

**UNPLUGGED 2.0 –
24 - Hour Hardware Hackathon**

Round 2

**Team Name:
Brocode**

Team Members:

Harsh Pandey [B.tech - EXTC]

Soham Nagvekar [B.tech – EXTC]

Prasad Rane [B.tech – EXTC]

Atharva Wadekar [B.tech – EXTC]

Advait Shinde [Diploma – AI ML]

Vrushika Panchal [Diploma – AI ML]

Table of Content

Overview

Design and Electrical Rule Checks

Pin mapping and component placement

No. of components used

Overall Layout

Documentation

Final PCB

Total

OVERVIEW

PROBLEM STATEMENT

With rapid urbanization, real-time environmental monitoring has become essential for sustainable city planning. The **Smart City Sentinel** project addresses this need by developing a modular PCB that integrates sensors, power management, and communication protocols. This enables seamless data collection and transmission, ensuring efficient environmental surveillance in urban areas.

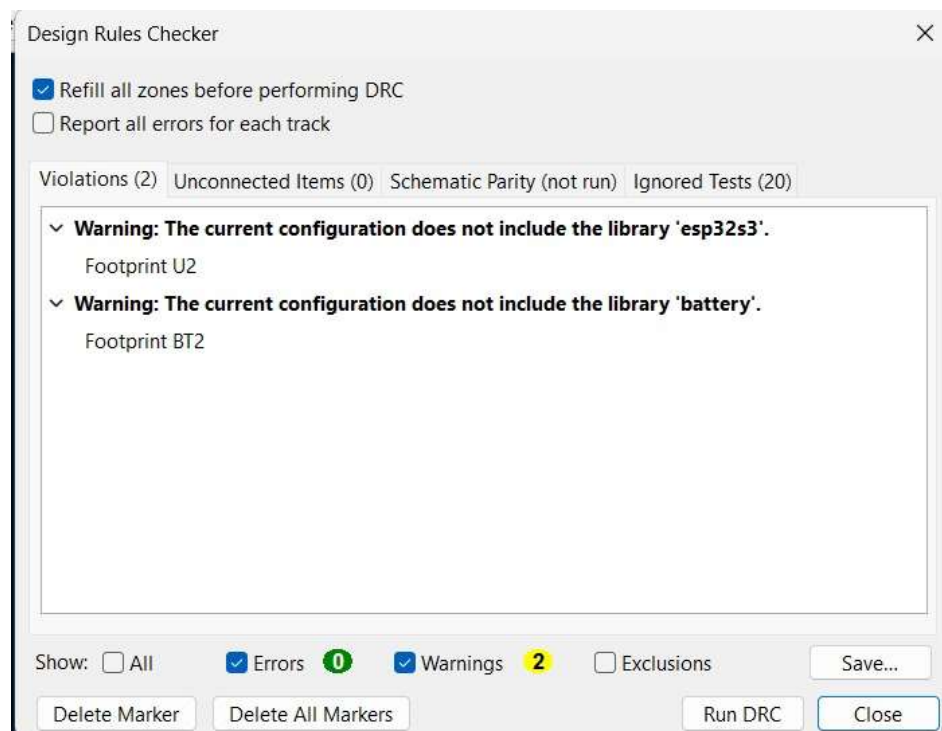
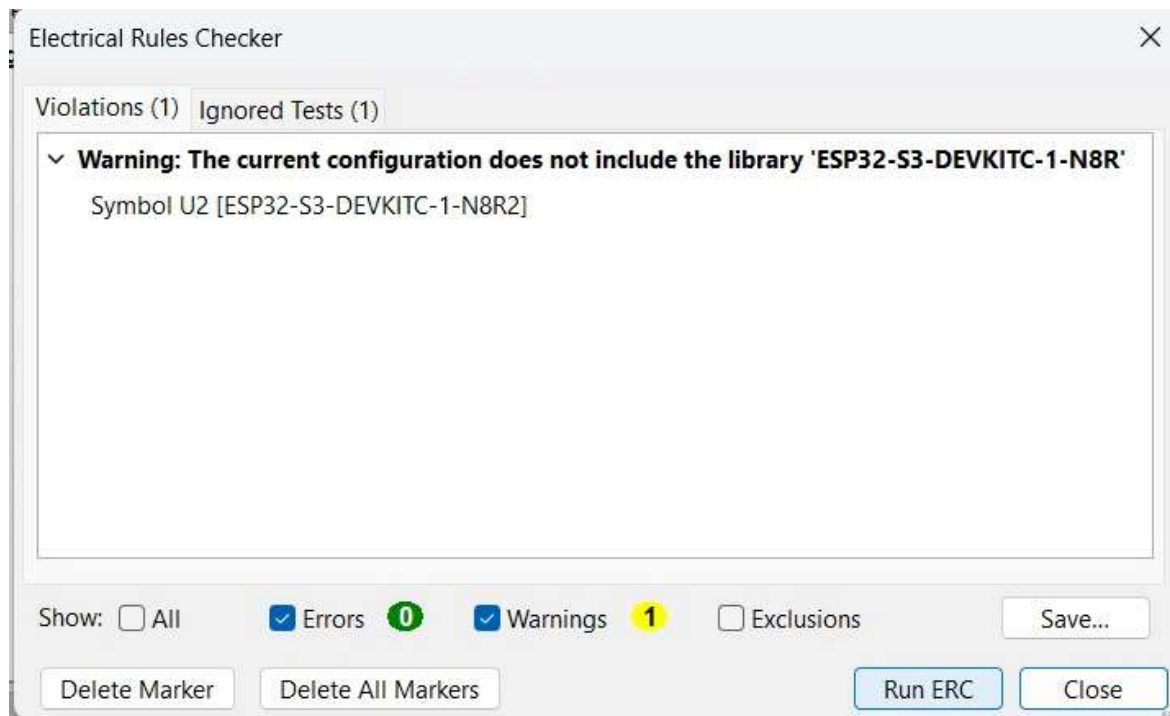
INTRODUCTION

The **Smart City Sentinel** project focuses on designing a modular PCB using **KiCad** to facilitate real-time environmental monitoring. The PCB incorporates **sensor interfacing, power management, and efficient data transmission** within a scalable and optimized architecture. Adhering to competition constraints, the design features a **two-layer PCB, standardized components**, and **optimized connectivity**, ensuring seamless functionality and future scalability.

