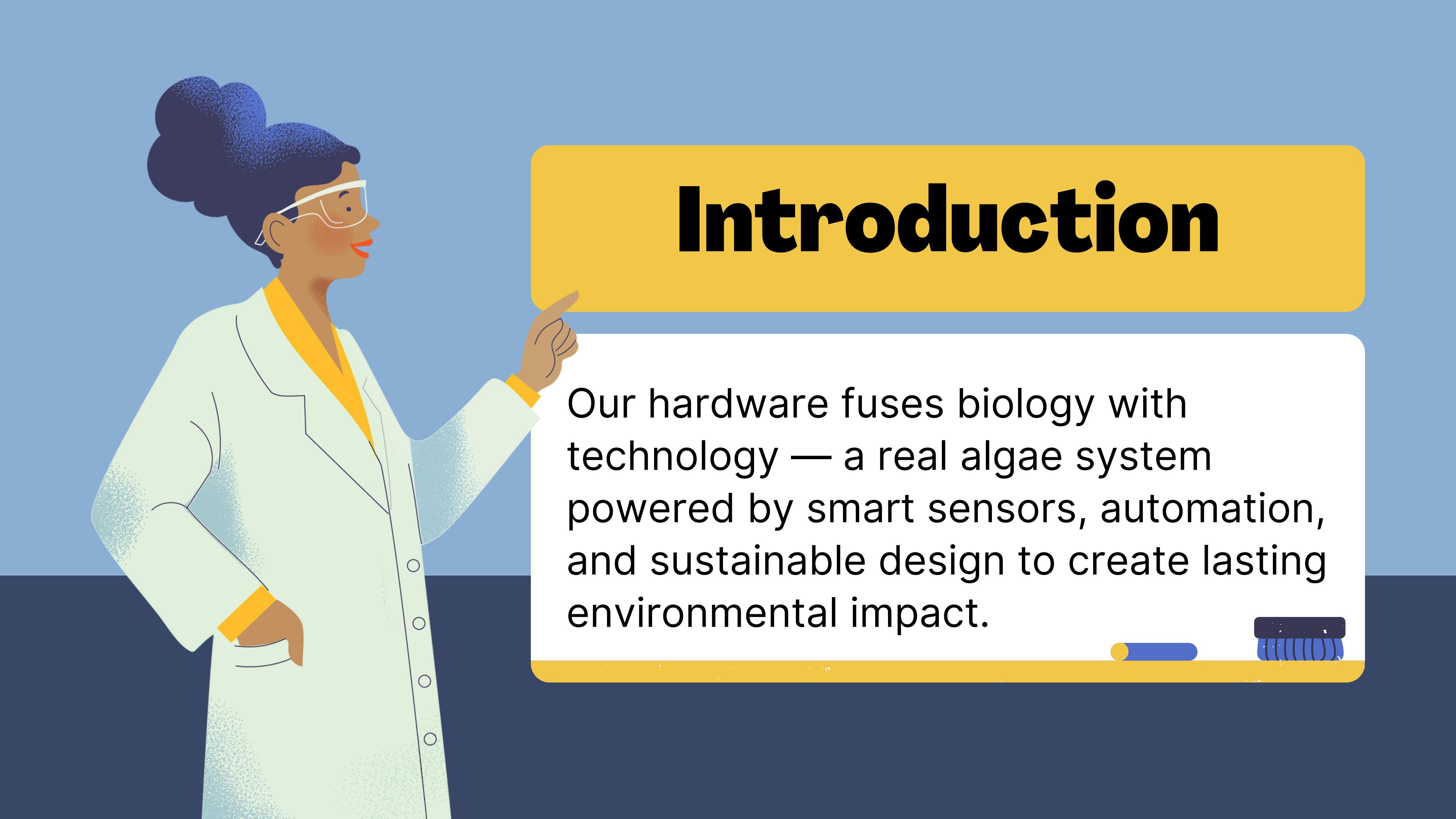


CENG 317

Sanskriti Mansotra N01523183



Introduction

Our hardware fuses biology with technology — a real algae system powered by smart sensors, automation, and sustainable design to create lasting environmental impact.

