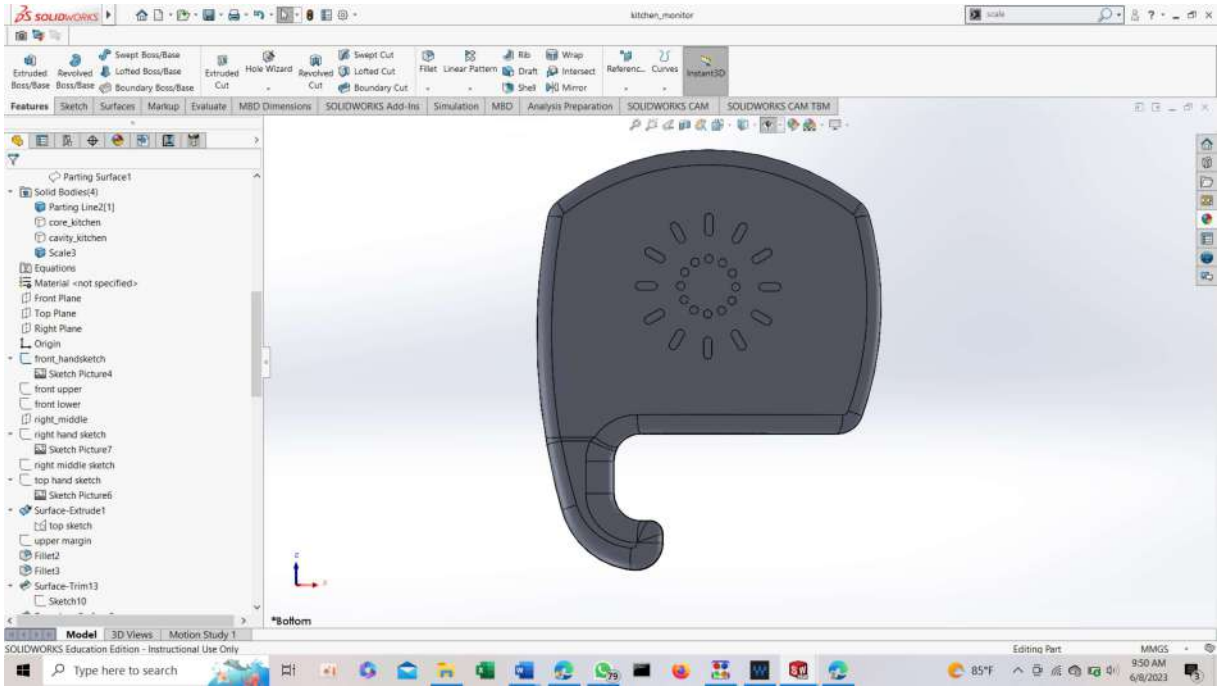


Figure 44: Upper part

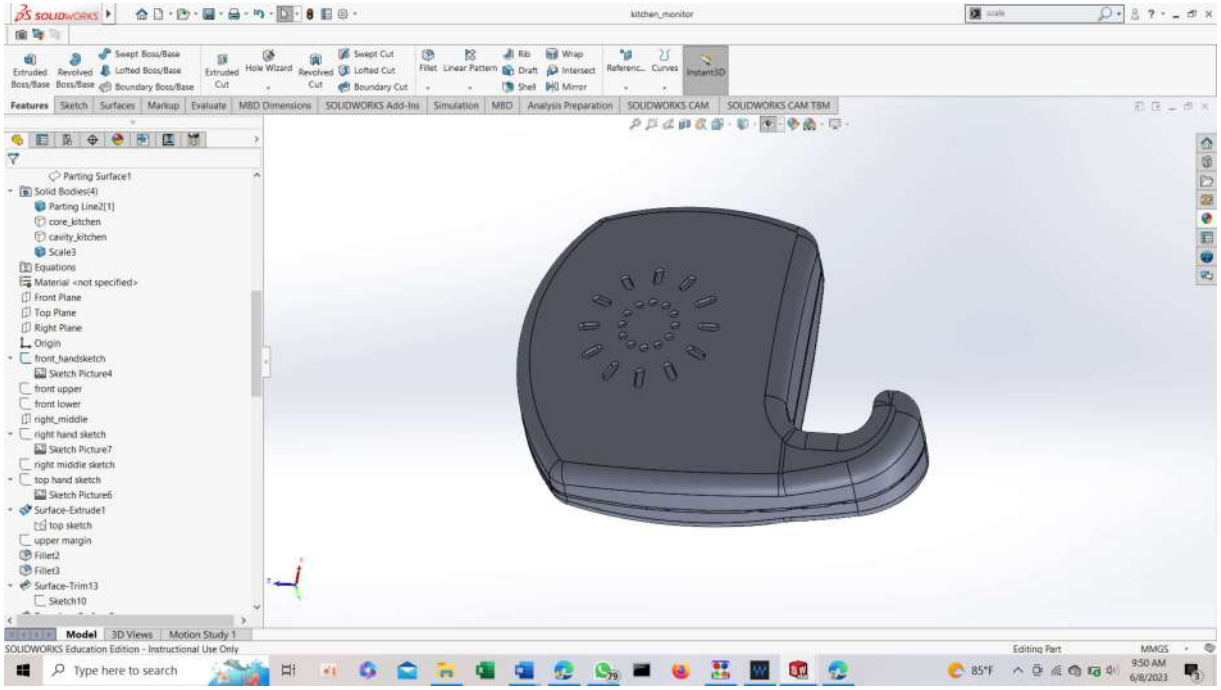


Figure 45: side view

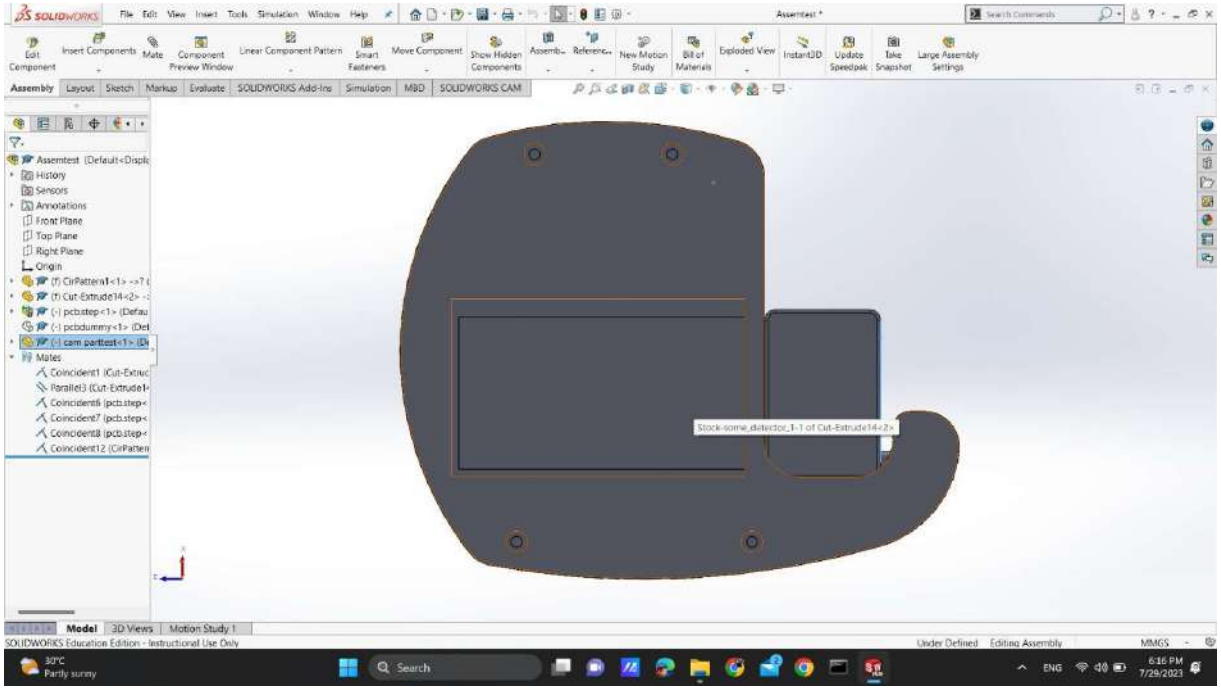


Figure 46: bottom view

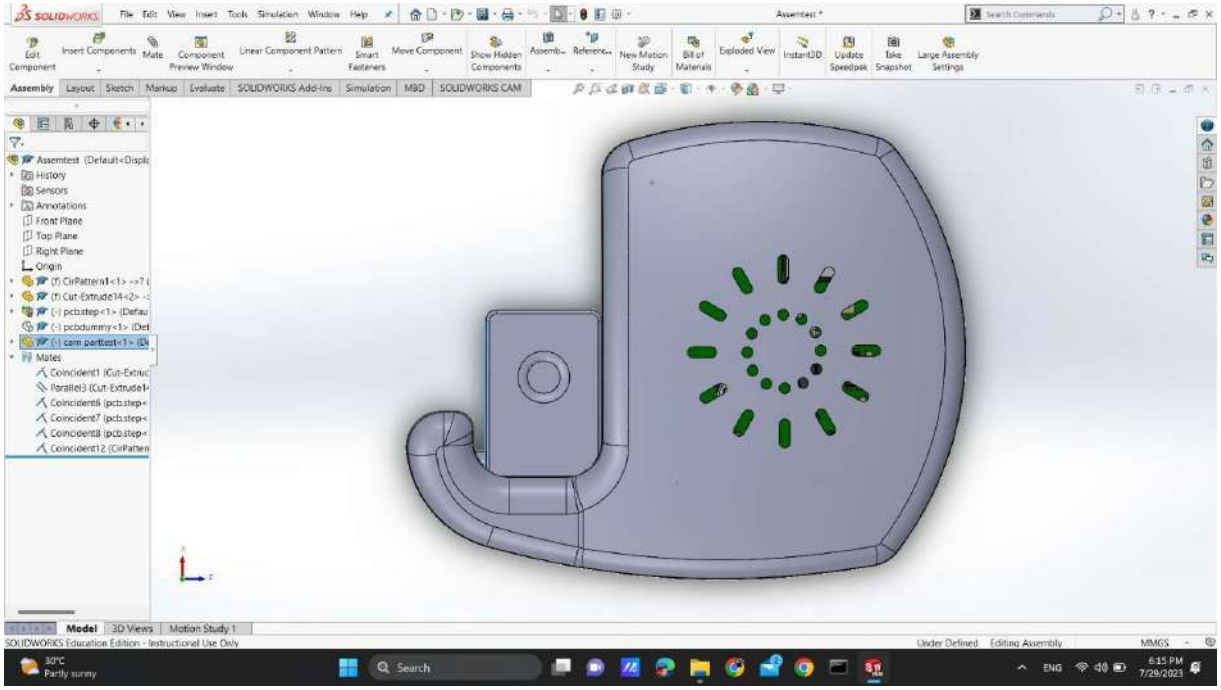


Figure 47: top view

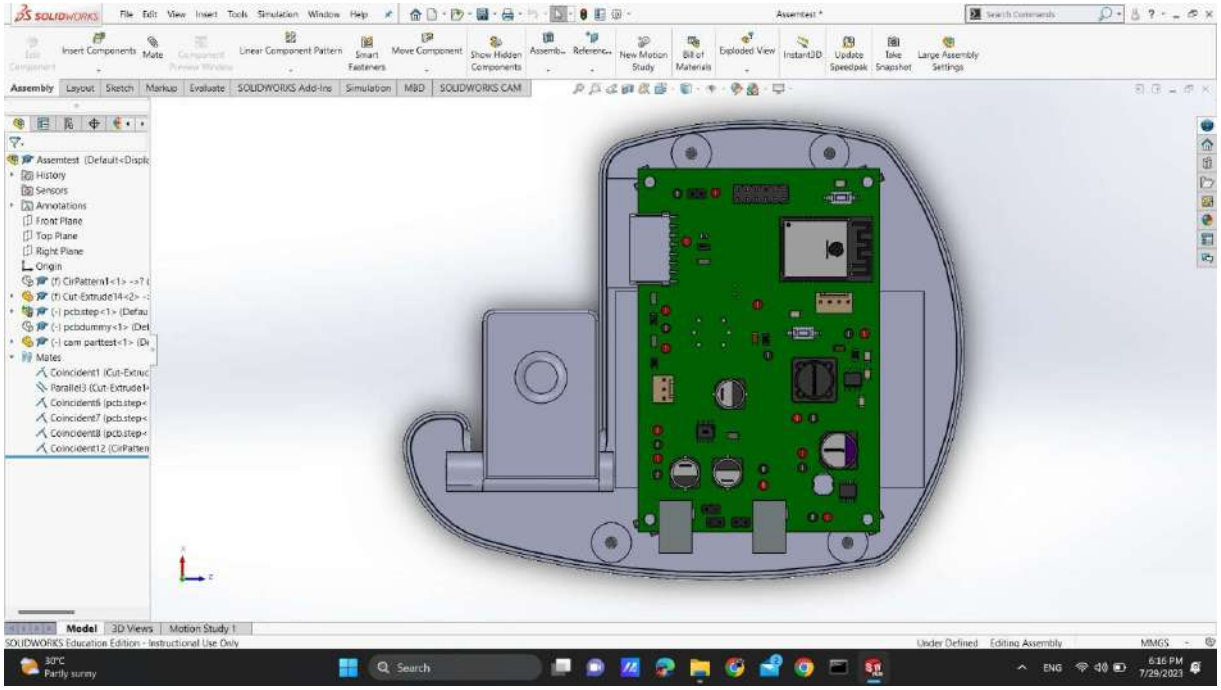


Figure 48: top view with PCB

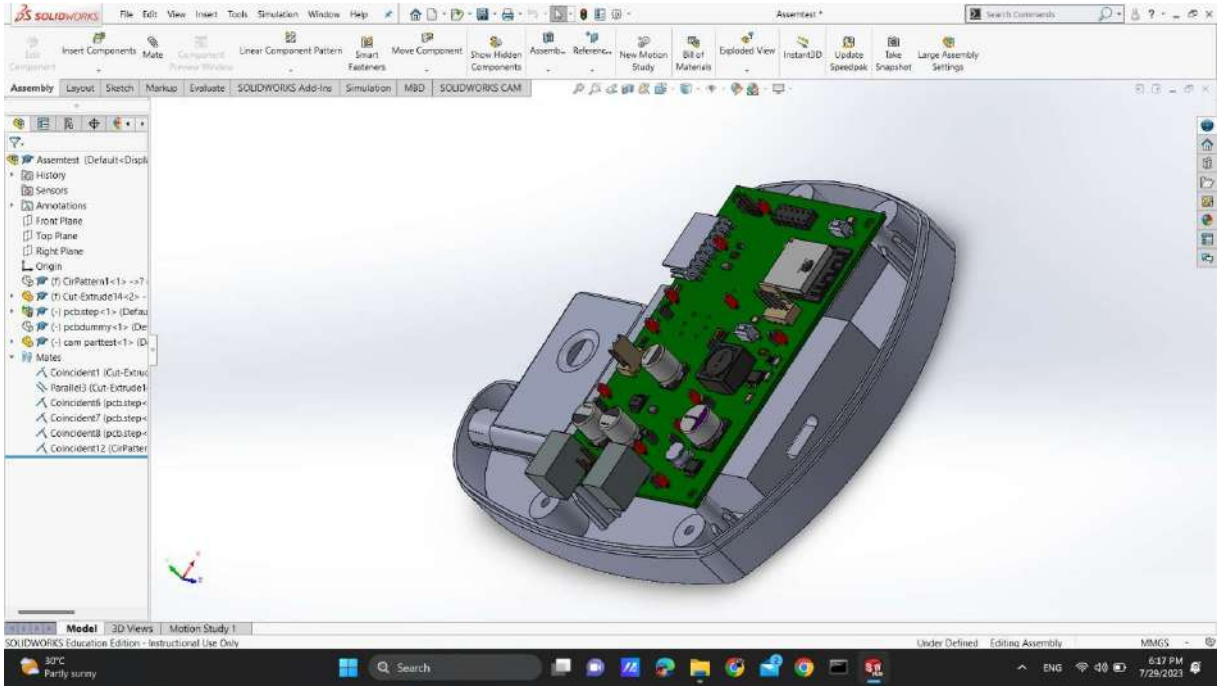


Figure 49: side view with PCB

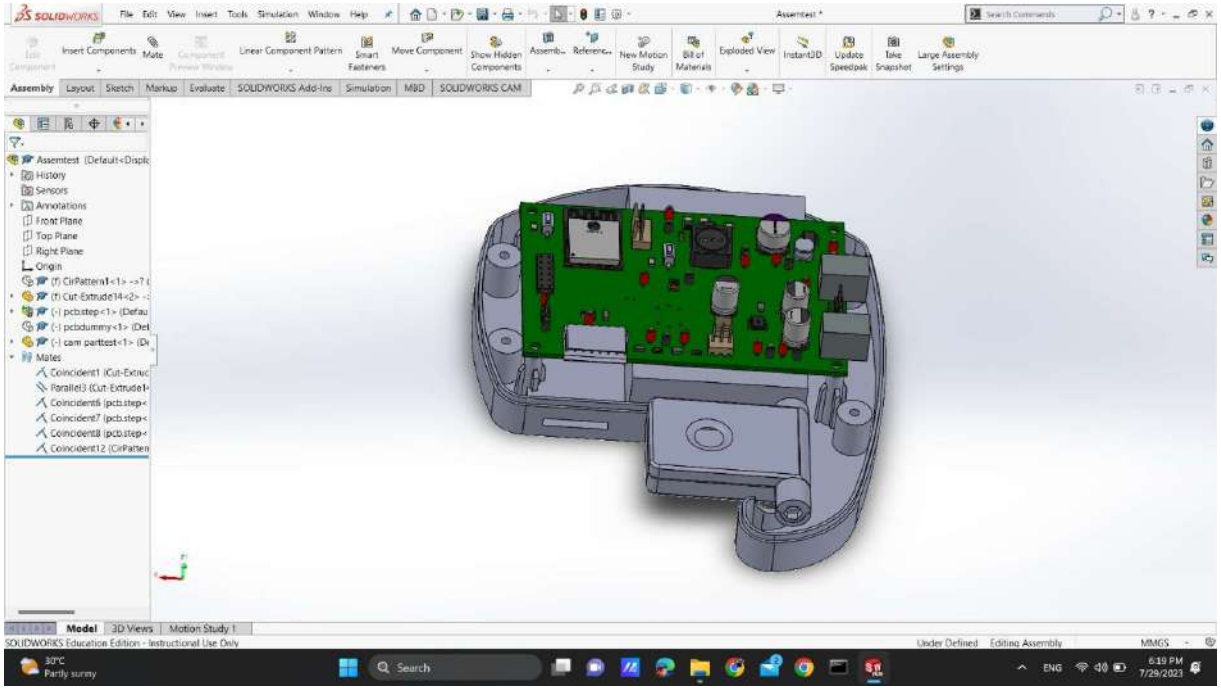


Figure 50: side view with PCB