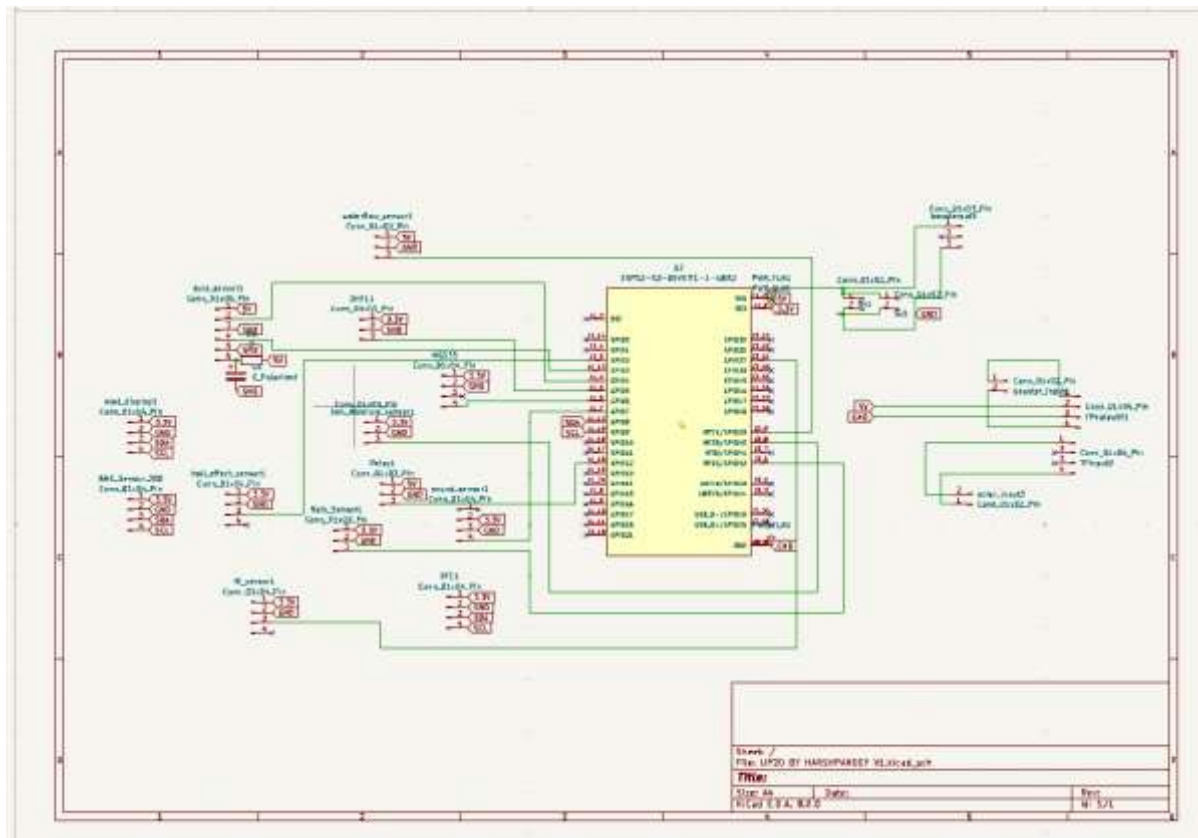
ABSTRACT

The **Smart City Sentinel** is an advanced modular PCB designed for intelligent environmental surveillance. It integrates **multiple sensors**, a **robust power management system with solar panel support**, and **structured communication protocols** to enable real-time data collection and transmission. The design prioritizes **modularity**, allowing for **future enhancements with minimal modifications**, while strictly adhering to **power and connectivity constraints**. Additionally, a **precision-engineered 3D CAD model** ensures a **seamless structural fit with a predefined solar panel**, enhancing its **practical usability** and **real-world implementation**.