System Function

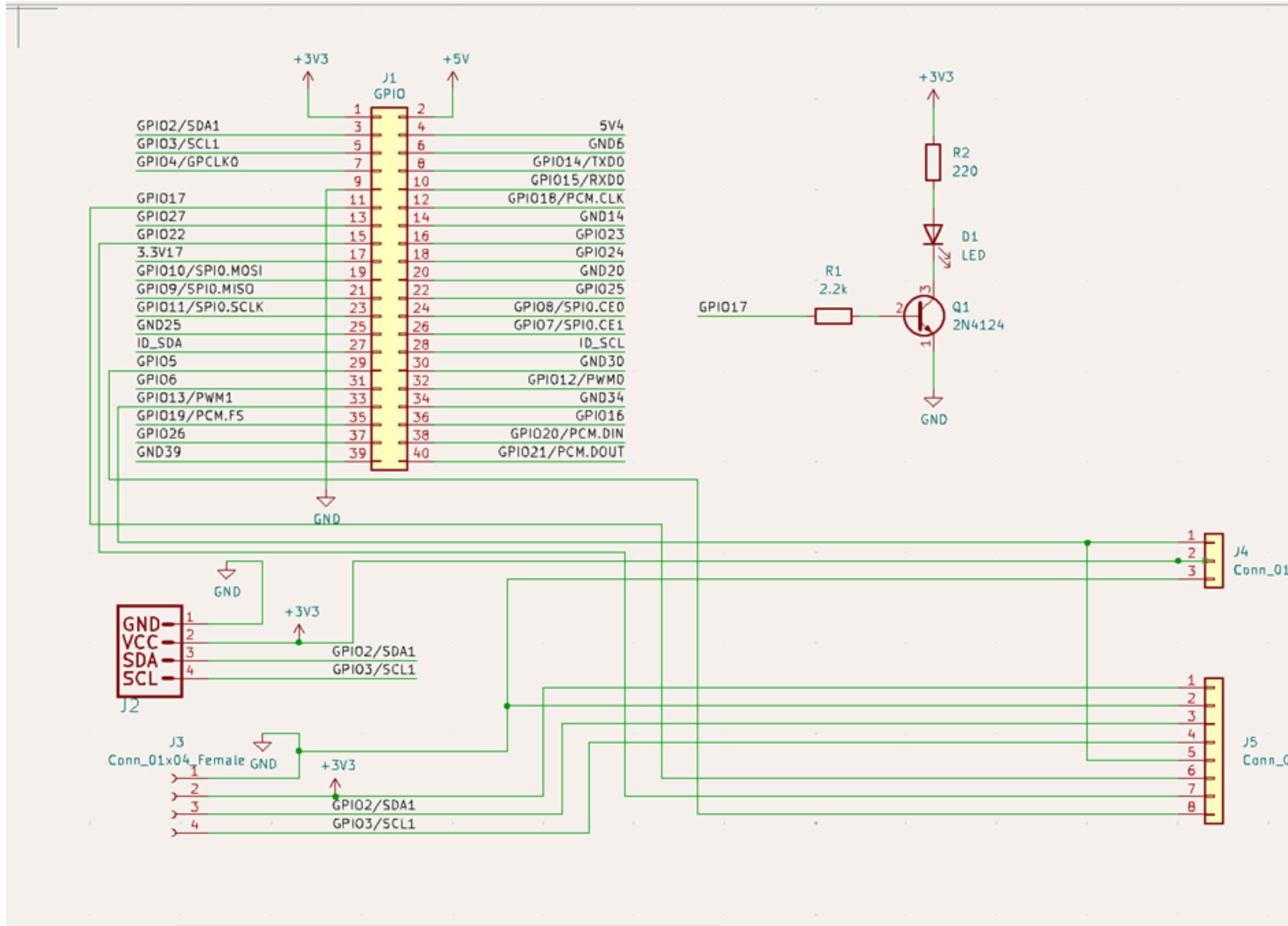
- Measures real-time lux, white, and ambient light.
- Communicates via I²C to Raspberry Pi.
- Converts and displays readings in Python.
- Triggers LED alerts on threshold levels.
- PCB ensures stable power and clean signals.

