PROJECT REPORT

Title: Real-Time Industrial Temperature Monitoring and Emergency Alert System

Mode: Simulation in Wokwi using ESP32, RGB LED, Potentiometer, and Buzzer

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📝 1. Project Overview

This project simulates a **real-time temperature monitoring system** for industrial machines. It continuously monitors temperature using a **potentiometer (as a temperature sensor)** and provides alerts through:

- A **buzzer** when the temperature exceeds a safe threshold.
- A **RGB LED**, cycling through Red → Green → Blue for visual status.
- A **16x2 I2C LCD** to display live temperature.
- **Serial monitor** for logging data and simulating emergency SMS alerts.

🧪 **Platform**: Wokwi – No hardware required.

🏭 2. Industry Use Case

⚙️ Scenario:

In factories, machines such as motors or furnaces may overheat due to continuous operation.

🎯 Objective:

- Prevent equipment failure by early detection of overheating.
- Alert staff before damage occurs.

✅ Solution:

- Real-time temperature monitoring
- Local buzzer alert
- Simulated SMS alert via Serial Monitor
- Visual feedback with multi-color LED
- Entire system simulated in Wokwi

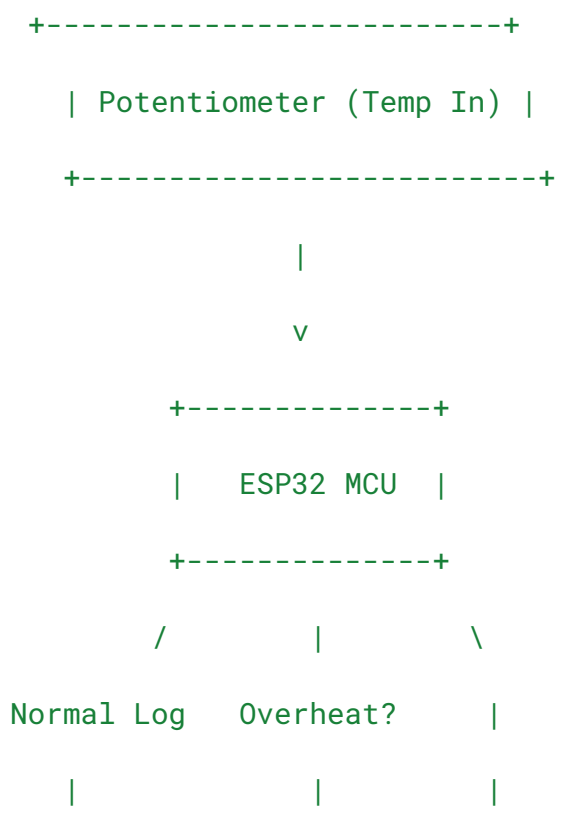
🔧 3. System Architecture

Component	Purpose
ESP32	Main microcontroller
Potentiometer	Simulates temperature input
RGB LED	Visual color alert (cycling every 1s)
Buzzer	Audio alert on high temperature
LCD 16x2 (I2C)	Displays live temperature and status
Serial Monitor	Logs system status and simulated alerts

⚠️ Trigger Threshold:

If simulated temperature > **60°C**, buzzer activates and alert message is logged.

🔁 4. Workflow Diagram



```
Serial ←-- Yes --+--→ Buzzer ON
Monitor          → RGB LED Color Cycle
                 → Simulated Alert Log
```

🧪 5. Test Cases and Expected Results

Test Case	Input Temp	Expected Output
Normal operation	`< 60°C`	LCD shows temp, buzzer OFF, normal log
At threshold	`= 60°C`	LCD warning, buzzer ON, alert log
Above threshold	`> 60°C`	Buzzer ON, RGB cycling, emergency alert log
Temp back to normal	`< 60°C`	Buzzer OFF, LCD shows "Status: NORMAL"

🚨 6. Emergency Alert Simulation

When temperature crosses the **threshold (60°C)**:

Simulated Serial Output:

text

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```
⚠️ ALERT: Temperature exceeded 60°C.
Buzzer Activated.
Simulated SMS sent to +91XXXXXXXXXX.
```

Real-world upgrade ideas:

- Use Twilio API for SMS
- Trigger email/Telegram via IFTTT

- Push data to Google Sheets or Firebase

✅ 7. Advantages

- 💡 No hardware required — 100% Wokwi-based
- 🔧 Preventive maintenance solution
- 🚀 Ready to scale to real-world deployment
- 🌐 Can be expanded to cloud dashboards
- 🔔 Simulates emergency alerts and system logs

🛠️ 8. Tools and Technologies Used

Tool/Library	Purpose
Wokwi	Circuit simulation
ESP32	Main microcontroller
LiquidCrystal_I2C	LCD display driver
Potentiometer	Simulated temperature sensor
RGB LED	Multi-color visual alert
Serial Monitor	Logging and alert emulation

🌱 9. Future Enhancements

- 🔗 Integrate real sensors (e.g., DHT22, LM35)
- ☁️ Store logs in Google Sheets/Firebase

- 📧 Add Telegram/Email alerts via webhook
- 📊 Display data on a real-time dashboard
- 🔁 OTA firmware updates
- 🧩 Add support for multiple temperature points

📌 10. Conclusion

This project successfully demonstrates an **IoT-based industrial safety system** that monitors temperature, generates alerts, and logs status in real-time — all within a virtual simulation using **Wokwi** and **ESP32**.