

USER MANUAL – AUTOMATED ROOF COOLING SYSTEM

1. Introduction

The Automated Roof Cooling System is designed to reduce roof temperature automatically using DHT22 sensors and a water pump controlled by an ESP32 microcontroller. This IoT-based system utilizes Node-RED as a monitoring platform to display temperature readings, system status, and manual pump controls.

2. List of Components

- ESP32 Devkit V1
- 2x DHT22 Temperature & Humidity Sensors (Indoor & Outdoor)
- Relay Module (1 Channel)
- Water Pump
- Power Supply 5V / 12V (depending on pump type)
- Pipes and Sprinkler
- Laptop/PC running Node-RED
- WiFi connection (same network for ESP32 and PC)

3. Component Connections

- Connect DHT22 (Indoor) to pin D4 on ESP32.
- Connect DHT22 (Outdoor) to pin D5 on ESP32.
- Connect Relay module to pin D18 on ESP32.
- Connect relay output to the water pump.
- Ensure all power connections are correct and stable.

4. How to Operate the System

Step 1 – Node-RED Setup

1. Open Node-RED on the PC.
2. Ensure the MQTT broker is running (e.g., localhost or test.mosquitto.org).
3. Import the project flow into Node-RED.
4. Deploy the flow and open the Dashboard (<http://localhost:1880/ui>).

Step 2 – ESP32 Setup

1. Upload the ESP32 code using Arduino IDE.
 2. Make sure the WiFi SSID and password match the PC network.
 3. Open Serial Monitor to verify the MQTT connection.
- Message 'Connected to MQTT broker' confirms successful connection.

Step 3 – System Testing

1. Observe Indoor and Outdoor temperature on the Node-RED dashboard.
2. When temperature exceeds the threshold (e.g., 35°C), the water pump activates automatically.
3. Status changes to 'Water Cooling is Running'.
4. When temperature drops, the pump stops and status reverts to 'Standby Mode'.

5. Manual Control Function

The Node-RED dashboard includes a manual ON/OFF button to control the water pump directly without depending on temperature readings. Notifications are sent when the pump is manually turned on or off.

6. Maintenance

- Ensure DHT22 sensors are kept dry and protected from water.
- Clean the sprinkler to prevent clogging.
- Check relay and pump connections regularly.
- Maintain a stable WiFi connection for smooth data transmission.

7. Safety

- Avoid touching electronic components while the system is running.
- Use suitable DC power supply for the water pump.
- Do not run the pump without water to prevent damage.

8. Conclusion

This project provides an automated solution for reducing roof temperature efficiently. It is suitable for residential houses, offices, or laboratories exposed to high heat. The system promotes energy efficiency and supports environmental sustainability.