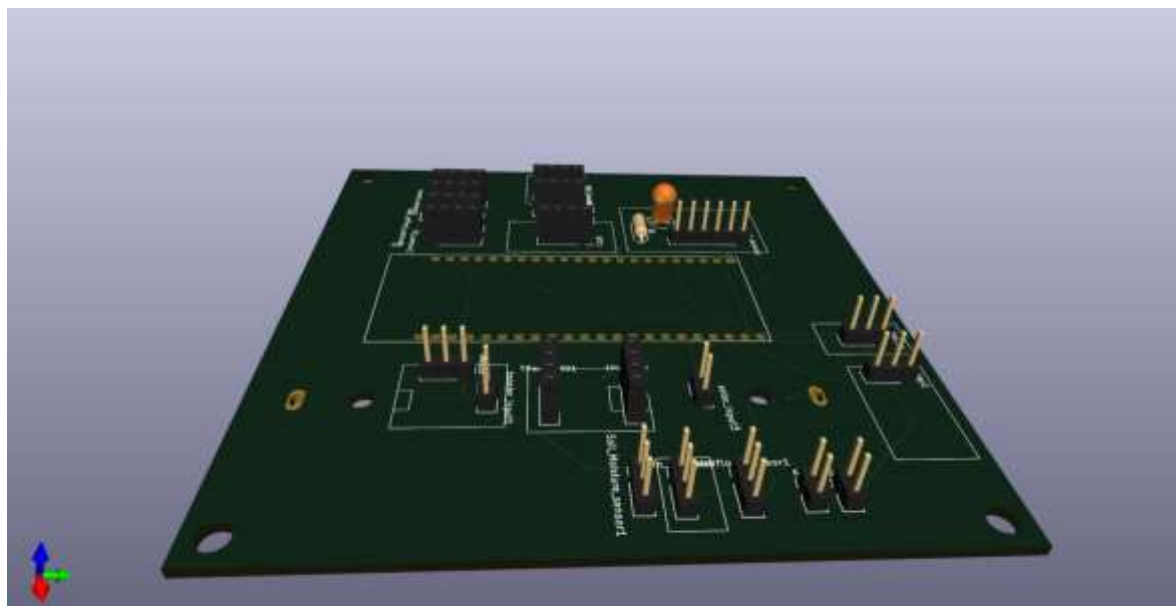
DESIGN AND ELECTRICAL RULE CHECKS



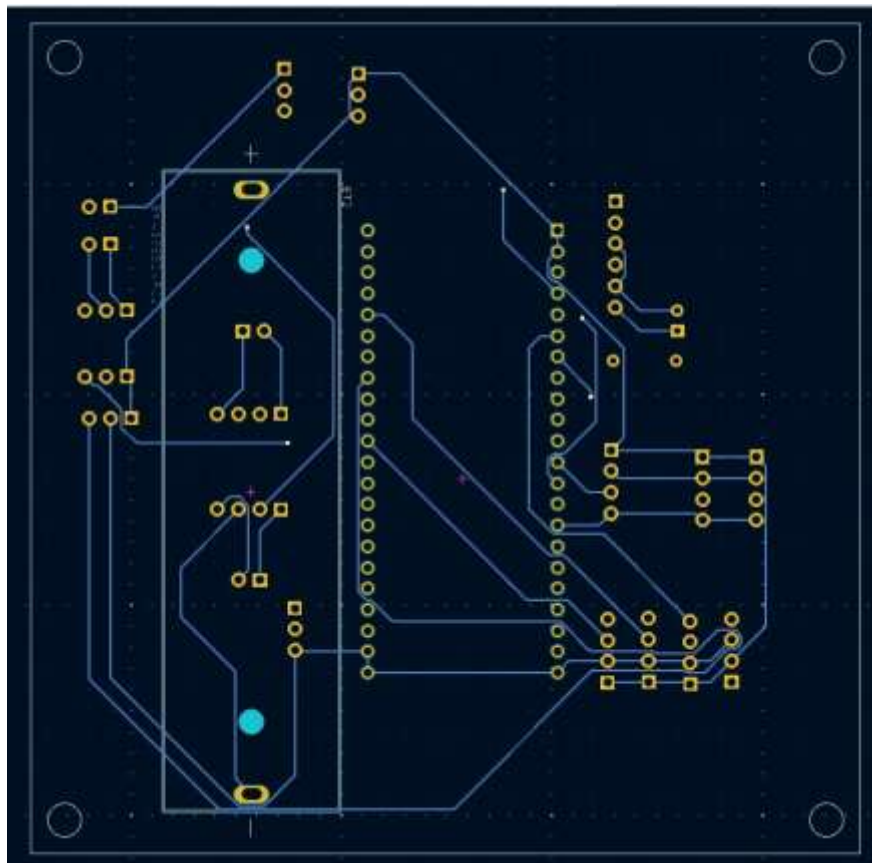
PIN MAPPING AND COMPONENT PLACEMENT