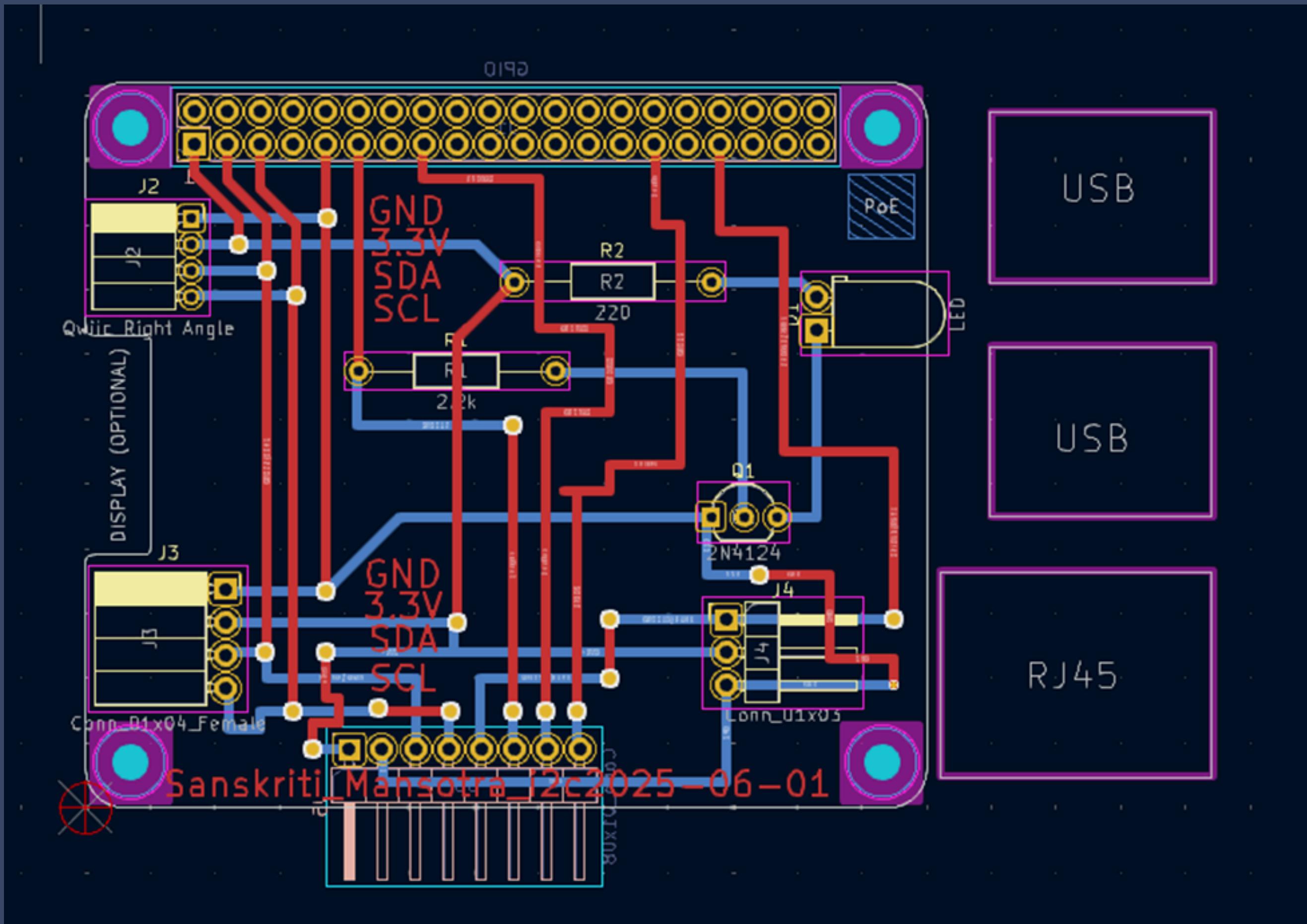
Sensor Type and Parameter

- Measures 0 – 120,000 lux with high resolution (~0.0036 lux/count)
- Operates on 3–5 V, with onboard regulator & level shifting
- I²C interface (10 kHz–400 kHz)
- Plug-and-play via STEMMA QT / Qwiic connectors