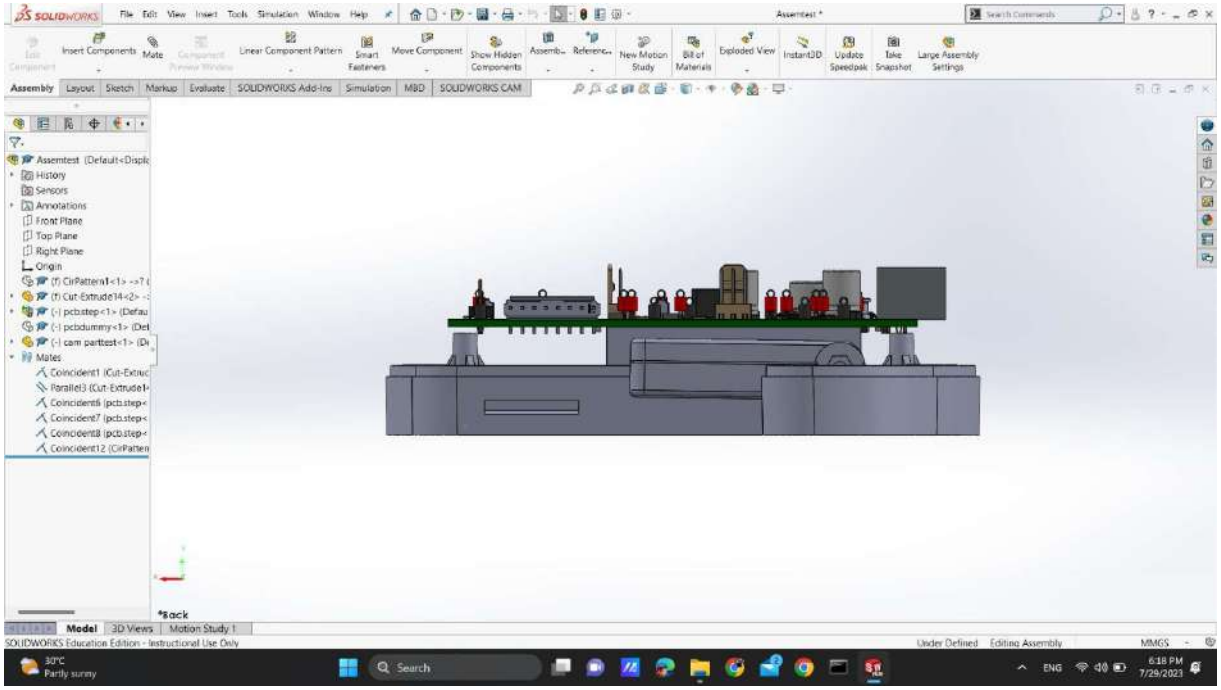


Figure 51: side view with PCB

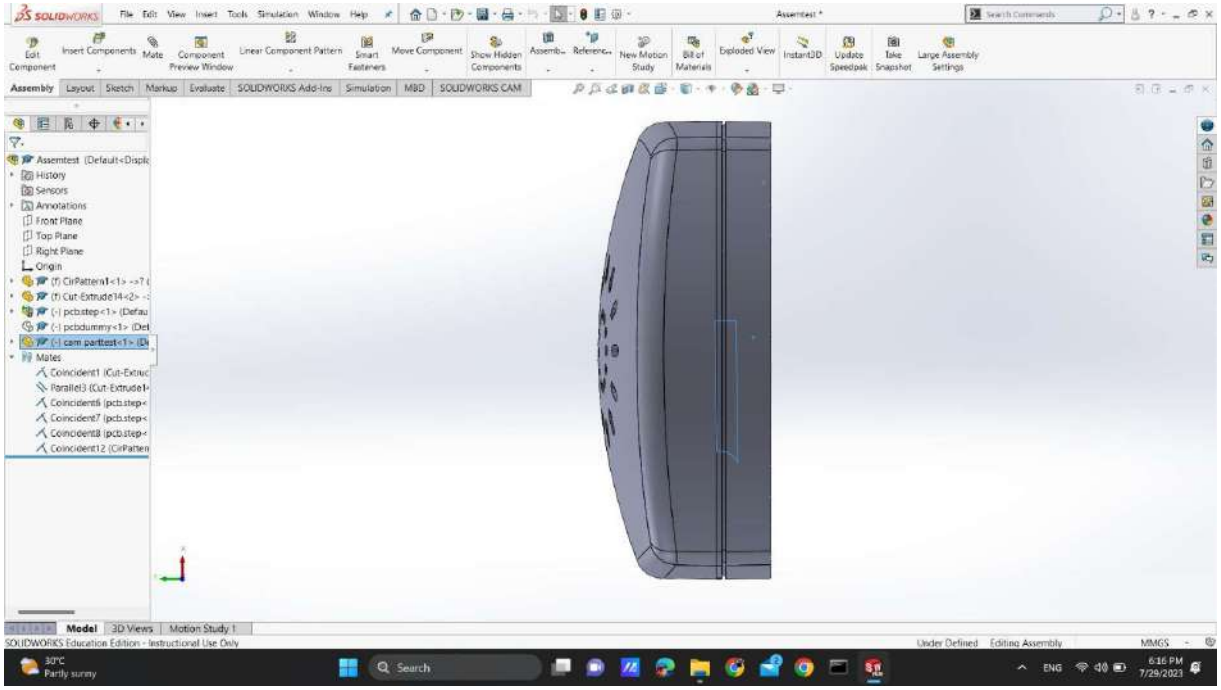


Figure 52: side view

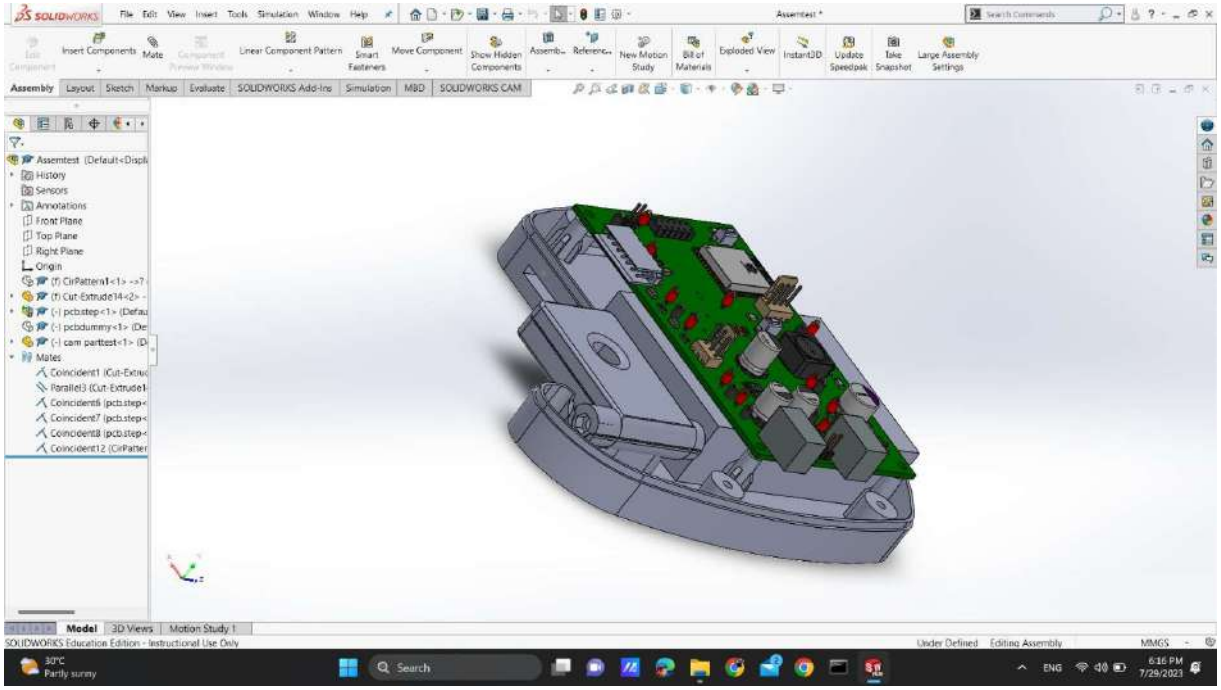


Figure 53

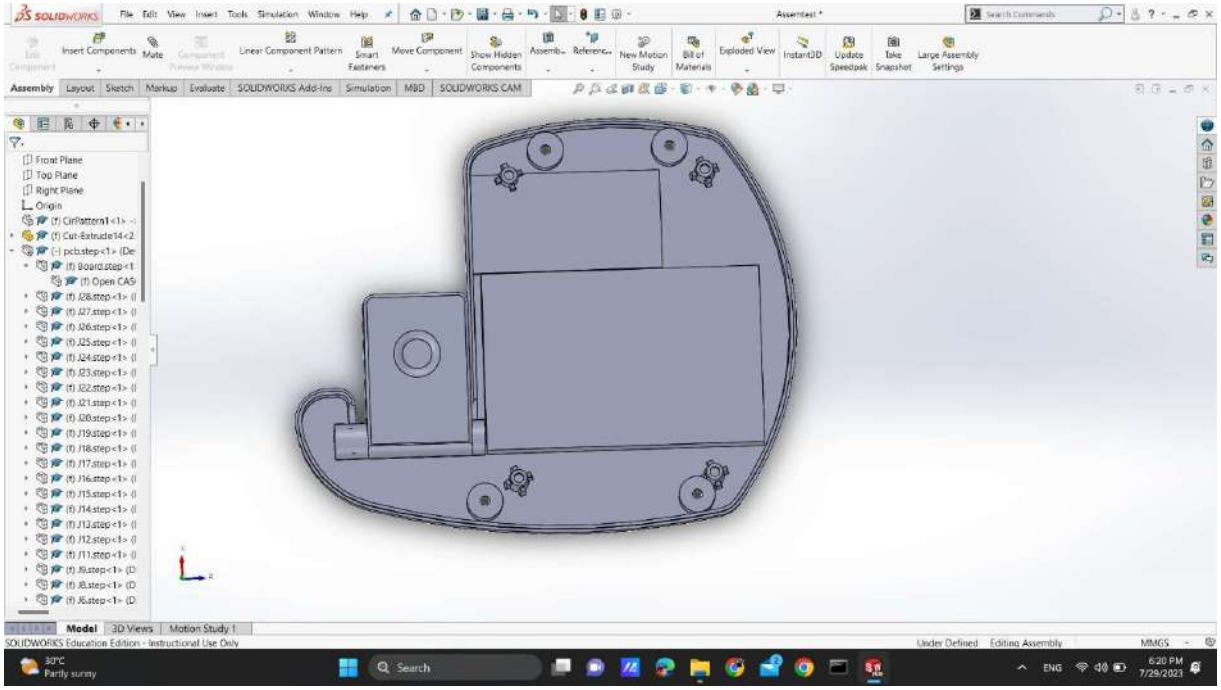


Figure 54: top view with Mounting bosses and screw holes

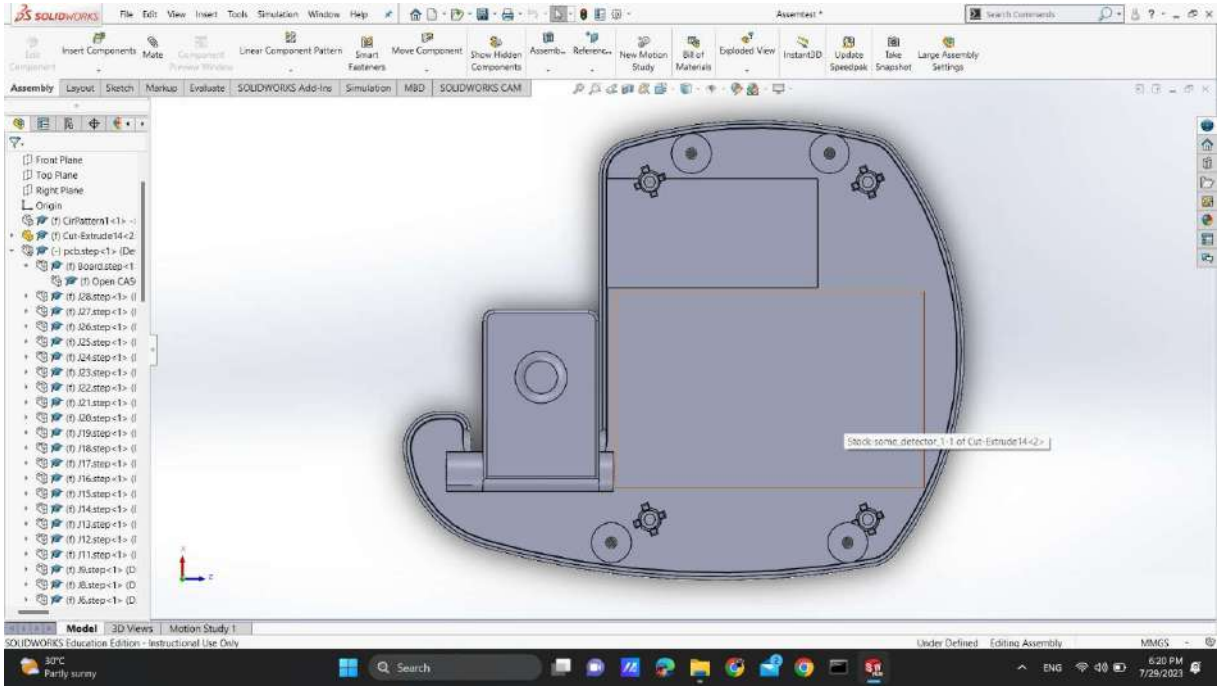


Figure 55: top view with mounting bosses

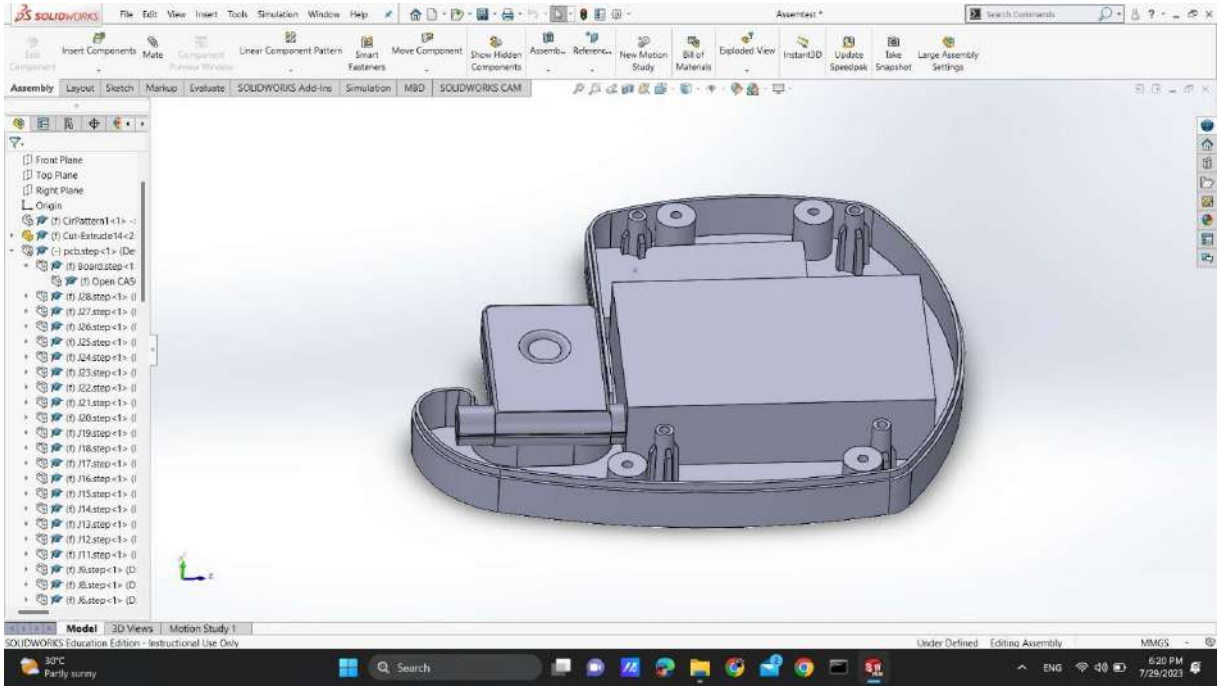


Figure 56: side view with mounting bosses and mounting holes

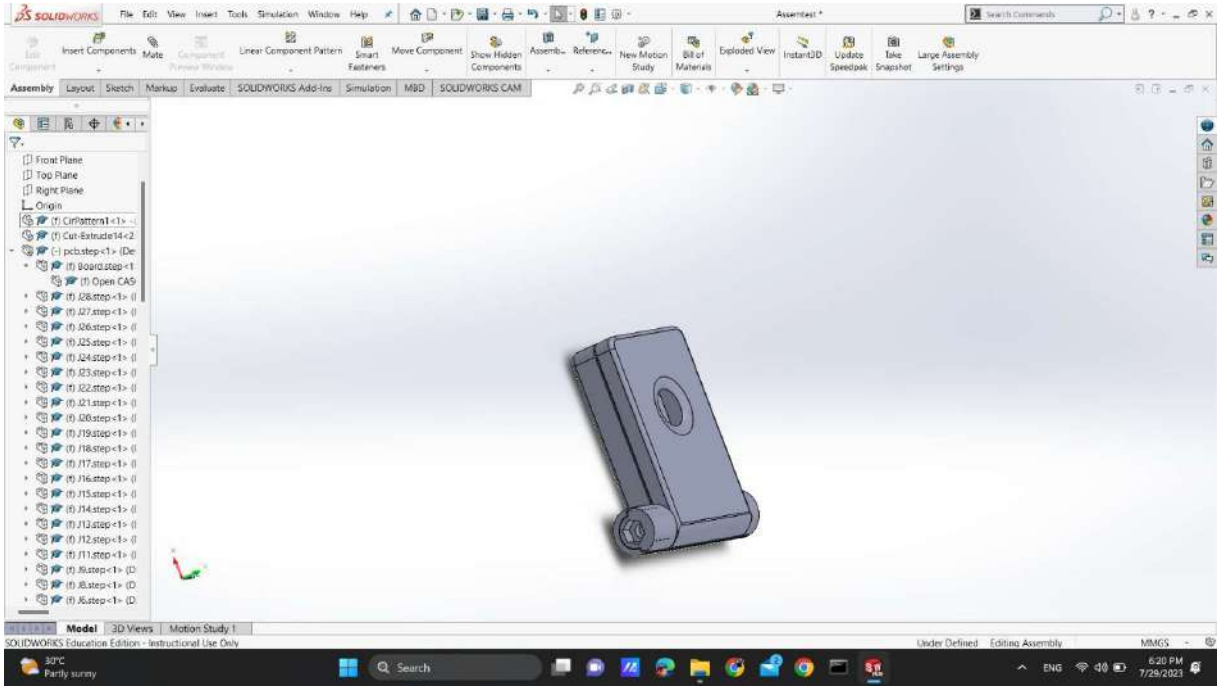


