

# IoT-Based Monitoring and Control of Substation Equipment

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**Abstract:** *The reliability and efficiency of electrical power systems are critical for modern industrial and domestic applications. Substations play a vital role in power transmission and distribution, where continuous monitoring and control are essential to avoid failures and ensure system stability. This paper presents an Internet of Things (IoT)-based system for real-time monitoring and control of substation equipment. The proposed system uses sensors to measure parameters such as voltage, current, temperature, and transformer oil level. These parameters are continuously monitored using a microcontroller (ESP32), and the data is transmitted to a cloud server for remote access via a web or mobile application. In case of abnormal conditions, the system automatically triggers protective mechanisms such as relays and circuit breakers while generating alerts. The proposed system improves reliability, reduces maintenance costs, and enhances operational efficiency.*

**Keywords:** IoT, Substation Automation, ESP32, Real-Time Monitoring, Smart Grid, Sensors, Relay Protection