- Improved 4.7 kΩ pull-ups for reliable I²C communication
- Supported in Arduino, CircuitPython, Raspberry Pi
- Compact board with optional power LED jumper

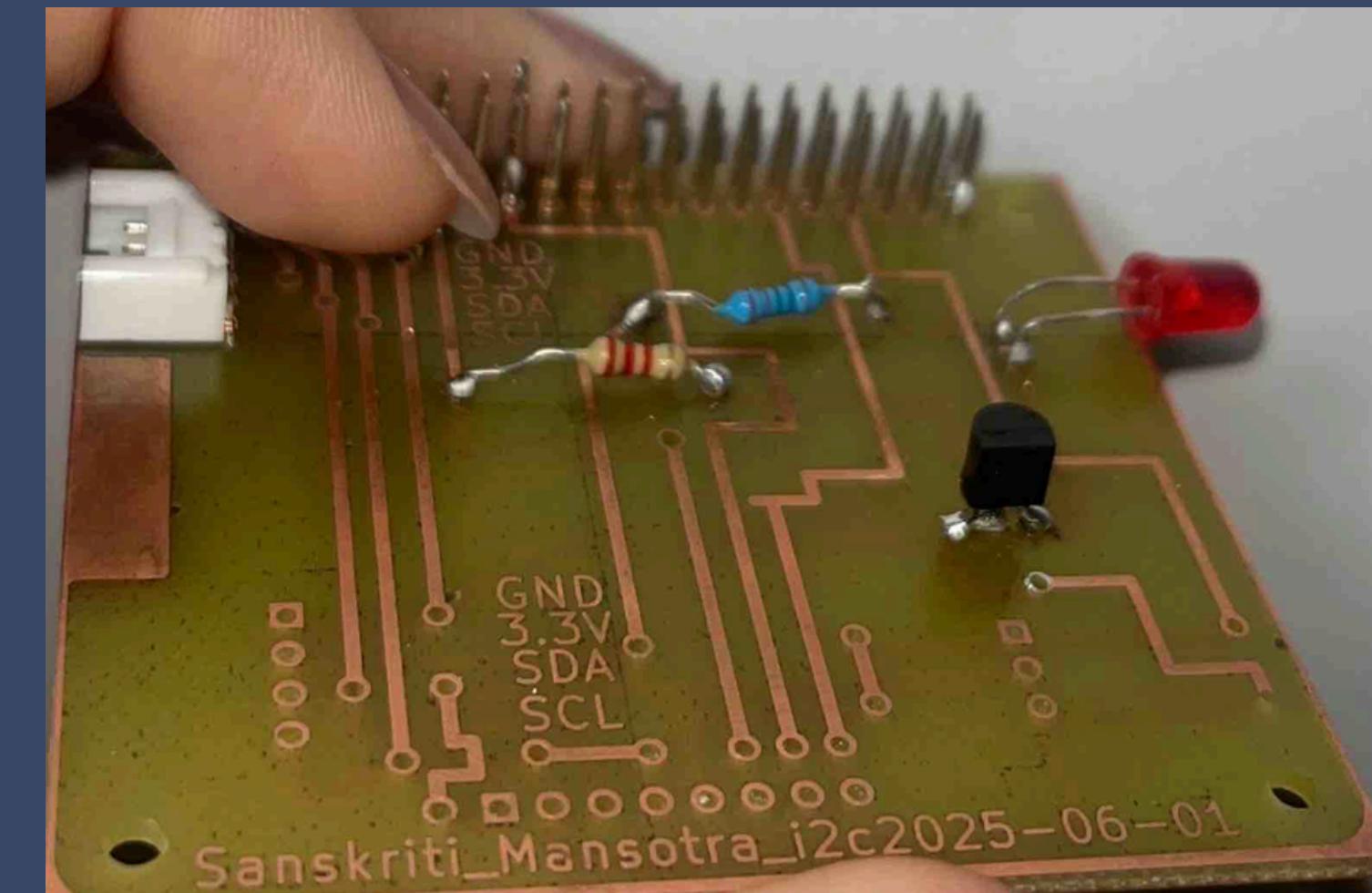
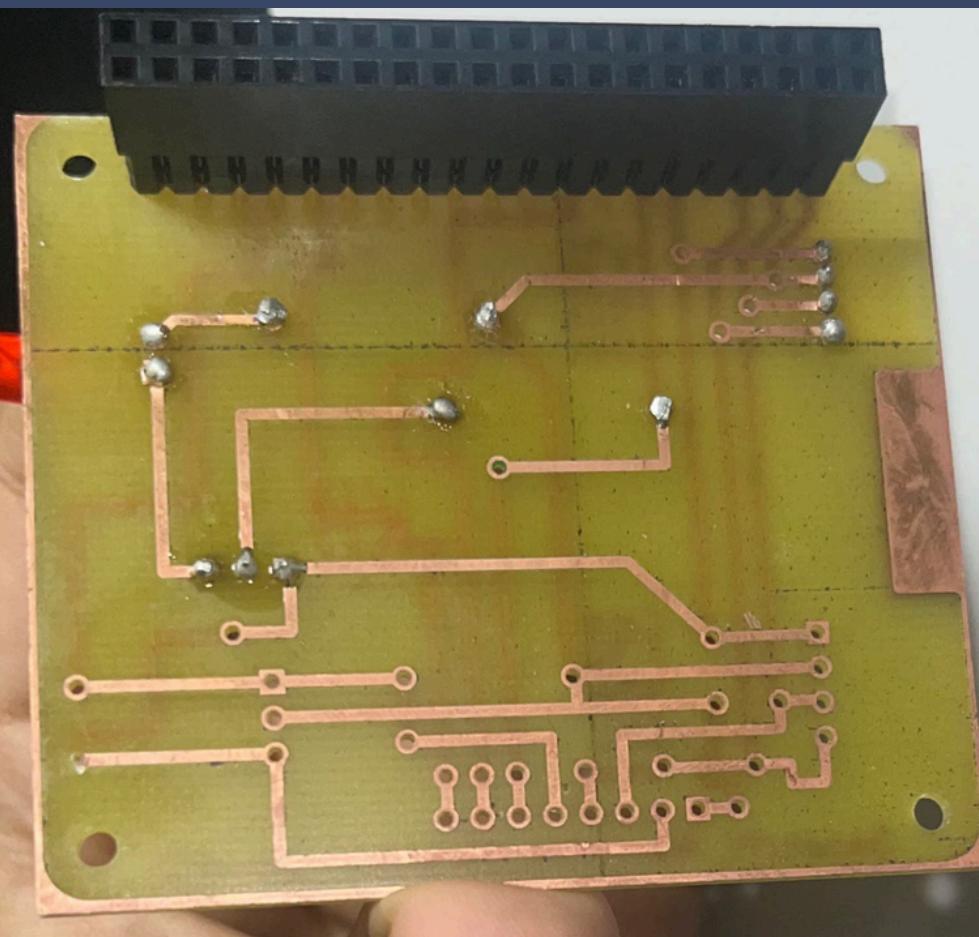