Figure 57: camera mounting part

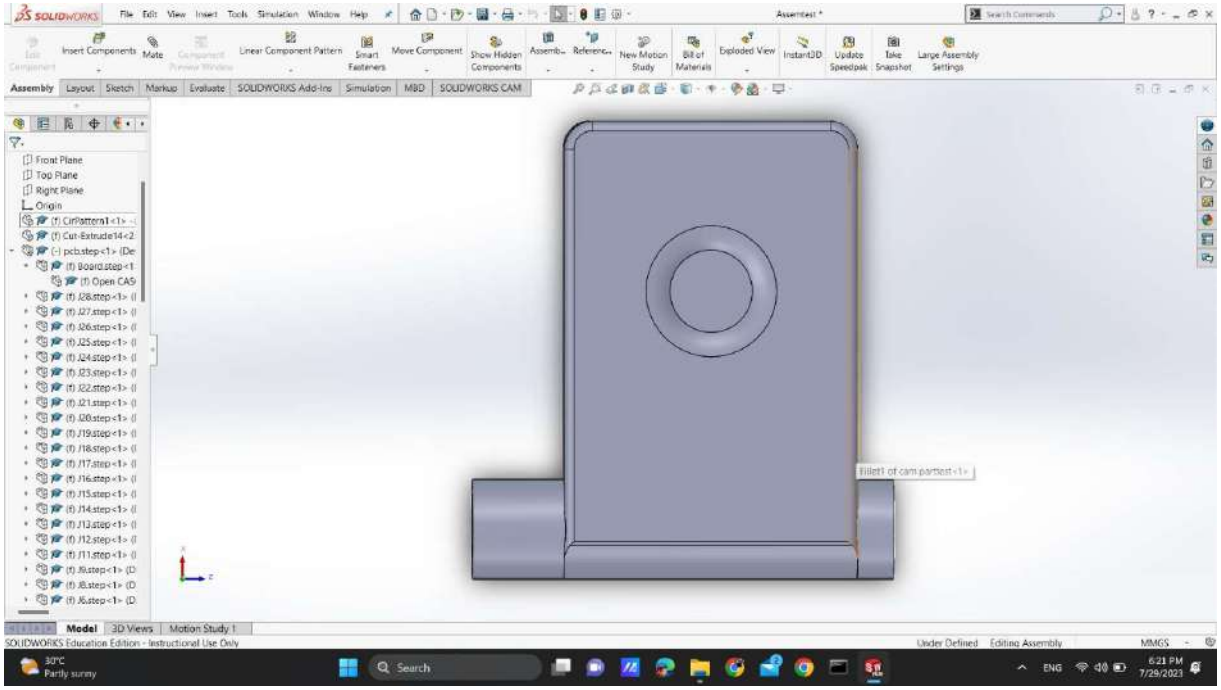


Figure 58: camera mounting part

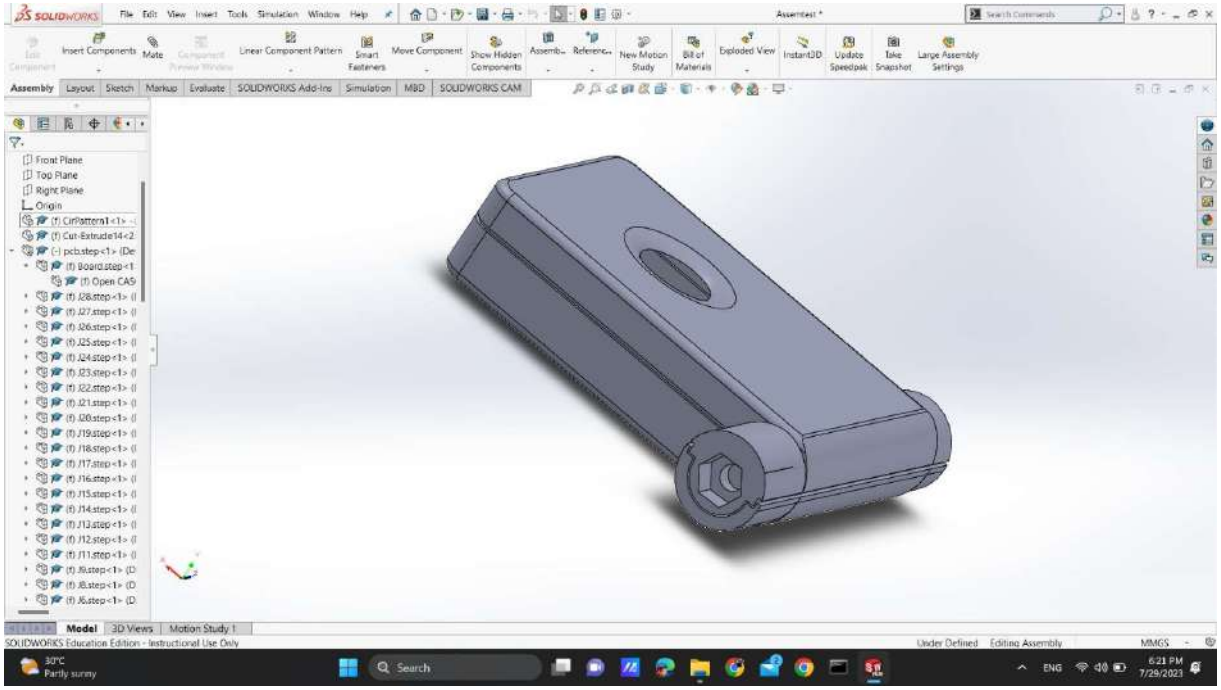


Figure 59: camera mounting part

6.1 draft analysis

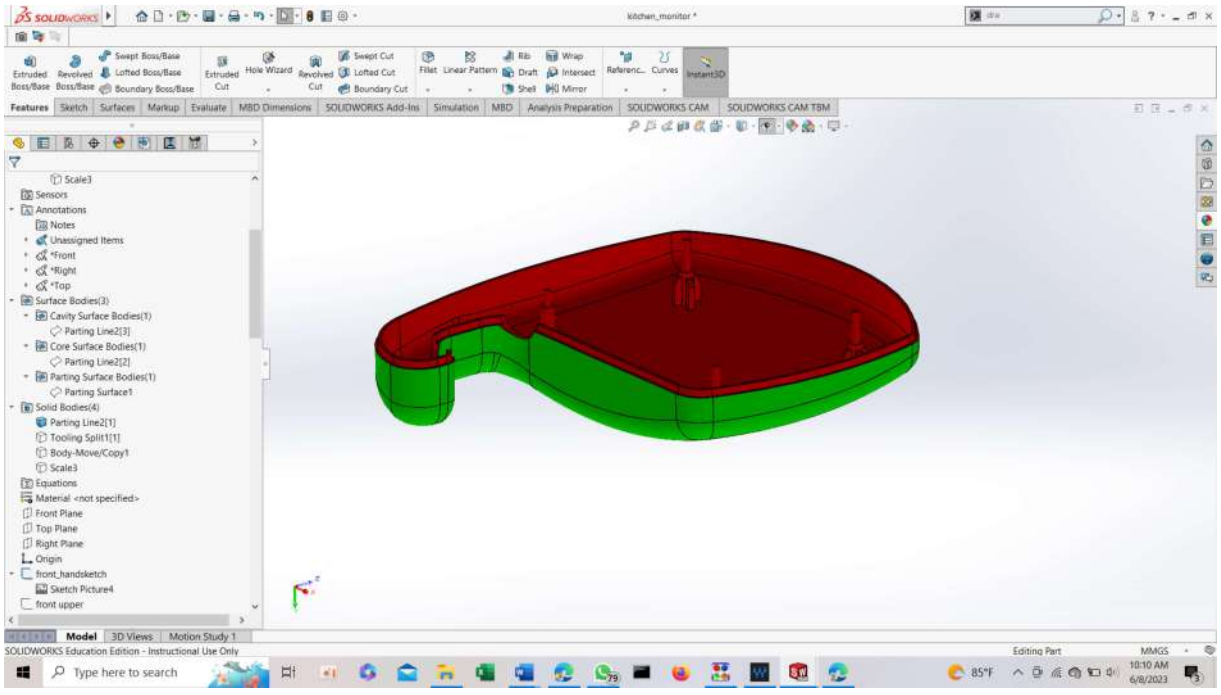


Figure 60: draft analysis

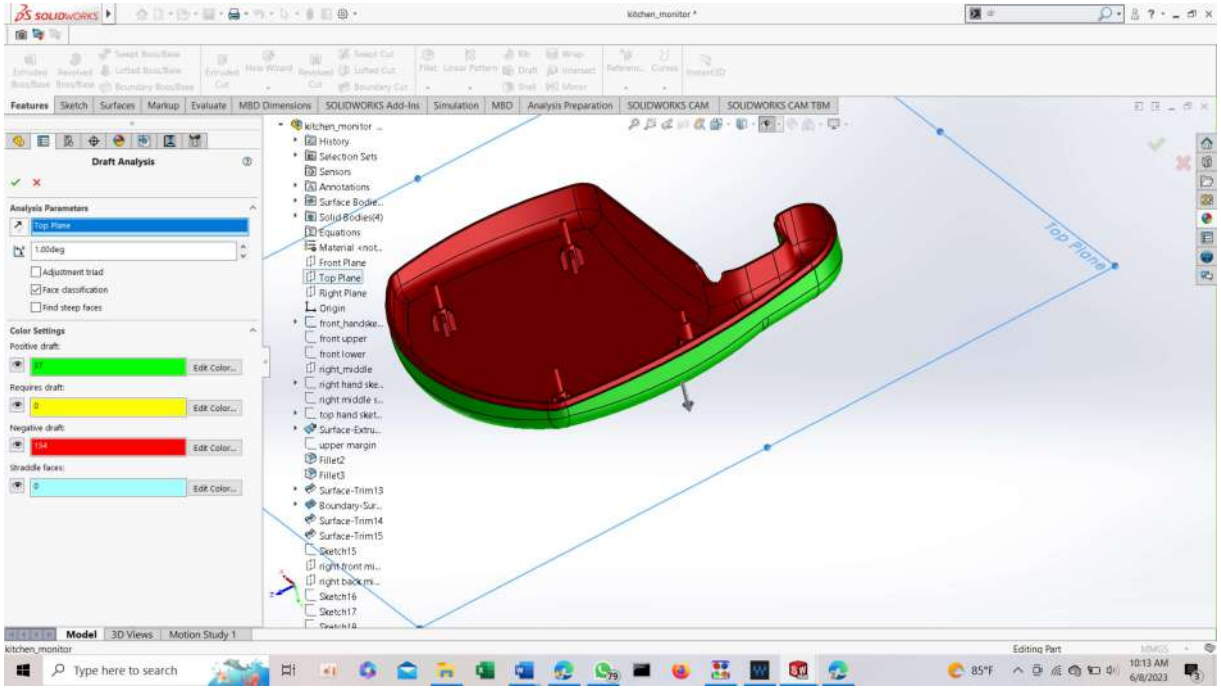


Figure 61: draft analysis

6.2 Mold design

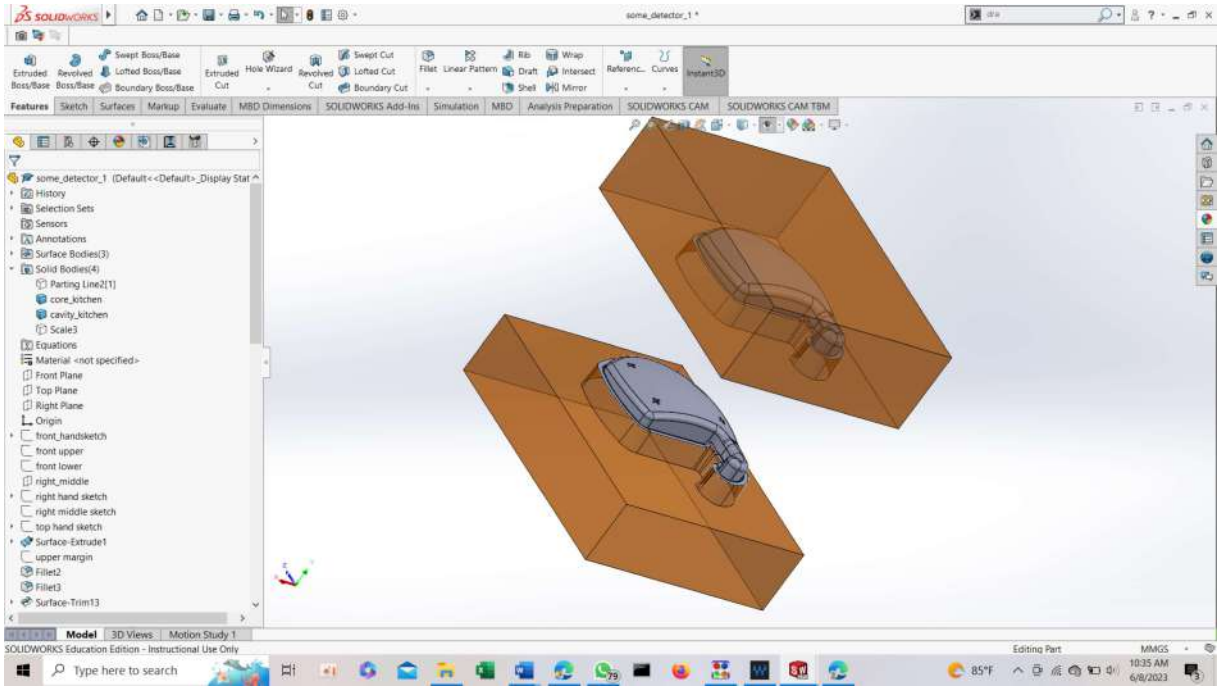


Figure 62: mold design

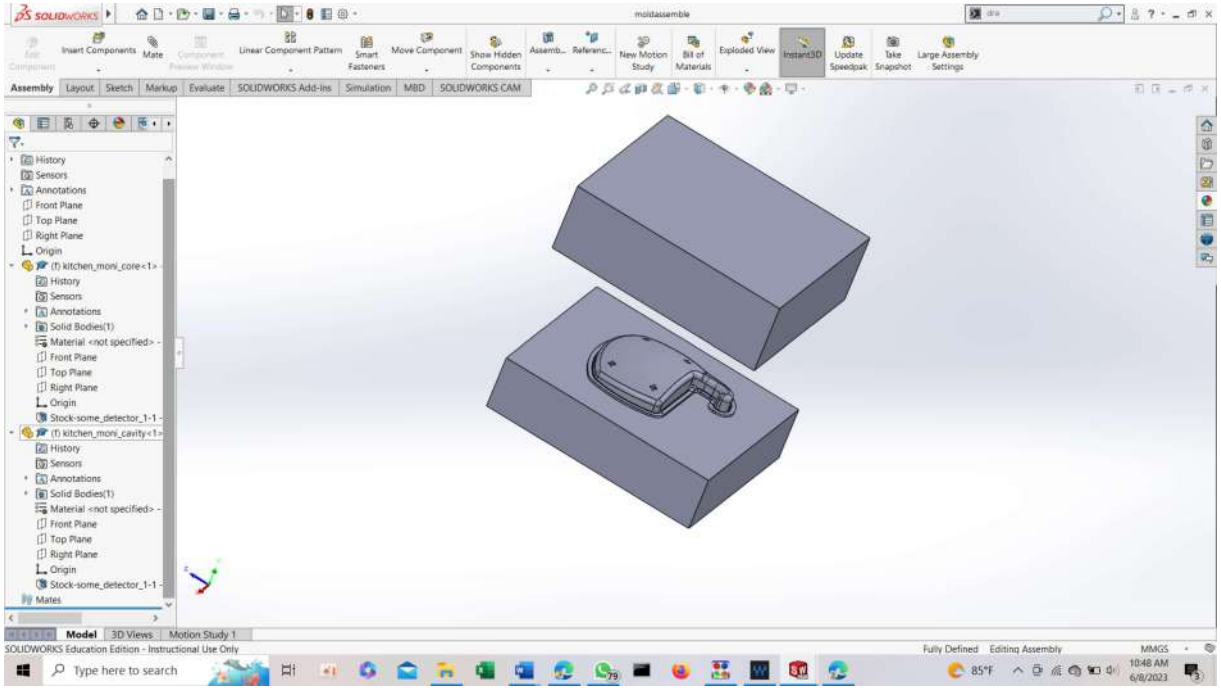


Figure 63: core and cavity