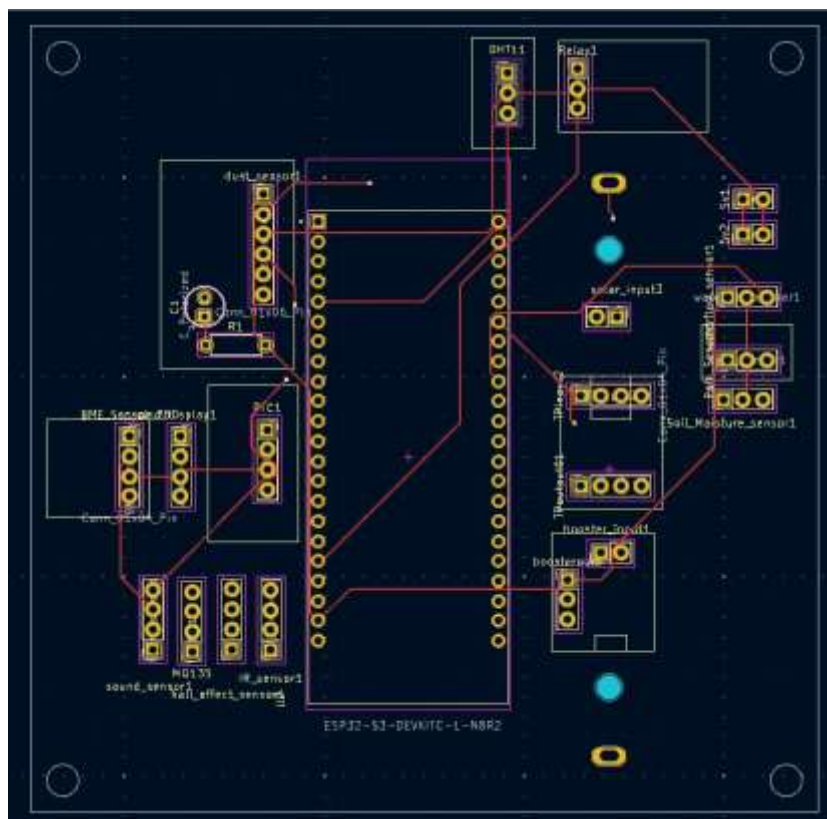
3D View



Back Copper layer



Front Copper Layer

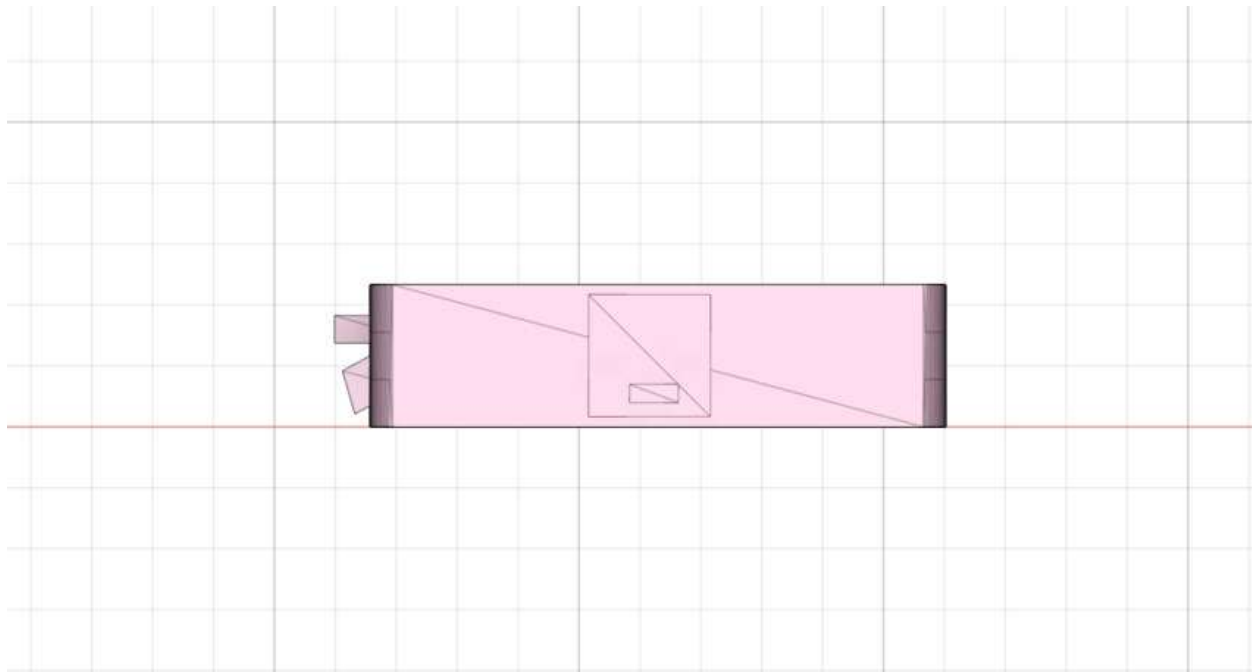
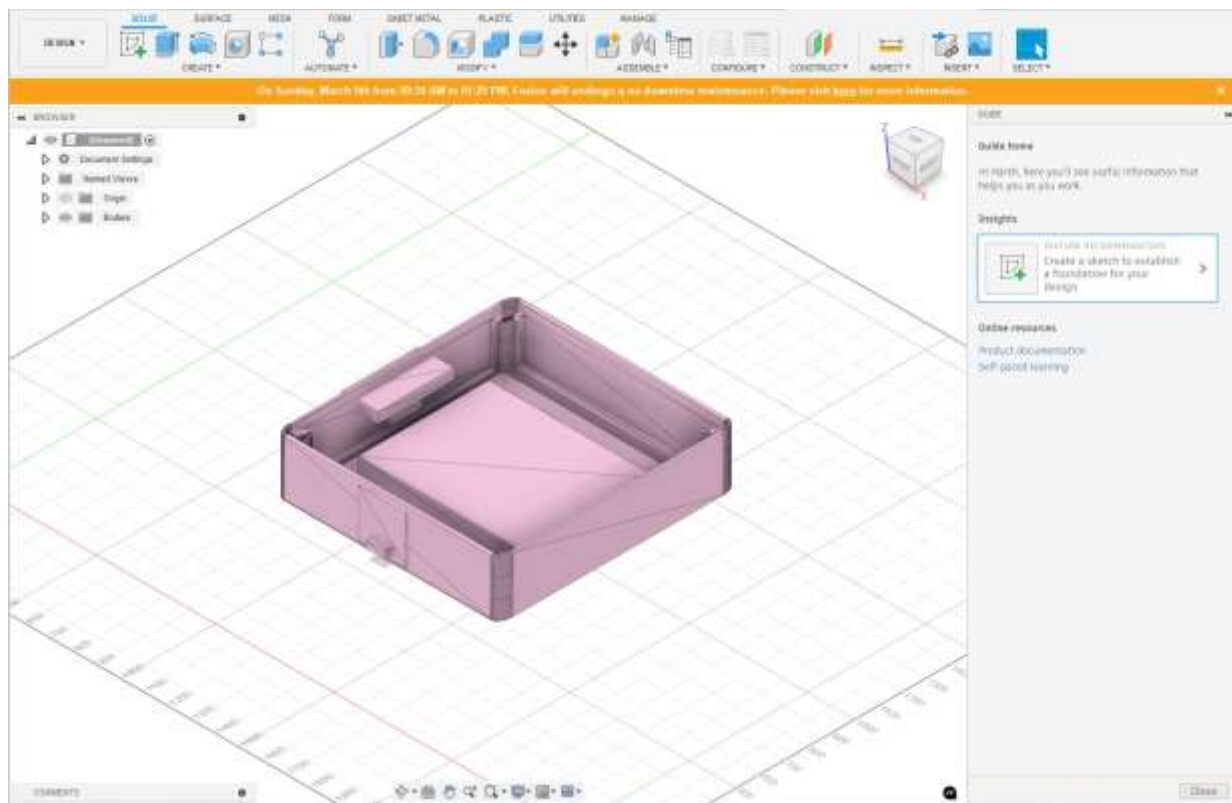


