ElectroWizards

Unplugged 2.0; 24 Hardware hackathon

SUBMISSION ROUND 2

CITYSYNC : SMARTER. GREENER. CONNECTED.

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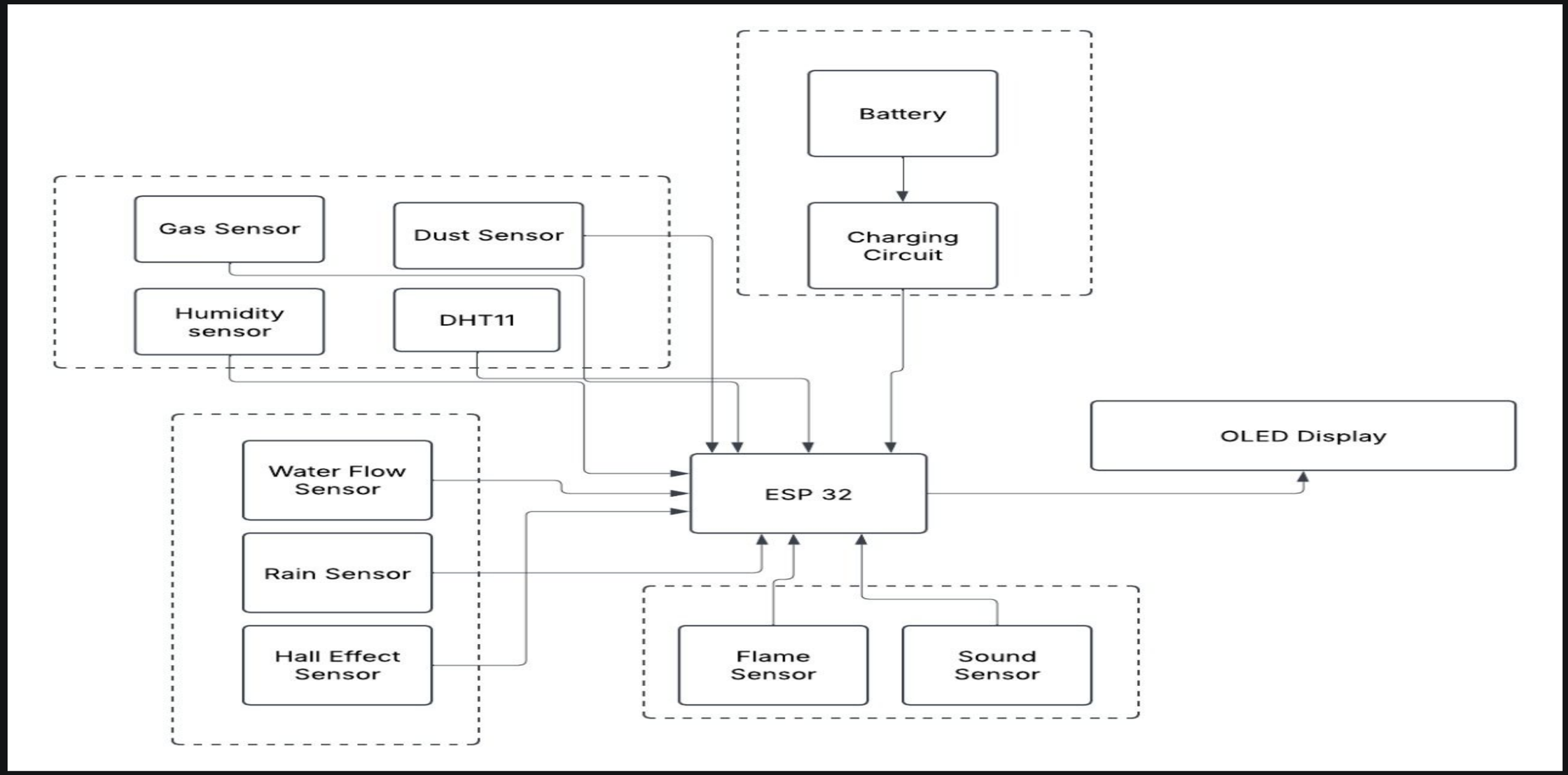
Problem Statement