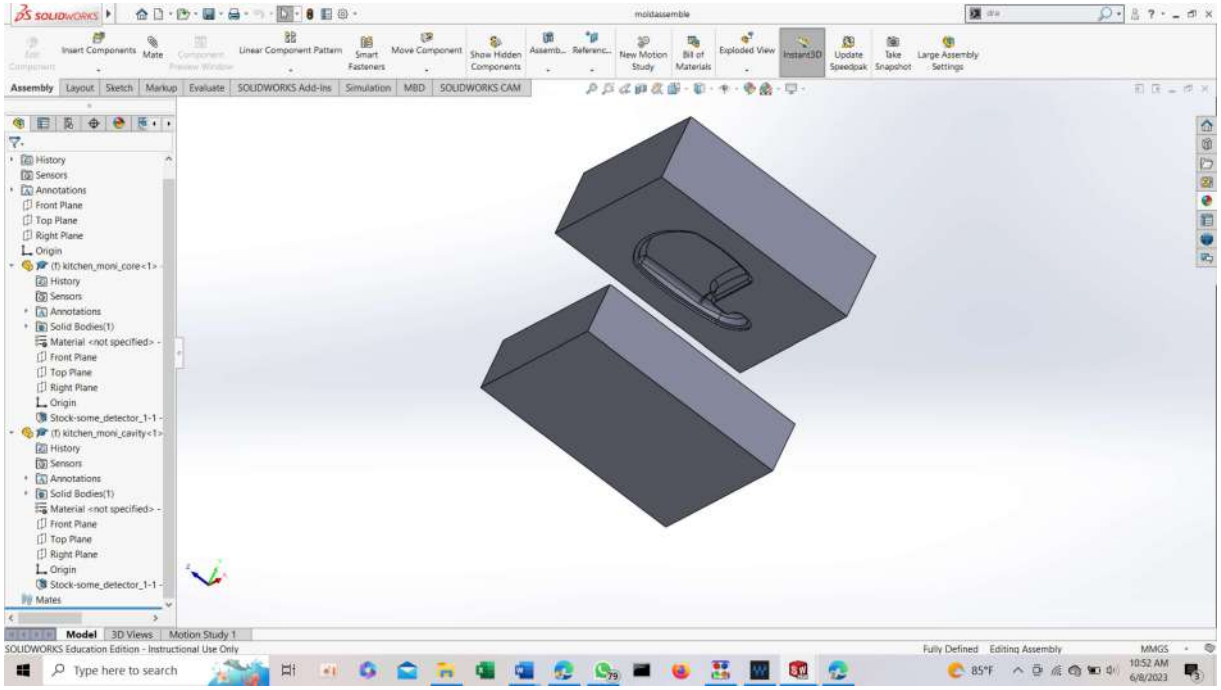


Figure 64: core and cavity

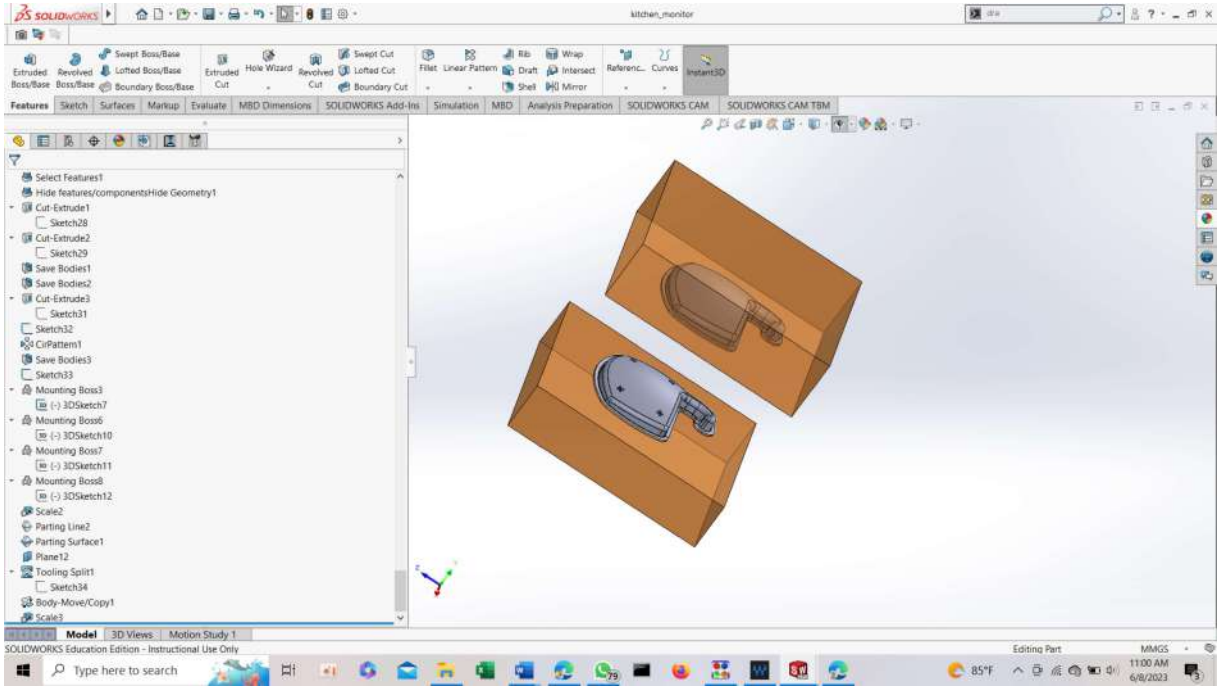


Figure 65: core and cavity

7 Assembly Instructions for the Kitchen Safety Monitor

Below are the step-by-step assembly instructions to help you set up the device and ensure it functions properly:

Note: Before beginning the assembly, ensure that you have all the necessary components and tools as mentioned in the parts list provided with the device.

7.1 Step 1: Component Placement

.

