upliance.ai – Embedded Systems Intern Assignment

1.INTRODUCTION

This project simulates a heater control system using an ESP32 microcontroller and a DHT22 temperature sensor. The system transitions through multiple states: IDLE, HEATING, STABILIZING, TARGET_REACHED, and OVERHEAT based on real-time temperature readings. An LED simulates the heater, and a buzzer alerts when an overheat condition is detected. All operations are logged to the Serial Monitor.
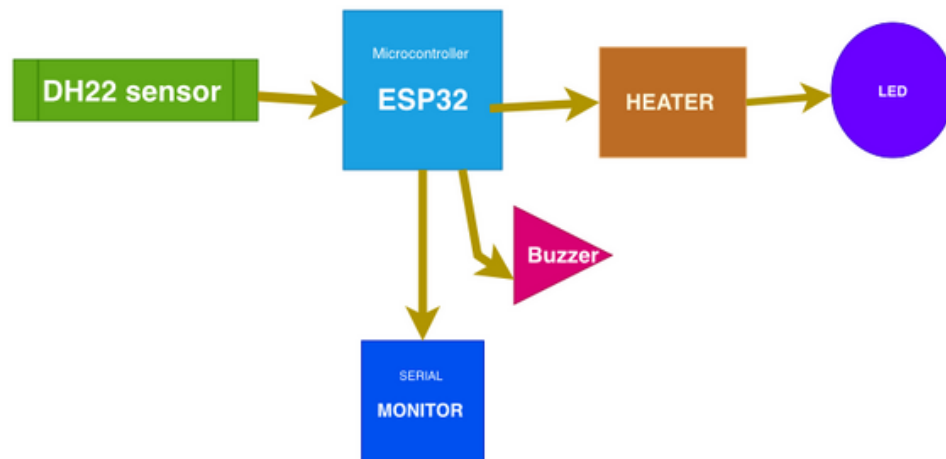
2. SENSORS USED

- DHT22 – Digital Temperature and Humidity Sensor (only temperature is used)

3. COMMUNICATION PROTOCOL

- One-Wire Protocol used by DHT22 for communication with ESP32

4. BLOCK DIAGRAM

5. SYSTEM STATES

- IDLE – System inactive
- HEATING – Heater (LED) is ON
- STABILIZING – Approaching target temp
- TARGET_REACHED – Target temp achieved
- OVERHEAT – Temp above limit; buzzer ON

6. STATE TRANSITION LOGIC

If temp < TARGET_TEMP - 3   → HEATING
If TARGET_TEMP - 3 ≤ temp < TARGET   → STABILIZING
If TARGET_TEMP ≤ temp ≤ OVERHEAT   → TARGET_REACHED
If temp > OVERHEAT_TEMP   → OVERHEAT

7. WOKWI SIMULATION LINK

https://wokwi.com/projects/438090817197413377

8. FUTURE ROADMAP

1.BLUETOOTH (BLE) CONTROL
use ESP32's Bluetooth to monitor or control the heater from a mobile app.

2.PID TEMPERATURE CONTROL
IMplement PID logic for smoother, more precise temperature control.

3. MOBILE APP INTEGRATION
Build an app that shows temperature, state, and remote ON/OFF control.

9. ACKNOWLEDGEMENT

I would like to thank the upliance.ai team for the opportunity to work on this assignment.It helped me better understand real-world embedded system design, sensor communication, and state machine logic.

Thank You!