Design a **modular PCB** in **KiCad** for **urban environmental surveillance**. The PCB must integrate **sensor interfacing, power management, and real-time data transmission** while ensuring **scalability and efficiency** under strict **power and connectivity constraints**. It should feature **mapped communication protocols** for sensors and actuators, a **robust power management unit** with battery monitoring, recharging, and a **solar panel interface**, and a **modular design** using standard electronic components. **Bonus points** will be awarded for a **precision-engineered PCB layout with a 3D CAD model** ensuring a perfect fit with a predefined solar panel.

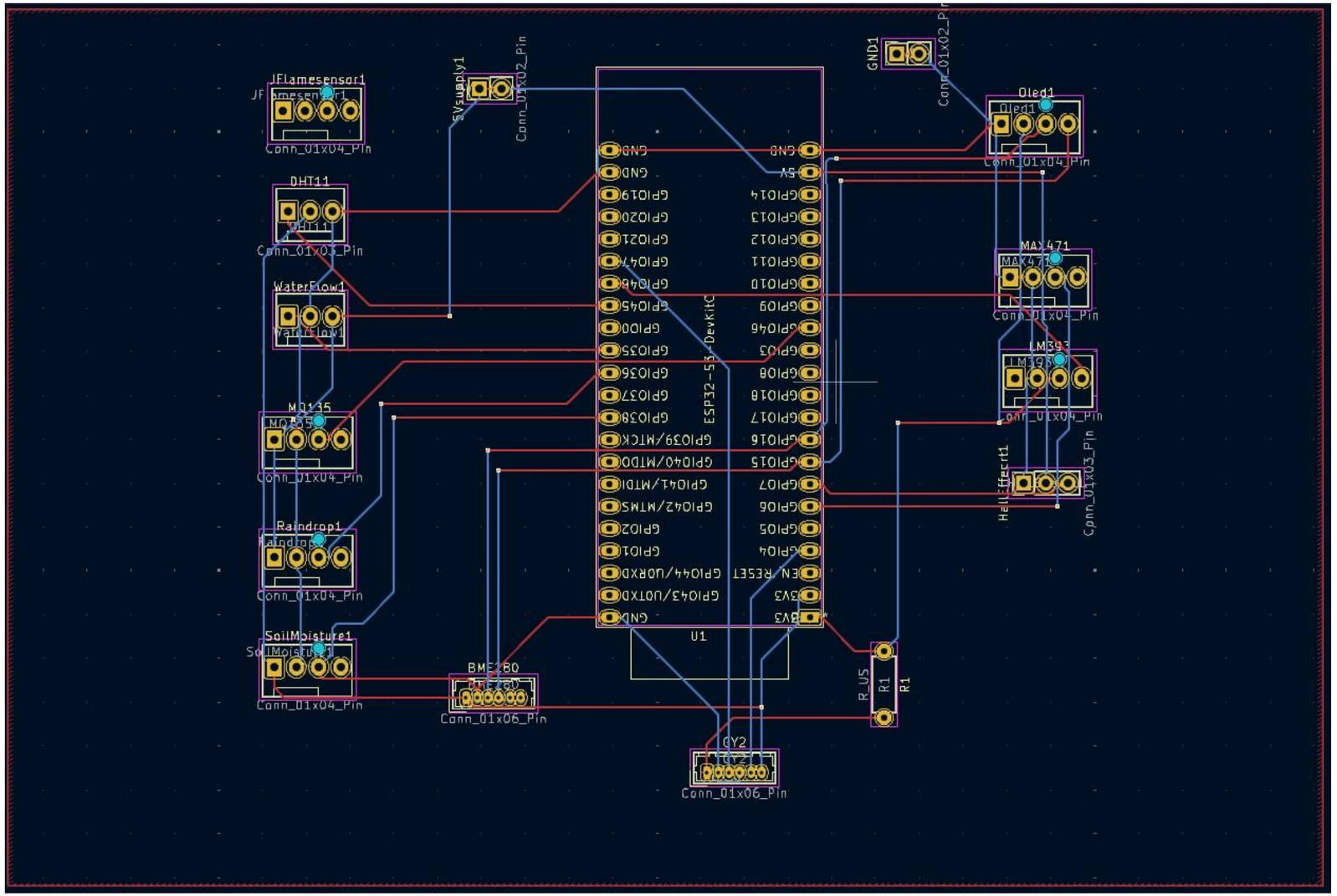
Proposed Solution

- **KiCad** is used for **schematic capture and PCB layout**, while **FreeCAD/Fusion 360** is utilized for **3D modeling** to ensure structural compatibility with the solar panel.
- The solution uses **ESP32/ESP8266** for **Wi-Fi & BLE**, **LoRa modules** for **long-range communication** for seamless **sensor-actuator integration**.
- **The air quality (MQ-135, CCS811), temperature & humidity , and light sensors (BH1750)** for comprehensive environmental monitoring.

Technical Approach



PCB Layout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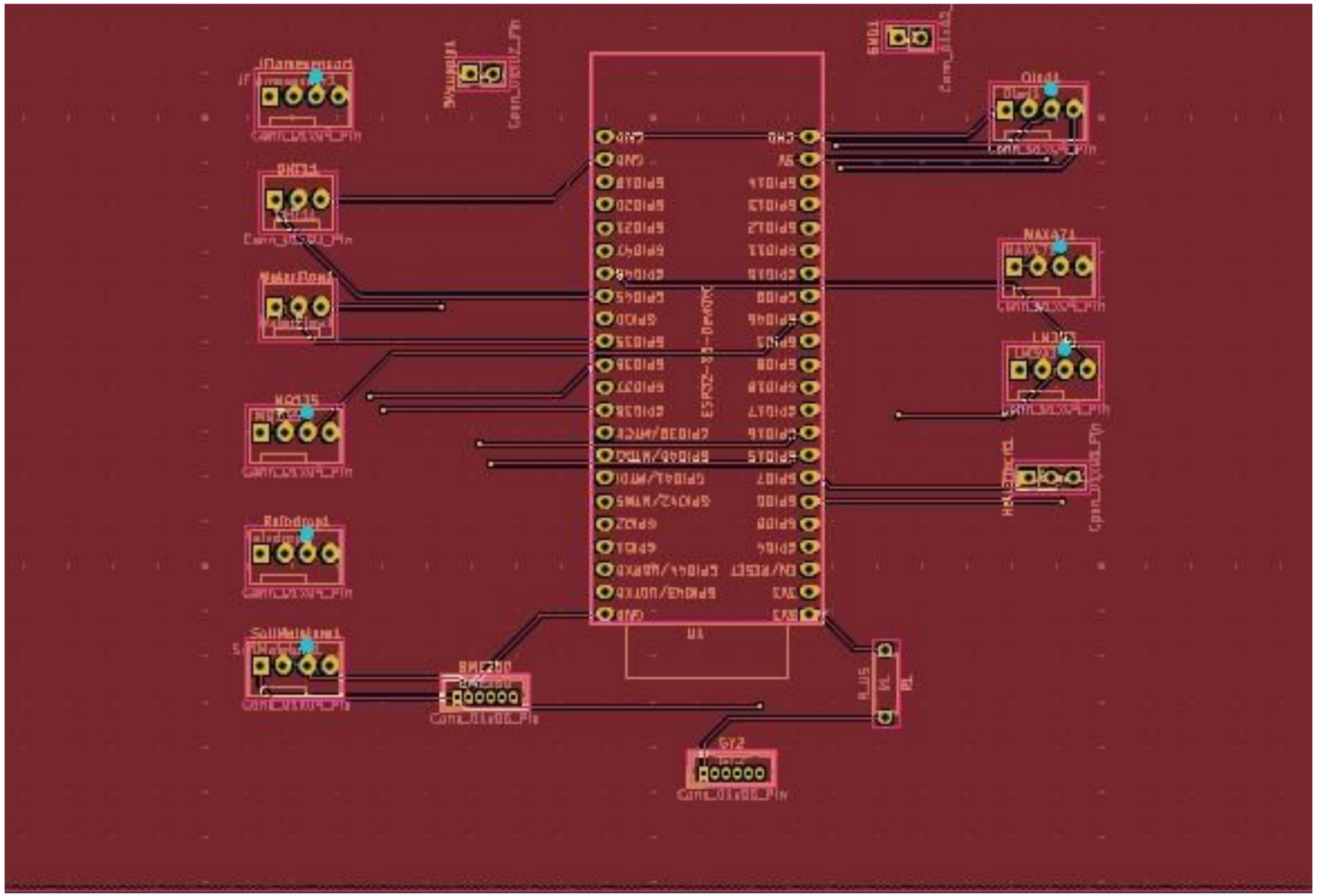
5Vsupply1
Conn_01x02_Pin
GND1
Conn_01x02_Pin
Oled1
Conn_01x04_Pin
DHT11
Conn_01x03_Pin
WaterFlow1
MAX471
Conn_01x04_Pin
MQ135
Conn_01x04_Pin
LM393
Conn_01x04_Pin
Raindrop1
Conn_01x04_Pin
HallEffect1
Conn_01x03_Pin
SoilMoisture1
Conn_01x04_Pin
BME280
Conn_01x06_Pin
R_US
R1
R1
QY2
Conn_01x06_Pin
U1
ESP32-S3-DevKitC
GND
5V
GPIO14
GPIO13
GPIO12
GPIO11
GPIO10
GPIO9
GPIO46
GPIO3
GPIO8
GPIO18
GPIO17
GPIO16
GPIO15
GPIO7
GPIO6
GPIO5
GPIO4
EN/RESET
3V3
GPIO43/U0TXD
GPIO44/U0RXD
GPIO42/MTMS
GPIO41/MTDI
GPIO40/MTDO
GPIO39/MTCK
GPIO38
GPIO37
GPIO36
GPIO35
GPIO0
GPIO45
GPIO48
GPIO47
GPIO21
GPIO20
GPIO19
GND
GND
3V3