1. Identify the components included in the kit, such as the PCB, gas sensors (MQ2 and MQ6), ESP32, camera module, buzzer, LED bulb, voltage regulators, power connector, and connectors..

2. Carefully place the components on the PCB following the designated footprints. Ensure proper orientation and alignment as indicated in the PCB layout.

7.2 Step 2: Soldering

.

1.Begin soldering the components onto the PCB. Start with the low-profile components and gradually move on to the taller ones to avoid obstruction.

2. Use a soldering iron with an appropriate tip and lead-free solder to ensure good solder joints. Avoid excessive heat to prevent damage to sensitive components.

7.3 Step 3: Power Connectors

Solder the power connector for the 9V adapter and the backup battery (7.4V) to their designated pads on the PCB. Make sure the polarities are correctly aligned.

7.4 Step 4: Voltage Regulators

Solder the voltage regulators (3.3V and 5V) onto their respective pads. These regulators will provide stable power supplies to the ESP32 and other components.

7.5 Step 5:Sensor Connections

Connect the MQ2 and MQ6 gas sensors to their designated pads on the PCB. Ensure proper pin alignment, and secure the sensors in place.

7.6 Step 6:Camera Module

Connect the camera module to the designated connector on the PCB, ensuring proper alignment and secure attachment.

7.7 Step 7: Buzzer and LED

Solder the buzzer and LED bulb onto their designated pads on the PCB. Ensure proper polarity for the LED.