PCB Design

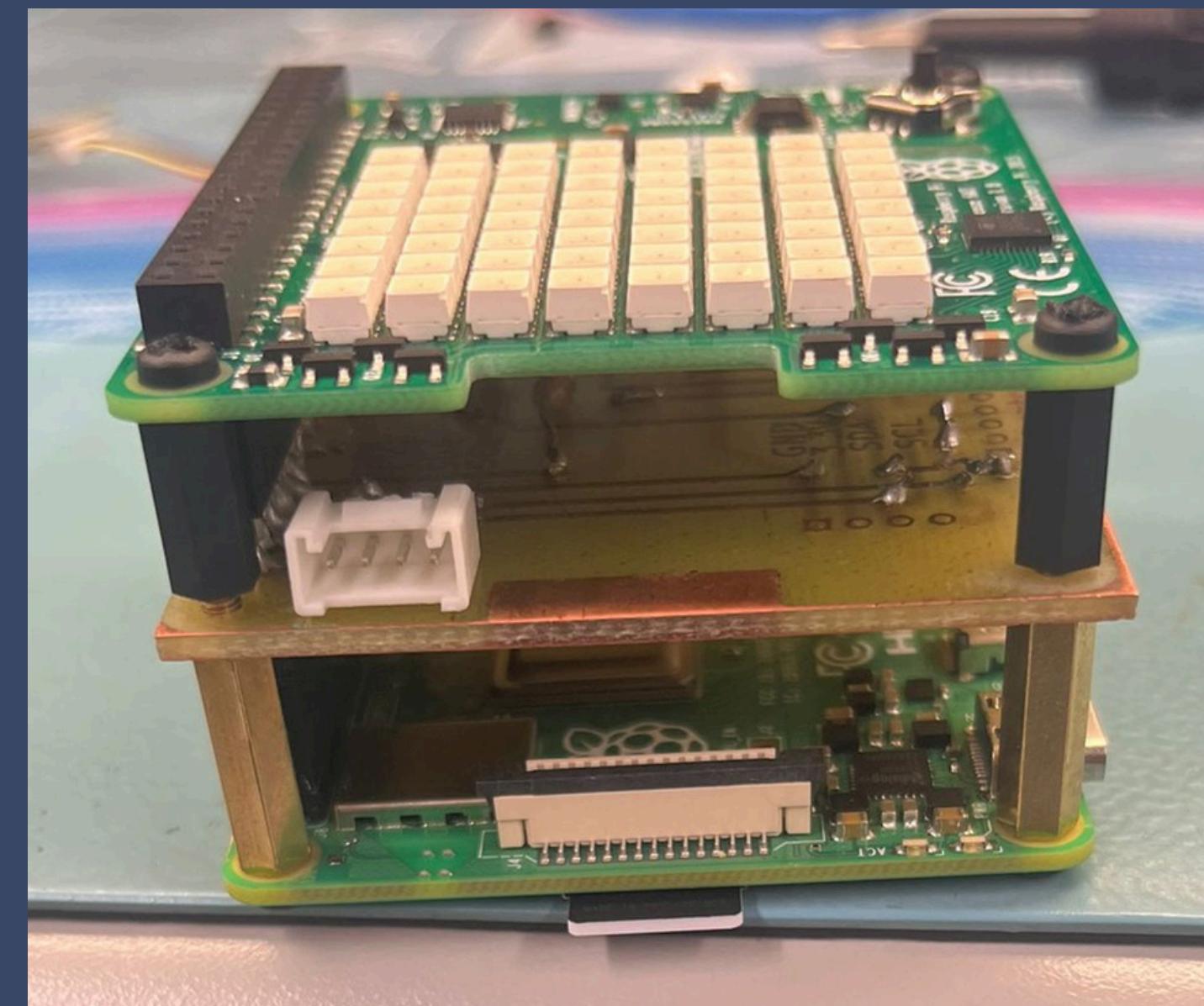
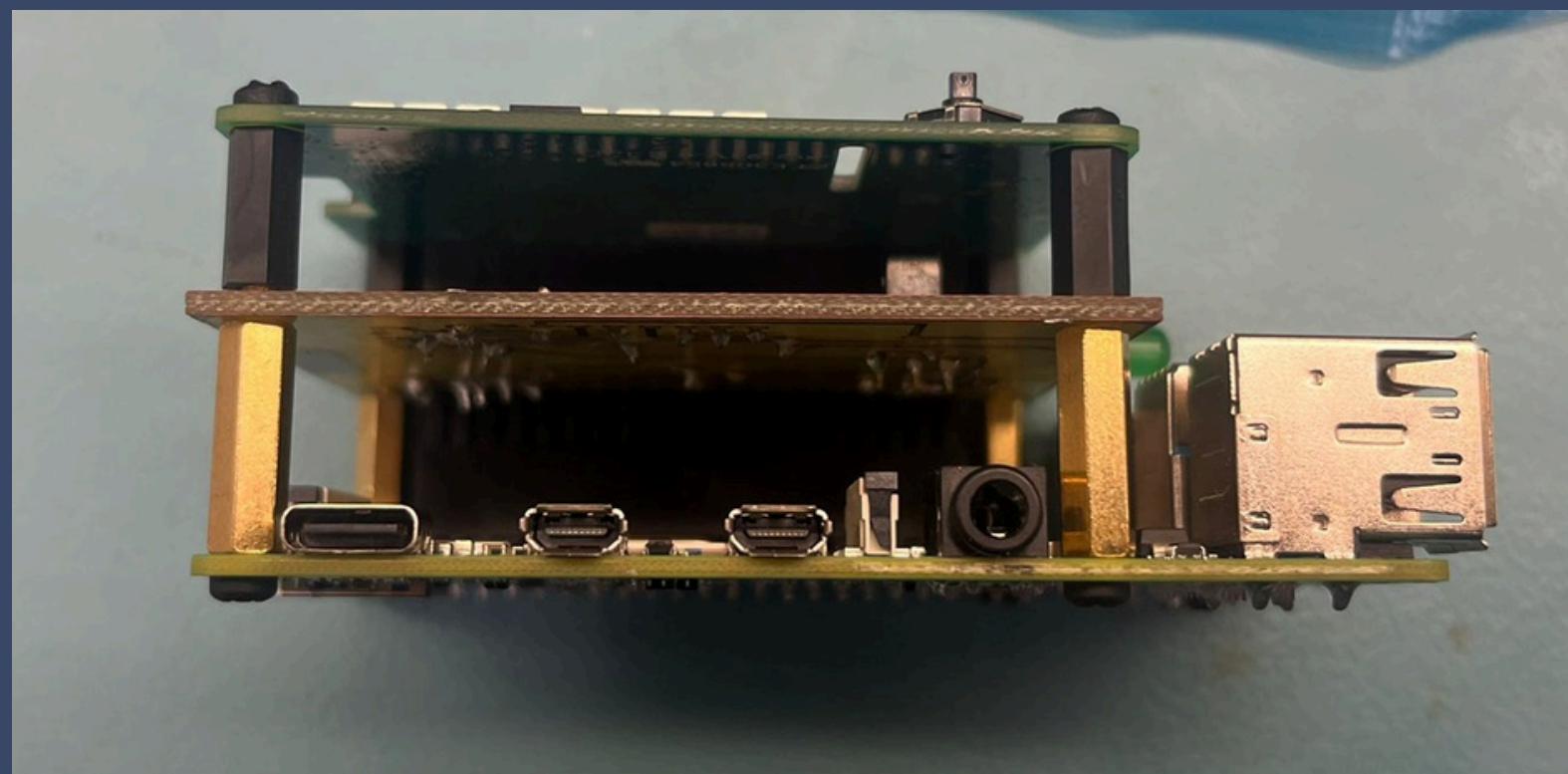