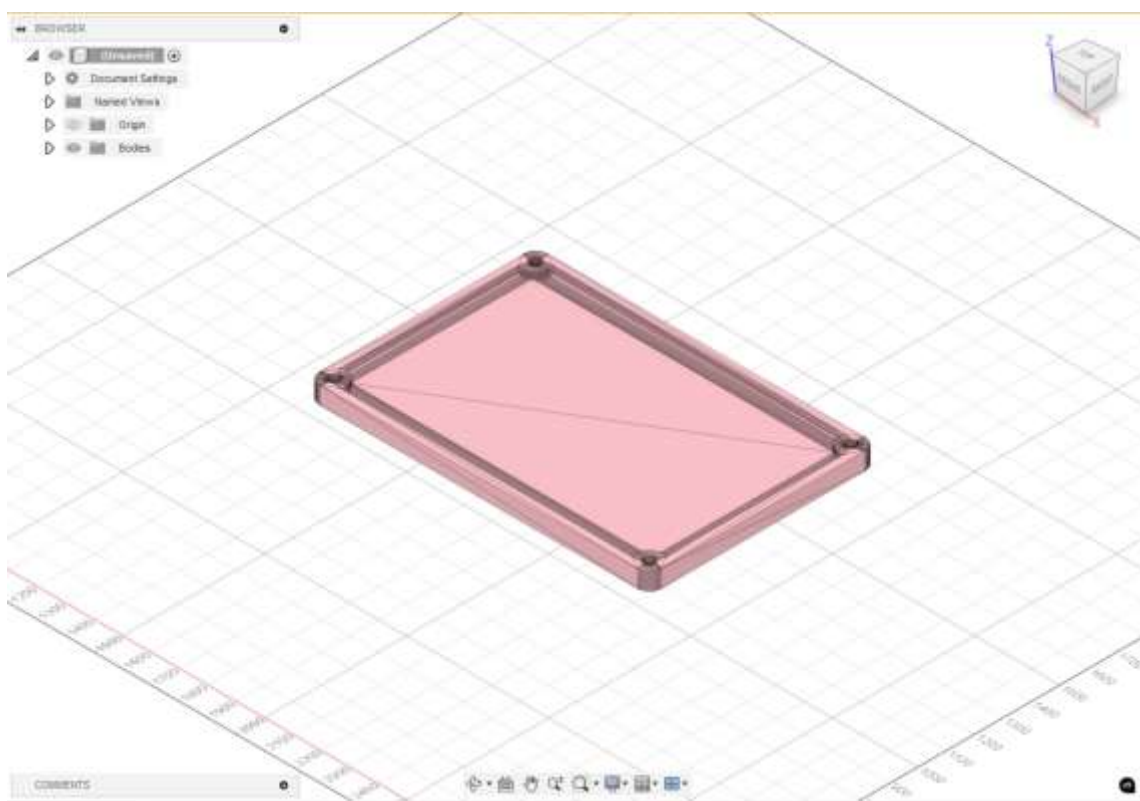
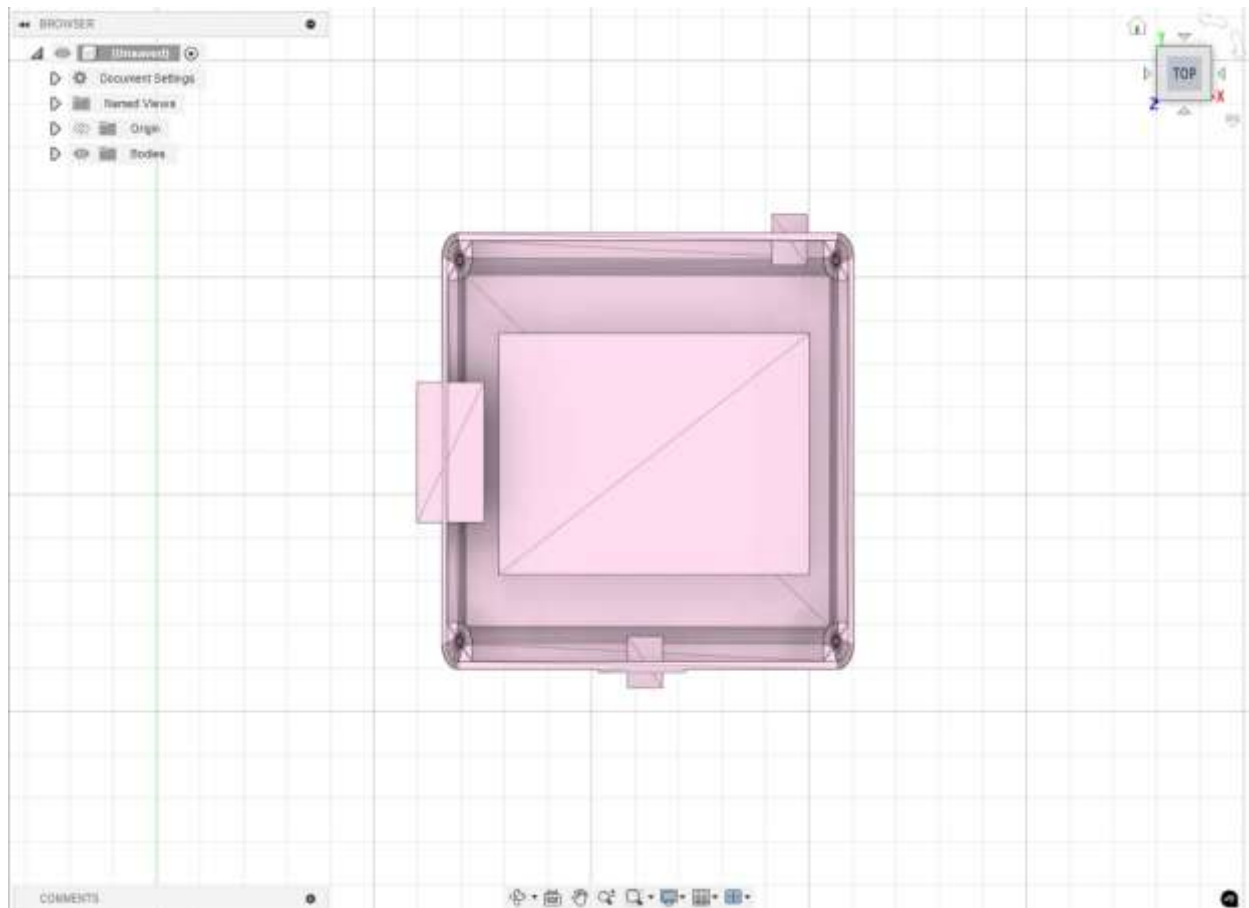
NO. OF COMPONENTS USED