7.8 Step 8: Power Source Switching

Check the connections and ensure that the power source switching mechanism between the 9V adapter and backup battery is functioning correctly.

7.9 Step 9:Inspect and Clean

Carefully inspect the entire assembly for any soldering bridges, cold joints, or errors. Use a magnifying glass if needed to ensure all connections are secure and clean any excess flux residue

7.10 Step 10: Testing

Connect the Kitchen Safety Monitor to the 9V adapter and power it on.

After a brief heating period, the sensors should start detecting smoke and LPG gas. Test the functionality of the alert system, including the buzzer and LED..

7.11 Step 11: WiFi Configuration

Follow the instructions provided in the user manual to connect the Kitchen Safety Monitor to your WiFi network for real-time WhatsApp notifications.

Your Kitchen Safety Monitor is now assembled, installed, and ready to enhance kitchen safety by detecting smoke and gas leakage while providing real-time alerts through WhatsApp and remote access to the live kitchen feed. Always ensure to keep the device and its components away from moisture and handle them with care to maintain their optimal functionality and longevity.

8 Testing for Functionality of the Kitchen Safety Monitor

8.1 Power-Up Test

.

1. Connect the Kitchen Safety Monitor to the 9V adapter and turn it on.
2. Observe the startup sequence. Ensure that all LEDs and indicators, such as power-on indicator and status LEDs, light up correctly, indicating that the device is powered and operational.

8.2 Sensor Heating Test

.

1. Allow the Kitchen Safety Monitor to heat up the gas sensors for the required duration (typically a few minutes) to ensure optimal performance.
2. Verify that the MQ2 and MQ6 sensors have stabilized and are ready to detect smoke and LPG gas, respectively, by checking the status LEDs or through the user interface.

8.3 Smoke Detection Test

.

1 .Introduce a controlled source of smoke, such as a lighter or incense, near the MQ2 sensor to simulate a smoke event.
2. Observe the response of the Kitchen Safety Monitor and ensure that the smoke detection signal is raised when smoke is continuously detected for 4 seconds.
3.Confirm that this action triggers the alert system, resulting in the activation of the buzzer and blinking LED to provide clear indications of the detected smoke.

8.4 LPG Gas Detection Test

.

1. Introduce a controlled source of LPG gas, such as a gas lighter, near the MQ6 sensor to simulate an LPG gas leak.
2.Observe the response of the Kitchen Safety Monitor and verify that the LPG gas detection signal is raised.
3. Confirm that the alert system is activated, generating the same audible and visual alerts as in the smoke detection test.

8.5 Real-Time Notification Test

.

1. Configure the Kitchen Safety Monitor to send WhatsApp notifications to a designated mobile device or phone number.
2. Repeat the smoke and LPG gas detection tests and verify that real-time notifications are promptly sent to the specified WhatsApp account, containing relevant information about the detected hazards.

8.6 Live Video Streaming Test

.

1. Access the provided link to the live video streaming feature on the designated mobile device.
2. Ensure that the live video stream displays the kitchen environment clearly and in real-time, allowing users to visually assess the situation remotely during smoke or LPG gas detection events.

8.7 Dual Power Source Test

.

1. With the Kitchen Safety Monitor powered by the 9V adapter, simulate a power outage by disconnecting the adapter.
2. Verify that the device seamlessly switches to the backup battery (7.4V) without interruption and continues to function normally.
3. Reconnect the 9V adapter to ensure that the device switches back to the main power source without any issues.

8.8 User Interface Test

.

1. Interact with the user interface (e.g., through buttons or a touchscreen) to adjust alert settings, such as notification preferences or alarm duration.
2. Confirm that changes made to the alert settings are accurately reflected in the device's behavior during subsequent detection events.

8.9 Alarm Reset Test

.

1. After the detection of smoke or gas, activate the alert system by simulating a smoke or LPG gas event.
2. Test the alarm reset functionality to ensure that the system can be reset once the hazardous condition is resolved, returning the Kitchen Safety Monitor to its standby state.

8.10 Durability Test

.

1. Subject the Kitchen Safety Monitor to normal environmental conditions, including variations in temperature and humidity, to assess its durability over time.
2. Conduct a controlled physical impact test to determine the device's resilience to accidental knocks or minor drops.

8.11 Overall Performance Test

.

1. Conduct a series of continuous tests, including multiple smoke and gas detection scenarios, to evaluate the overall performance and consistency of the Kitchen Safety Monitor.
2. Ensure that the device consistently functions as intended and meets the specified safety requirements throughout all test scenarios.

8.12 User Acceptance Test

.

1. Involve end-users, such as homeowners or relevant stakeholders, in a user acceptance test to gather feedback on usability, effectiveness, and overall satisfaction with the Kitchen Safety Monitor.
2. Record and address user feedback to improve the product and ensure its alignment with user expectations.

By thoroughly conducting these functionality tests, you can validate the reliability and effectiveness of the Kitchen Safety Monitor, ensuring it meets safety standards and provides a proactive solution for kitchen safety.

9 Kitchen Safety Monitor User Manual

.

1. Introduction: The Kitchen Safety Monitor is a cutting-edge device designed to ensure enhanced safety in domestic kitchens. With its advanced gas sensors and real-time communication capabilities, it provides proactive monitoring and timely alerts for potential hazards. Before using the Kitchen Safety Monitor, please read this user manual to understand its features, assembly, operation, and safety precautions.

2. Package Contents: Upon unboxing, ensure that the package contains the Kitchen Safety Monitor kit, including the PCB, gas sensors (MQ2 and MQ6), ESP32, camera module, buzzer, LED bulb, voltage regulators, power connectors, and other components.

3. Product Specifications: Refer to the detailed product specifications section for information on dimensions, power requirements, sensor specifications, communication interfaces, and technical details.

4. Product Components and Assembly: Follow the component list to verify all included components. The assembly instructions provide a step-by-step guide for placing and soldering components onto the PCB, ensuring a proper and functional assembly.

5. Getting Started: Power on the Kitchen Safety Monitor using the 9V adapter and connect it to your WiFi network for real-time notifications. Proper WiFi setup enables the device to send alerts to your WhatsApp when detecting smoke or LPG gas.

6. Operation: Understand the status indicators and LED meanings to monitor the device's readiness and status. Learn how the Kitchen Safety Monitor detects smoke and LPG gas, and familiarize yourself with the alert system's functioning, including the 4-second continuous detection rule for smoke.

7. Remote Monitoring: Utilize the real-time WhatsApp notifications to receive instant alerts about detected smoke or gas events. Access the live video streaming feature through the provided link to remotely assess your kitchen environment during potential hazards.

8. User Interface: Customize the alert settings to suit your preferences, such as notification preferences and alarm duration. Learn to monitor the system status through the user-friendly interface.

9. Maintenance and Care: Follow the cleaning instructions to maintain the Kitchen Safety Monitor's optimal performance. In case of battery replacement, refer to the guidelines provided.

10. Troubleshooting: In case of any issues, consult the troubleshooting section for common problem-solving steps.

11. Safety and Compliance: Prioritize safety by adhering to the safety precautions and regulatory compliance details provided in this manual.

12. Warranty and Support: The Kitchen Safety Monitor comes with a warranty. For any questions or assistance, reach out to our customer support team using the contact information provided.

We thank you for choosing the Kitchen Safety Monitor to enhance safety in your kitchen. By following this user manual, you can effectively set up, operate, and maintain the device to ensure a secure cooking environment for your household. For future reference, keep this manual in a safe place and always refer to it for any queries related to the Kitchen Safety Monitor.

10 Future improvements

.

1. Enhanced Gas Sensor Technology:** Integrate advanced gas sensor technology with improved sensitivity and selectivity to detect a wider range of harmful gases and reduce false alarms. This will enable the device to provide more accurate and reliable gas detection.

2. Wireless Mesh Networking:** Implement wireless mesh networking among multiple Kitchen Safety Monitors within a home to create a robust network. This will enhance communication between devices and extend coverage, ensuring comprehensive safety monitoring in larger kitchen spaces.

3. Machine Learning for Predictive Analysis:** Utilize machine learning algorithms to analyze historical data and usage patterns. The Kitchen Safety Monitor can then learn and predict potential hazards, providing proactive warnings and preventive measures.

4. Smartphone App Integration:** Develop a dedicated smartphone app for the Kitchen Safety Monitor, allowing users to control and monitor the device remotely. The app can offer real-time status updates, notifications, and customizable settings for enhanced user convenience.

5. Smart Integration with Home Automation:** Integrate the Kitchen Safety Monitor with popular smart home automation platforms, such as Apple HomeKit or Samsung SmartThings. This will allow seamless integration with other smart home devices, enabling automated actions based on safety alerts and user preferences.

These future improvements will make the Kitchen Safety Monitor more efficient, user-friendly, and capable of providing an advanced level of safety and peace of mind to homeowners.