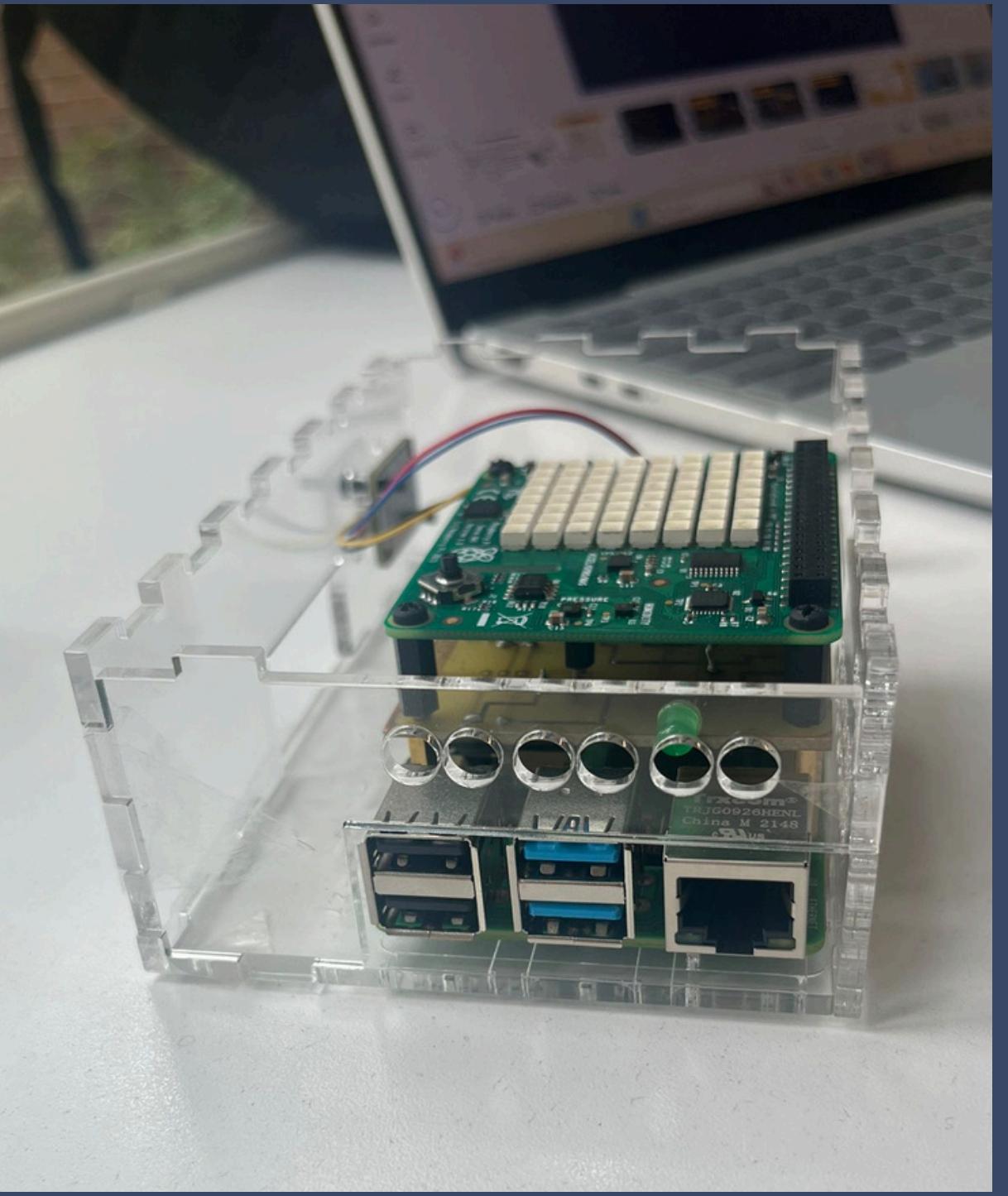
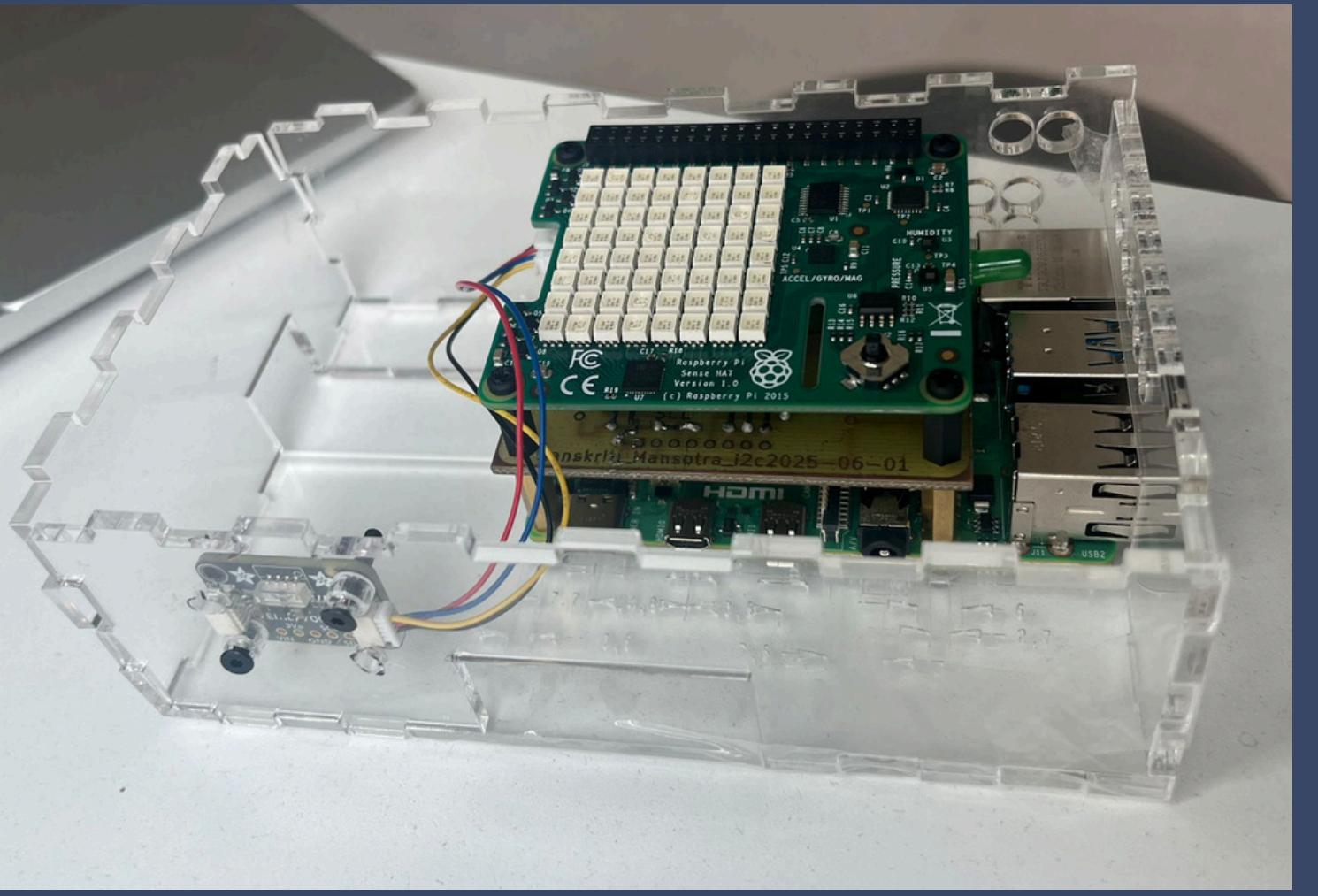
