

ABSTRACT

Electricity is a fundamental necessity in modern life, with power transformers serving as vital components in substations for voltage conversion. Uncontrolled temperature increases, especially in older transformers with limited monitoring, can significantly reduce efficiency and performance. This study implements IoT technology and fuzzy logic to develop a real-time monitoring and temperature control system for transformer cooling. The system monitors oil, body, and ambient temperatures using Node-RED as the IoT platform, MySQL as the database, and MQTT as the hosting server. The system demonstrates high accuracy in temperature readings: the DS18B20 sensor achieves an average accuracy of 99.43%, the MLX90614 sensor 99.19% at a 2 cm distance, and the DHT11 sensor 98.37%. Data transmission to the IoT server is highly reliable, with zero data loss and an average delay of 2.607 seconds across 300 data samples. Fan speed control is implemented using fuzzy logic with 27 rules, achieving an average error of 0.183816% compared to MATLAB simulations. These findings highlight the effectiveness and reliability of IoT and fuzzy logic-based systems for real-time monitoring and precise temperature control of transformers, enhancing their operational efficiency and extending their lifespan.

Keywords: Accuracy, fuzzy , Power transformer, MATLAB, MQTT, Node-RED,