IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, November 2026
Impact Factor: 8.2

IoT Based Temperature Monitoring of Transformer

Shinde Aditi[1], Raybhoge Sarswati[2], Prof. S. S. Puri[3]
[1],[2] Students, M. S. Bidve Engineering College, Latur, Maharashtra
[3]Assistant Professor, M. S. Bidve Engineering College, Latur, Maharashtra

Abstract : *The IoT-Based Transformer Temperature Monitoring System is designed to continuously monitor transformer temperature and provide real-time information to users.*
The system uses a DS18B20 temperature sensor to measure transformer temperature and a NodeMCU ESP8266 microcontroller to process the readings. The temperature is displayed on an I2C LCD and uploaded to the ThingSpeak IoT cloud platform through Wi-Fi every 20 seconds.
Users can remotely monitor the transformer temperature using a mobile phone or computer. If the temperature exceeds a predefined limit, the system generates a high-temperature alert to warn users about overheating.
Overall, this project provides a simple, economical, and effective solution for remote transformer temperature monitoring, early fault detection, and prevention of transformer damage

Keywords: IoT Based Temperature Monitoring of Transfarmer

IINTRODUCTION

Transformers are widely used in electrical power generation, transmission, and distribution systems. They are used to increase or decrease AC voltage according to the requirements of electrical equipment and power distribution networks. During transformer operation, heat is generated due to copper losses in the windings, iron losses in the magnetic core, overloading, and surrounding environmental conditions. If the temperature of a transformer increases beyond its permissible operating limit, it can damage the winding insulation, reduce the life of the transformer, and sometimes result in complete equipment failure. Therefore, continuous temperature monitoring is an important requirement for transformer safety and reliable operation.

II. OBJECTIVE OF THE PROJECT

1. **Prevent Transformer Overheating:** To detect excessive temperature and prevent overheating of the transformer.
2. **Early Fault Detection:** To identify abnormal temperature rise and detect possible faults before serious damage occurs.
3. **Remote Monitoring:** To monitor transformer temperature from anywhere using a mobile phone or computer through the Internet.
4. **Automatic Alert System:** To send alerts or notifications when the temperature exceeds the predefined safe limit.
5. **Improve Transformer Life:** To increase the operating life of the transformer by maintaining its temperature within safe limits.
6. **Reduce Maintenance Cost:** To reduce manual inspection and maintenance expenses through continuous automatic monitoring.

Copyright to IJARSCT
www.ijarsct.co.in
DOI: 10.48175/IJARSCT-40916

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, November 2026
Impact Factor: 8.2

III. HARDWARE COMPONENTS USED

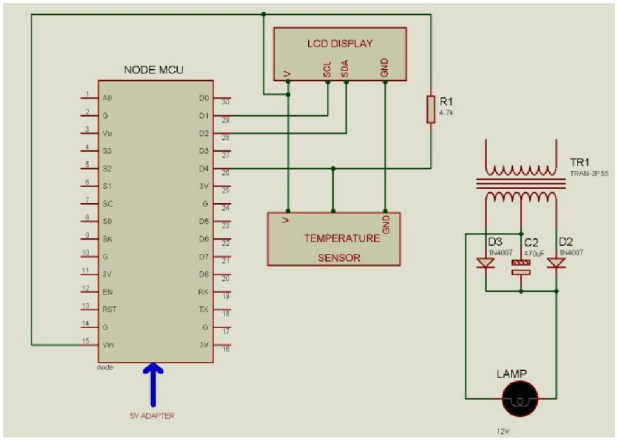
1. **DS18B20 Temperature Sensor**
   Measures the temperature of the transformer. Provides digital temperature readings. Sends temperature data to the NodeMCU.
2. NodeMCU ESP8266 Acts as the main controlling unit. Processes temperature readings. Uses built-in Wi-Fi to upload data to thecloud.
3. Jumper Wires Connect the sensor, NodeMCU and LCD. Carry signals and power between components.
4. 7 kΩ Pull-up Resistor Connected between the DS18B20 data pin and supply. Ensures reliable communication through the One-Wire interface
5. Step down transformer –provides a reduced voltage from the AC mains supply, which can be converted into regulated DC for operating the transformer temperature monitoring system.

IV. WORKING

Power Supply Connections: The 5V adapter is connected to the VIN and GND terminals of the NodeMCU ESP8266. It provides the required input power to the development board. The NodeMCU generates the regulated voltage required by the connected sensors and interfacing circuits. All low-voltage circuit grounds must be connected together to establish a common reference.

Transformer, Rectifier and Load Connections: The circuit diagram shows a step-down transformer TR1, two 1N4007 rectifier diodes D2 and D3, and a 470µF filter capacitor C2.

The secondary winding of the transformer is connected to the rectifier arrangement. The two diodes are used to convert the AC voltage into DC voltage, and the capacitor is connected across the rectified output to reduce voltage fluctuations. The resulting DC supply is connected to the 12V lamp load as shown in the circuit diagram.



Working of Circuit: The IoT-Based Transformer Temperature Monitoring System starts working when the 5V adapter supplies power to the NodeMCU ESP8266. After power-up, the microcontroller initializes the DS1820 temperature sensor and I2C LCD display. The Wi-Fi module then connects to the configured wireless network to establish internet connectivity.