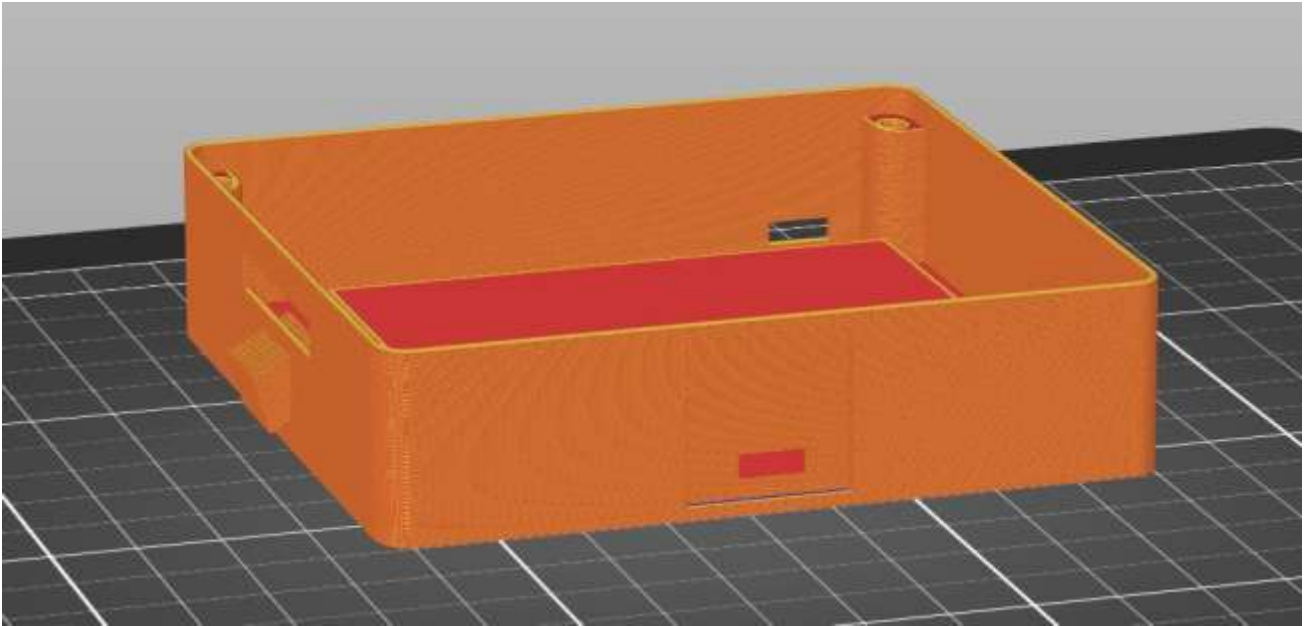
Bill of Material

Components	Quantity	Price
ESP32-53 Dev module	1	₹ 1,458.00
MQ-135 Gas Sensor	1	₹ 139.00
Sound Sensor Module	1	₹ 37.00
OLED Display	1	₹ 289.00
BME280 Environmental Sensor	1	₹ 44.00
Solar Panel	1	₹ 189.00
Rechargeable Module (TP4056)	1	₹ 24.00
IR Flame Sensor	1	₹ 69.00
Battery 3.7v 2500mAh 18560	1	₹ 800.00
Voltage Booster	1	₹ 49.00
Dust Sensor	1	₹ 599.00
Hall Effect Sensor	1	₹ 34.00
MAX471 Current and Voltage Sensor	1	₹ 399.00
Water Flow Sensor	1	₹ 236.00
DHT11 Temperature and Humidity Sensor	1	₹ 90.00
Soil Moisture Sensor	1	₹ 189.00
Relay Module	1	₹ 199.00
Rain Sensor	1	₹ 156.00
RTC DS3231 module	1	₹ 122.00
TOTAL		₹ 5,122.00

OVERALL LAYOUT







The 3D-printed enclosure protects the ESP32-S3 and camera module for traffic rule monitoring. It features cutouts for wiring, ventilation, and the camera lens, with a secure screw-on bottom cover. Designed for durability and outdoor use, it ensures stable image capture and processing for traffic analysis.

DOCUMENTATION

Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository.](#)

Required fields are marked with an asterisk (*).

Owner *



vrushikakpachal

Repository name *

brocode_git

✓ brocode_git is available.

Great repository names are short and memorable. Need inspiration? How about [literate-octo-happiness](#) ?

Description (optional)

This repository contains the complete design and documentation for the Smart City Sentinel, a modular PCB d



Public

Anyone on the internet can see this repository. You choose who can commit.



Private

You choose who can see and commit to this repository.

Initialize this repository with:



Add a README file

This is where you can write a long description for your project. [Learn more about READMEs.](#)