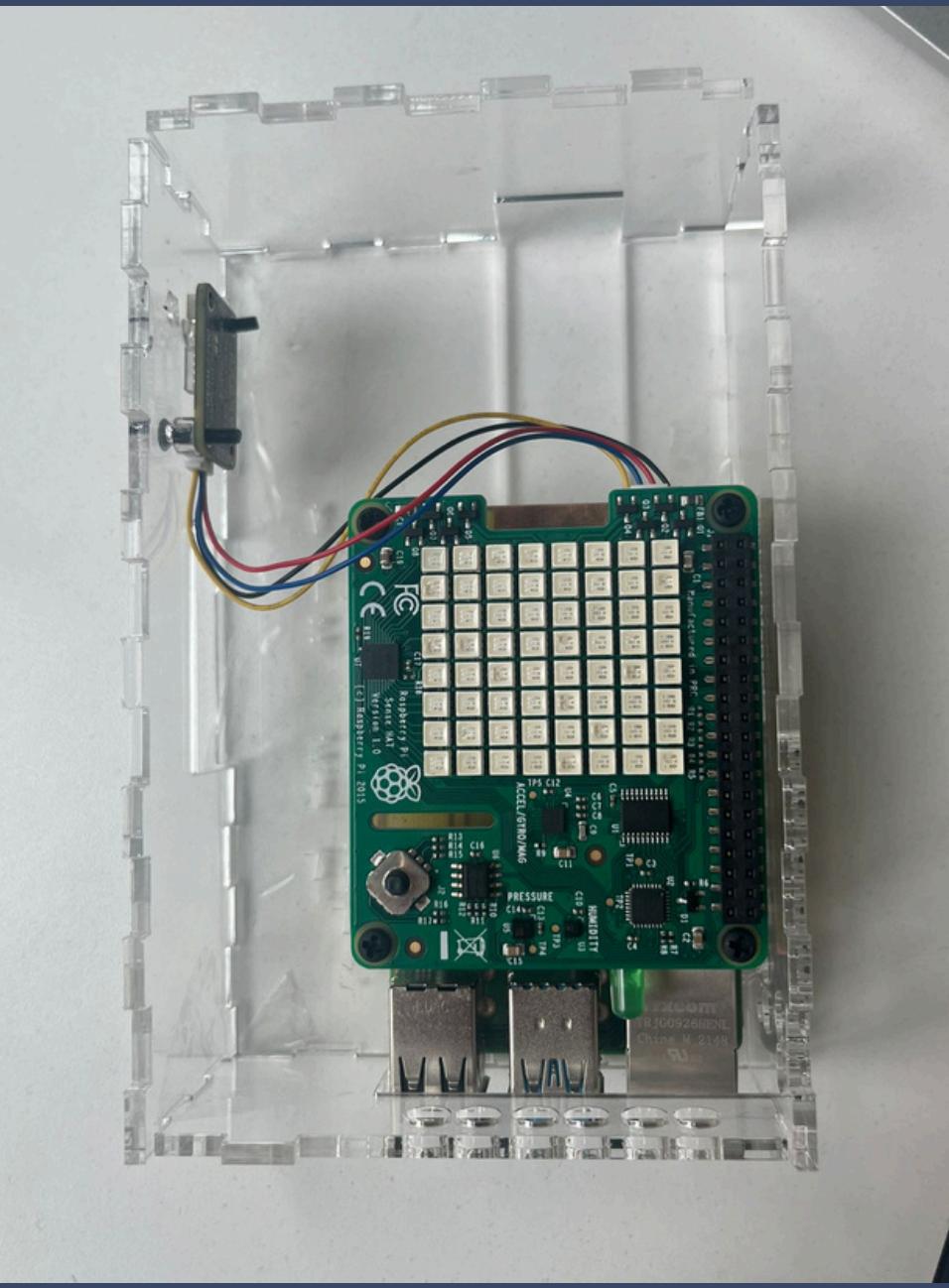
Printed PCB