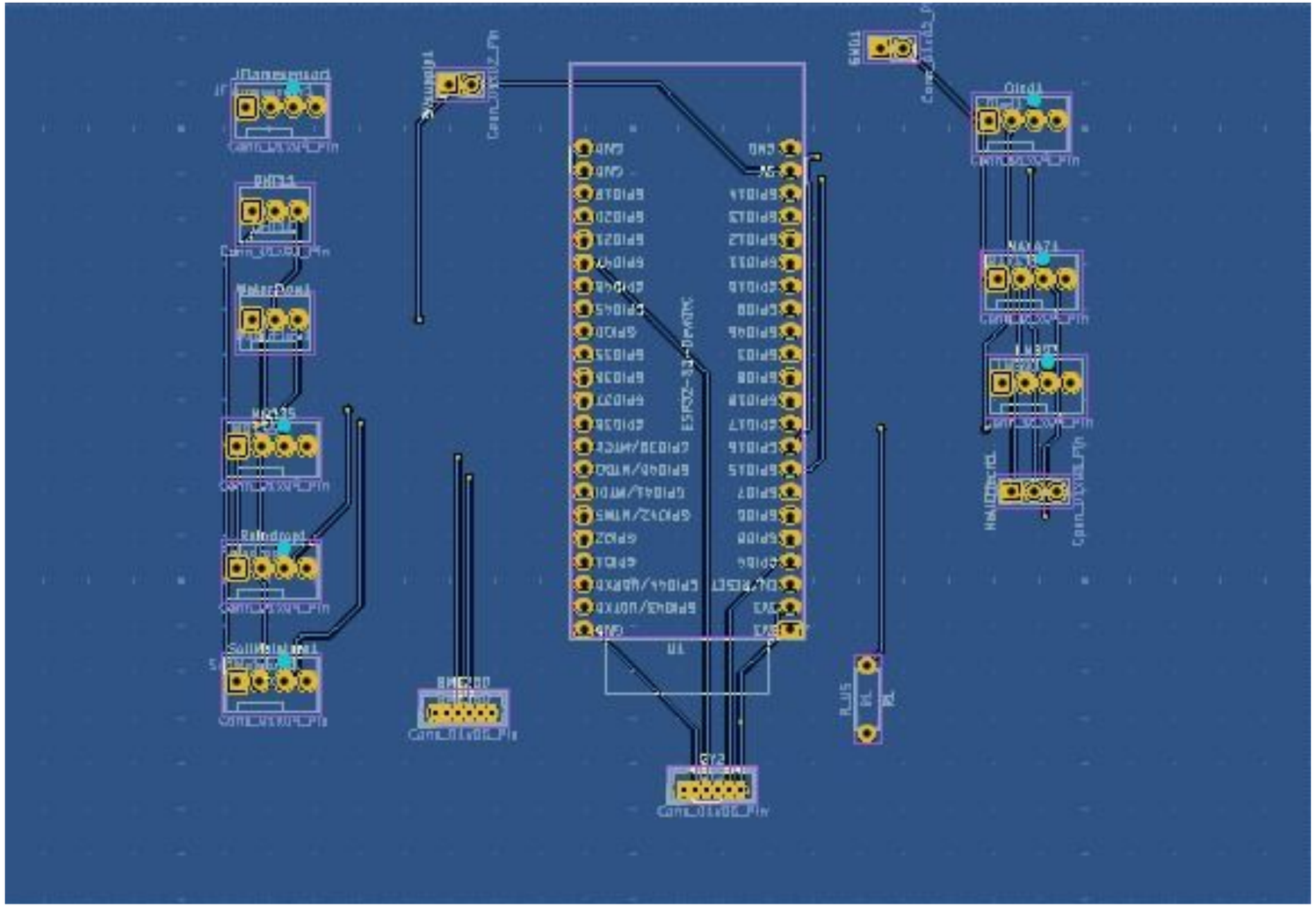
Front Copper Layer

ANALYTIKA

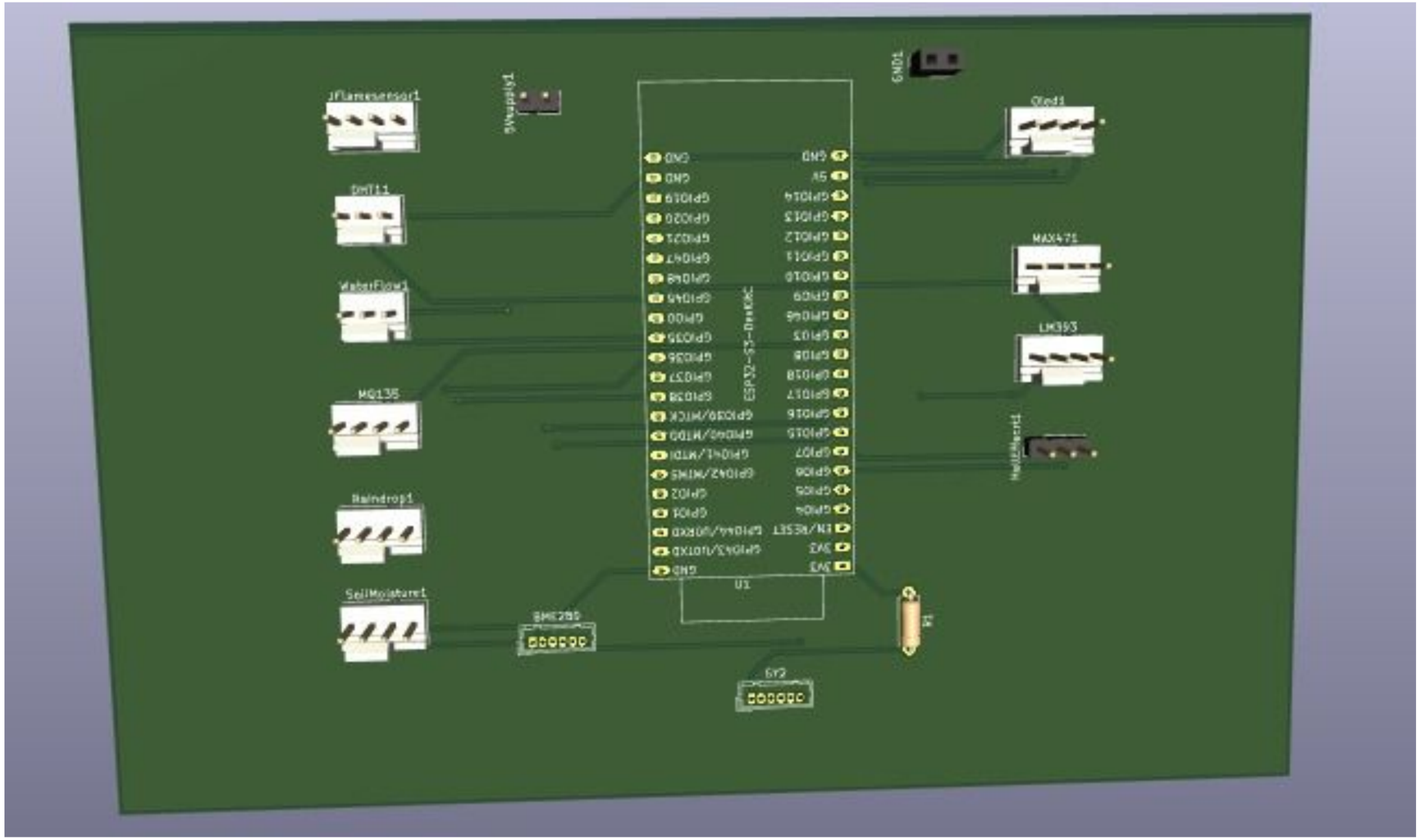
AWS User Groups Mumbai



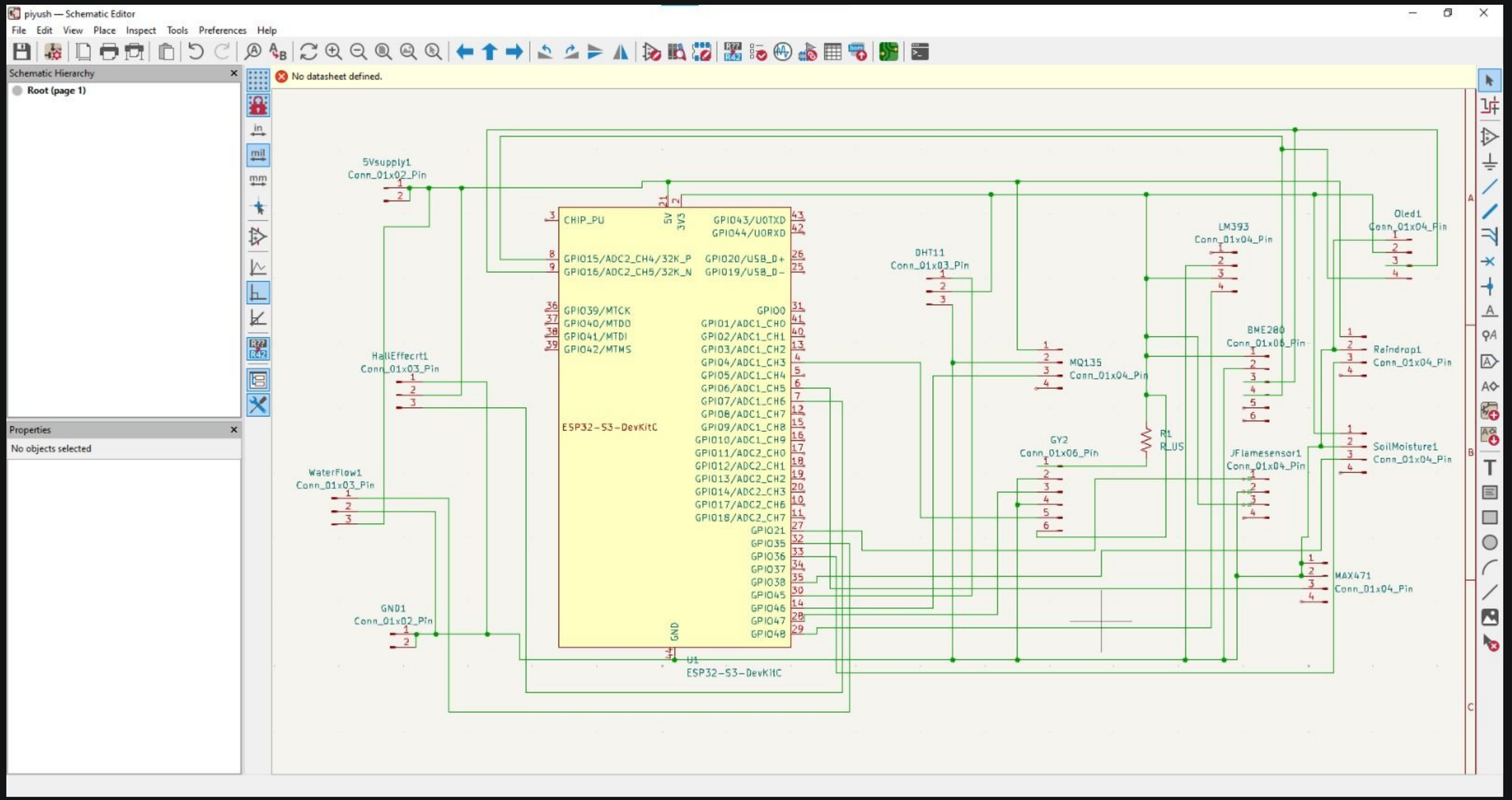
Back Copper Layer



3D Rendered Image :



Schematic Diagram



Bill of Materials

Component Name	Price (INR)	Specifications
ESP32-S3 Dev Module	500	Wi-Fi & BLE microcontroller
MQ-135 Gas Sensor	250	Air quality monitoring, detects CO2, NH3, alcohol, benzene
Sound Sensor Module	150	Microphone-based sound level detection
OLED Display	400	0.96-inch, I2C interface, 128x64 resolution
BME280 Environmental S	350	Temperature, humidity, and pressure sensor
Solar Panel	800	Renewable power source, typically 5V output
Rechargeable Module (T	100	Lithium battery charging module
IR Flame Sensor	180	Infrared-based fire detection sensor
Battery 3.7V 2500mAh 18	300	Rechargeable Li-ion battery
Voltage Booster	200	Boosts voltage for stable power supply
Dust Sensor	600	PM2.5 and PM10 air quality monitoring
Hall Effect Sensor	120	Detects magnetic fields, used for speed and proximity sensing
MAX471 Current and Vol	250	Measures current and voltage for power monitoring
Water Flow Sensor	450	Measures fluid flow rate in pipes
DHT11 Temperature and	100	Basic temperature and humidity sensor
Soil Moisture Sensor	150	Detects moisture levels in soil
Relay Module	200	Electromechanical switch for high-power applications
Rain Sensor	180	Detects rainwater presence
RTC DS3231 Module	250	Real-time clock module with battery backup

THANKYOU!