Add .gitignore

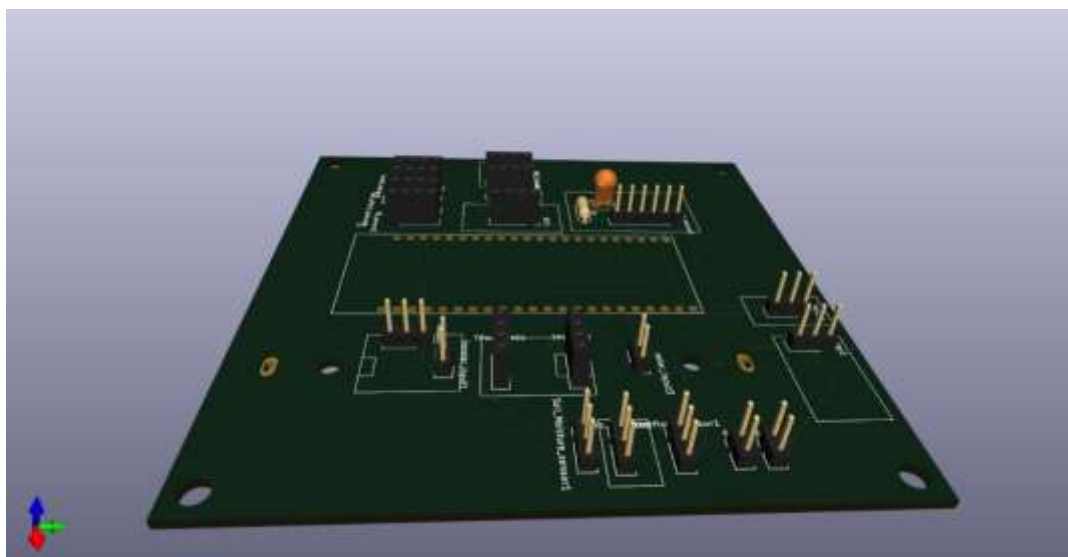
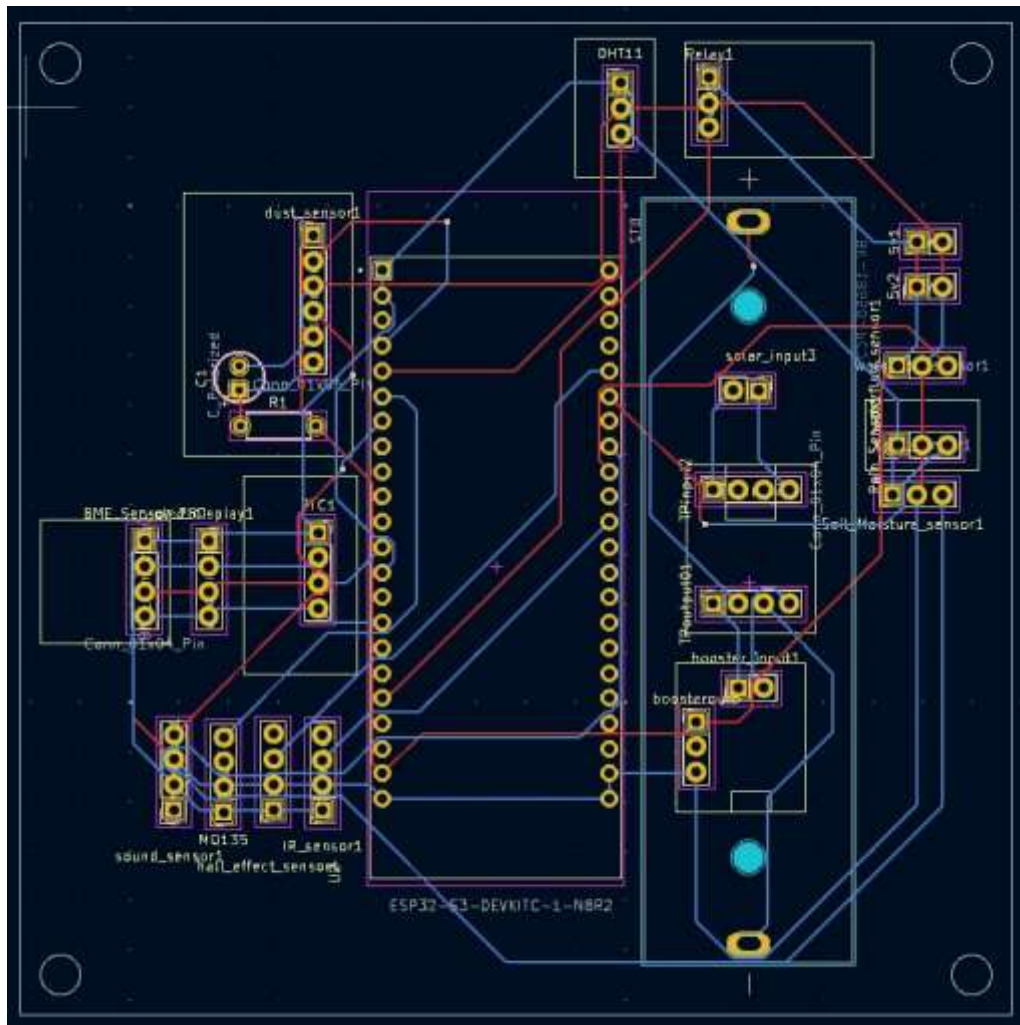
.gitignore template: None

SmartCity-Sentinel-PCB: A modular PCB designed for real-time environmental monitoring. This repository contains schematic files, PCB layouts, CAD models, and project documentation.

GitHub Navigation:

~UP20 BY HARSHPANDEY V1.kicad_pcb.lck	08-03-2025 14:16	LCK File	1 KB
~UP20 BY HARSHPANDEY V1.kicad_sch.lck	08-03-2025 14:16	LCK File	1 KB
BROCODE DRC.rpt	08-03-2025 14:16	RPT File	1 KB
ERCOutput.rpt	08-03-2025 14:16	RPT File	1 KB
fp-info-cache	08-03-2025 14:16	File	1 KB
UP20 BY HARSHPANDEY V1.kicad_pcb	08-03-2025 14:16	KICAD_PCB File	194 KB
UP20 BY HARSHPANDEY V1.kicad_prl	08-03-2025 14:16	KICAD_PRL File	2 KB
UP20 BY HARSHPANDEY V1.kicad_pro	08-03-2025 14:16	KICAD_PRO File	14 KB
UP20 BY HARSHPANDEY V1.kicad_sch	08-03-2025 14:16	KICAD_SCH File	110 KB
GERBER	08-03-2025 14:16	File folder	

FINAL PCB



GitHub Link: https://github.com/vrushikakpanchal/brocode_git

Mentor's Suggestions for Improvement

System Overview

- Label components clearly (ESP32-S3, Camera, Server, etc.).
- Use arrows to show data flow direction.
- Apply a color scheme (blue for sensors, green for processing, red for power).

Data Flow & Processing

- Label all connections (WiFi, RFID signals, data transfer).
- Use different line styles (dashed for wireless, solid for wired).
- Add a legend to explain symbols and abbreviations.

Traffic Control & Detection

- Clearly explain the detection process step by step.
- Label emergency vehicle detection.
- Improve spacing for better readability.