Assembled PCB



Assembled case and 3d model



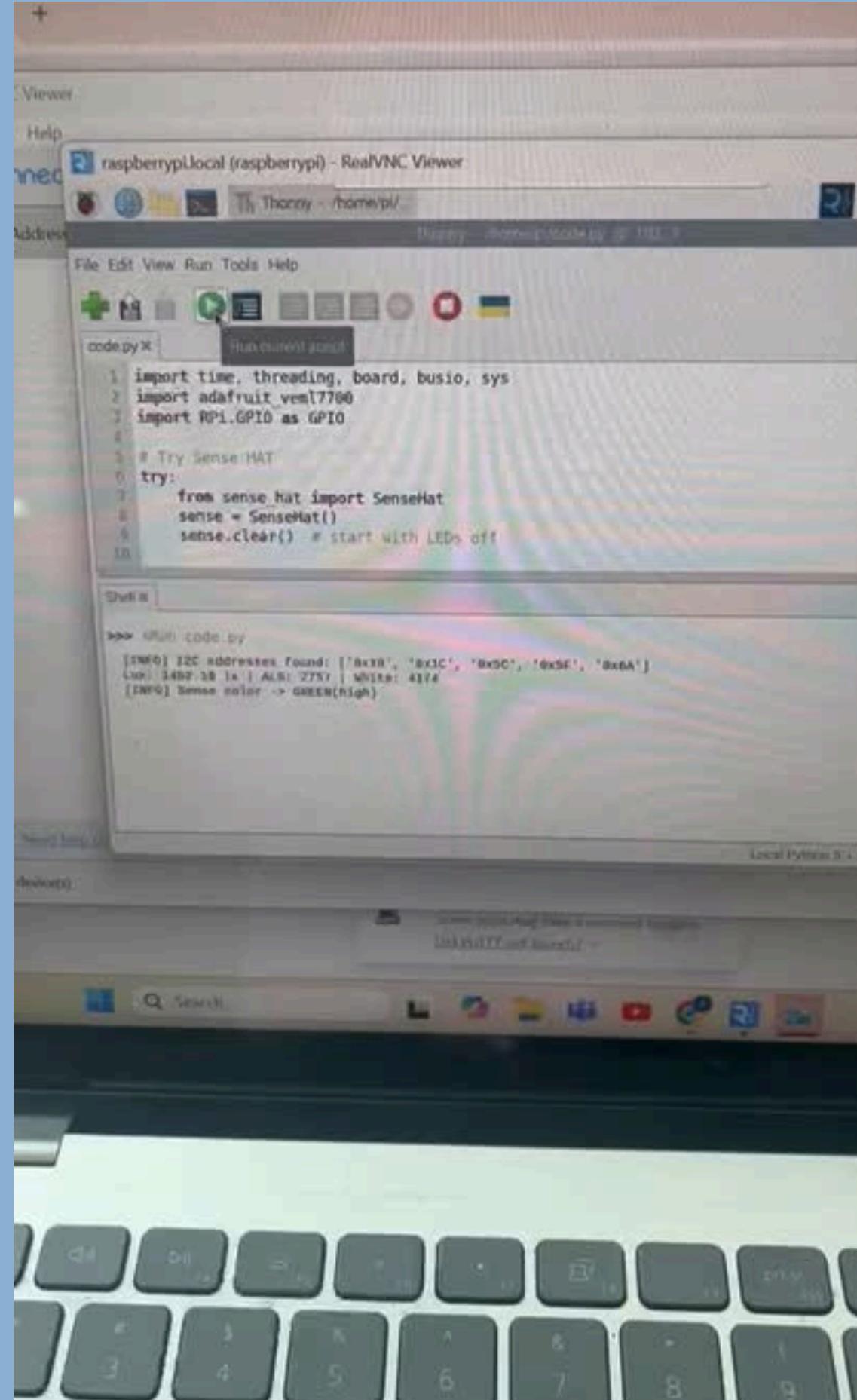
Code

code.py *%

```
1 import time, threading, board, busio, sys
2 import adafruit_veml7700
3 import RPi.GPIO as GPIO
4
5 # Try Sense HAT
6 try:
7     from sense_hat import SenseHat
8     sense = SenseHat()
9     sense.clear() # start with LEDs off
10
11    SENSE_OK = True
12 except Exception as e:
13     print("[ERR] Sense HAT import/init failed:", e)
14     sense = None
15     SENSE_OK = False
16
17 # Optional: quick I2C scan (no extra deps)
18 def i2c_scan(i2c):
19     found = []
20     while not i2c.try_lock():
21         pass
22     try:
23         found = i2c.scan()
24     finally:
25         i2c.unlock()
26     return ["0x%02X" % a for a in found]
27
28 # --- CONETS ---
29 # === CONFIG ===
30 LED_PIN = 17
31 BLINK_INTERVAL = 0.5
32 LUX_LOW = 50.0
33 HYST = 5.0
34 # === GPIO ===
35 GPIO.setmode(GPIO.BCM)
36 GPIO.setup(LED_PIN, GPIO.OUT)
37
38 # === I2C + sensor ===
39 i2c = busio.I2C(board.SCL, board.SDA)
40 print("[INFO] I2C addresses found:", i2c_scan(i2c))
41 veml7700 = adafruit_veml7700.VEML7700(i2c)
42
43 # === Sense color helper ===
44 def set_sense_color(low):
45     if not SENSE_OK:
46         return
47     trv:
```

```
40     return
41
42     try:
43         sense.clear((255,0,0) if low else (0,255,0))
44     except Exception as e:
45         print("[ERR] Sense HAT clear failed:", e)
46
47     # === Threads ===
48     def blink_led():
49         while True:
50             GPIO.output(LED_PIN, GPIO.HIGH); time.sleep(BLINK_INTERVAL)
51
52             GPIO.output(LED_PIN, GPIO.LOW); time.sleep(BLINK_INTERVAL)
53
54     def read_sensor():
55         current_low = None
56         while True:
57             try:
58                 lux = float(veml7700.lux)
59                 als = float(veml7700.light)
60                 white = float(veml7700.white)
61                 print(f"Lux: {lux:.2f} lx | ALS: {als:.0f} | White: {white:.0f}")
62
63                 # hysteresis
64                 if current_low is None:
65                     new_low = lux < LUX_LOW
66                 elif current_low:
67                     new_low = lux < (LUX_LOW + HYST)
68                 else:
69                     new_low = lux < (LUX_LOW - HYST)
70
71                 if new_low != current_low:
72                     current_low = new_low
73                     print(f"[INFO] Sense color -> {'RED(low)' if current_low else 'GREEN(high)'})
74                     set_sense_color(current_low)
75
76             except Exception as e:
77                 print("[ERR] Sensor read failed:", e)
78             time.sleep(1)
```

Video



Challenges and Solution

- **Issue:**

During assembly and testing, the on-board status LED failed to blink when controlled from Raspberry Pi GPIO17 through the NPN transistor (2N4124). Even though software tests confirmed the pin was toggling correctly, there was no visible LED activity.

- **Cause:**

The transistor switching circuit had an interrupted or incorrect conduction path, preventing current from flowing properly to the LED.

- **Solution:**

We inspected the wiring and component placement, identified the faulty path, and corrected the circuit connections so the transistor could switch the LED as intended.

Thanks