The DS1820 sensor continuously senses the temperature of the transformer and sends digital temperature readings to the NodeMCU through the D4 data pin. The microcontroller receives the readings and processes them to obtain the temperature in degrees Celsius. The measured temperature is displayed on the I2C LCD so that the operator can observe the transformer temperature locally.

The controller compares the measured temperature with a predefined temperature threshold stored in the program. the LCD displays the normal condition and no high-temperature alert is generated. If the temperature exceeds the specified

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429 Volume 6, Issue 4, November 2026 Impact Factor: 8.2

threshold, the controller identifies an overheating condition and generates a high-temperature alert. The alert can also be represented through the cloud monitoring system.

At the same time, the NodeMCU uses its built-in Wi-Fi connectivity to send the measured temperature to the ThingSpeak cloud platform every 20 seconds. ThingSpeak stores the received data and displays it in graphical form. The user can access the cloud dashboard through a mobile phone, laptop, or computer to observe the latest temperature and previous temperature records. In this way, the system provides continuous temperature monitoring, automatic data transmission, and early indication of transformer overheating.

V. ADVANTAGES

1. **Continuous Temperature Monitoring**: The system continuously monitors transformer temperature and displays real-time readings on the LCD.
2. **Remote Monitoring:** Using Wi-Fi and ThingSpeak, users can monitor transformer temperature remotely through a mobile phone or computer.
3. **Early Overheating Detection:** The system generates an alert when the temperature exceeds the predefined limit, helping to identify overheating conditions.
4. **Automatic Data Recording:** Temperature information is automatically uploaded to the cloud every 20 seconds, allowing users to observe previous temperature readings and monitor temperature variations.

VI. DISADVANTAGES

1. **Internet Dependency:** The system requires a stable Wi-Fi or internet connection to upload temperature data to the cloud and enable remote monitoring.
2. **Power Supply Dependency**: The system requires a continuous power supply to operate properly. Power failure may interrupt temperature monitoring.
3. **Sensor Accuracy:** The accuracy of temperature monitoring depends on the quality and calibration of the temperature sensor. Incorrect readings may affect system performance.
4. **Limited Monitoring Range**: The system can monitor only the temperature at the location where the sensor is installed. Additional sensors are required to monitor multiple points.

VII. RESULT

The IoT-Based Transformer Temperature Monitoring System successfully provides continuous monitoring of transformer temperature using a DS1820 digital temperature sensor and NodeMCU ESP8266. The measured temperature is displayed on an I2C LCD and transmitted to the ThingSpeak cloud platform at regular intervals of 20 seconds. When the temperature exceeds the predefined threshold, a high-temperature alert is generated, while normal temperature conditions do not produce an alert. Thus, the proposed system provides an economical and effective solution for local and remote transformer temperature monitoring.

VIII. APPLICATION

1. **Electrical Substations:** Used for monitoring the temperature of distribution transformers installed in electrical substations.
2. **Industrial Power Systems:** Useful for monitoring transformers used in industrial electrical installations and manufacturing units.
3. **Distribution Transformers:** Can be used for monitoring the external surface temperature of distribution transformers in electrical distribution networks.
4. **Educational Laboratories**: Useful for demonstrating IoT-based temperature monitoring, wireless communication, and transformer protection concepts in engineering and polytechnic laboratories.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 4, November 2026
Impact Factor: 8.2

IX. FUTURE SCOPE

1. **Real-Time Fault Detection**: In the future, the system can be upgraded to detect
2. different types of transformer faults by monitoring temperature and other operating parameters.
3. **Mobile Application Development:** A dedicated mobile application can be developed to monitor transformer temperature and receive instant notifications from anywhere.
4. **AI-Based Temperature Prediction:** Artificial Intelligence (AI) and Machine Learning (ML) can be used to predict future temperature variations and identify possible overheating conditions before failure occurs.
5. **Automatic Cooling System:** The system can be connected to cooling fans or pumps that automatically operate when the transformer temperature exceeds the predefined limit.
6. **Monitoring Multiple Parameters:** In the future, additional sensors can be added to monitor oil temperature, humidity, voltage, current, and load conditions of the transformer.

X. CONCLUSION

The IoT-Based Transformer Temperature Monitoring System provides an efficient and reliable method for continuously monitoring transformer temperature. It displays real-time temperature readings on an LCD and allows remote monitoring through Wi-Fi and the ThingSpeak cloud platform. The system helps detect overheating conditions at an early stage and reduces the risk of transformer damage. Overall, this project improves transformer safety, reliability, and maintenance while supporting smart monitoring of electrical systems.

REFERENCES

1. G. R. Yadav, A. N. Reddi, D. R. Kumar, P. Sumanth, and E. Nooka Raju, "IoT Based Transformer Health Monitoring System," International Journal of Recent Advances in Multidisciplinary Topics (IJRAMT), Vol. 4, No. 4, pp. 236–239, April 2023. DOI: 10.65138/ijramt.2023.v4i4.3318.
2. "Transformer Real Time Health Monitoring System," 2022 IEEE Delhi Section Conference (DELCON), February 2022. DOI: 10.1109/DELCON54057.2022.9753348.
3. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill Education India, 2017.
4. S. V. Kulkarni and S. A. Khaparde, Transformer Engineering: Design, Technology, and Diagnostics, 2nd Edition, CRC Press, 2013.