Server & Database Handling

- Clarify whether data is stored locally or in the cloud.
- Show feedback loops (e.g., alerts to traffic lights).
- Use database symbols to indicate storage points.

Demonstration (Hardware + Software)

UNPLUGGED
A 24-HOUR HARDWARE HACKATHON

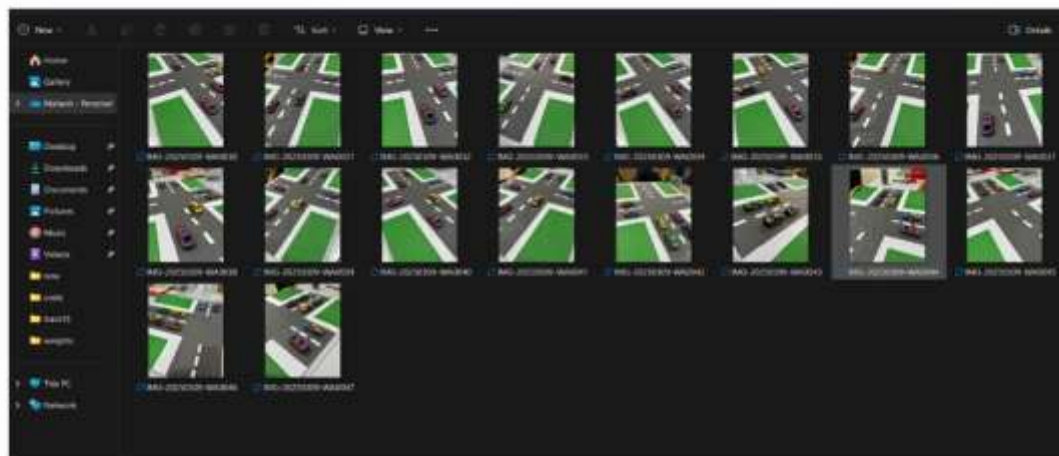
Data annotation



Team Name: Brevado

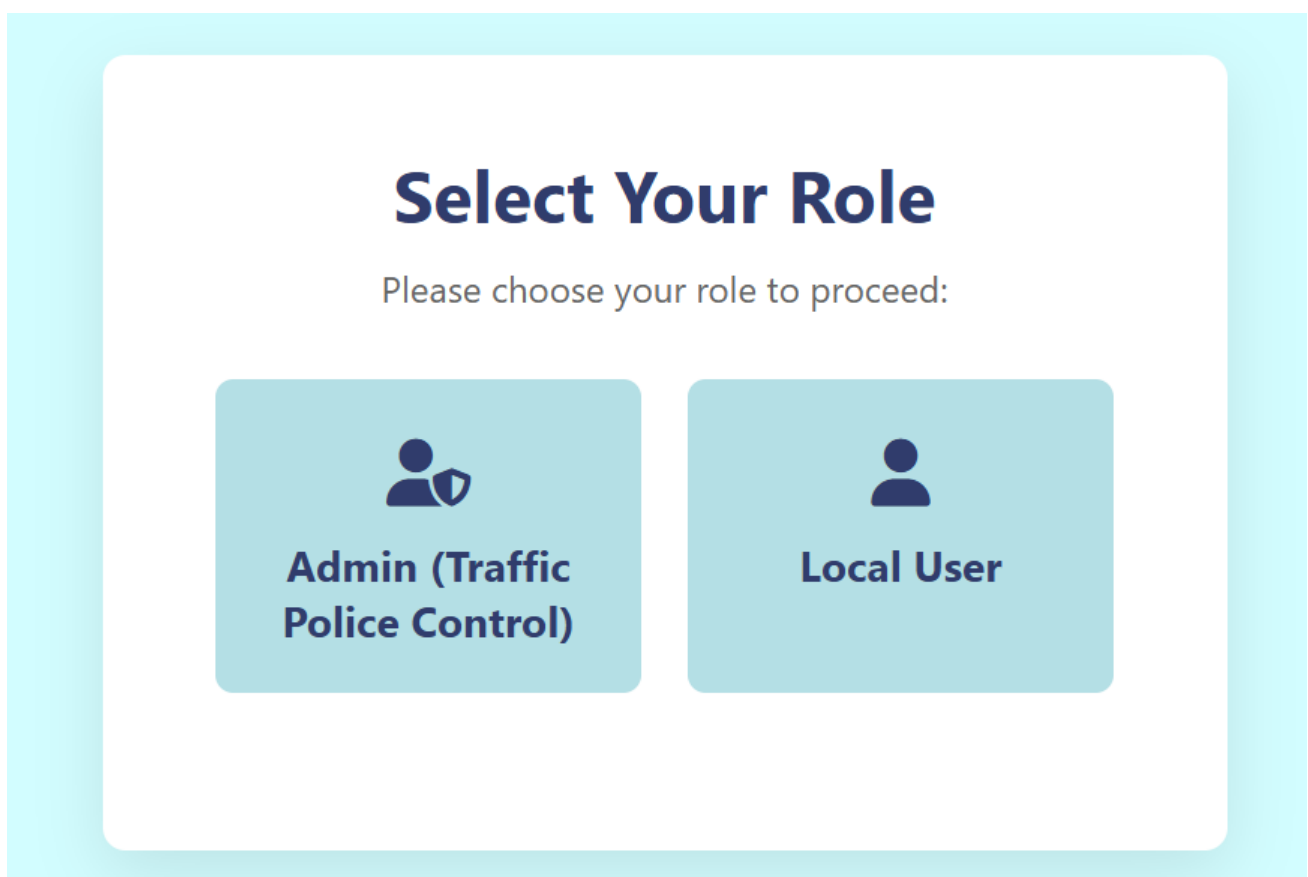
Dataset Creation

UNPLUGGED
A 24-HOUR HARDWARE HACKATHON



- Collected **traffic flow data** from real-world scenarios.
- Compiled **air quality data** to analyze pollution levels.
- Mapped data to **GIS-based spatial analysis** for location-specific insights.
- Continuously updating datasets to **improve AI model performance**.

FRONTEND:



FLOW:

