Design and Simulation of an IoT-Enabled Distribution Transformer Monitoring System

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Abstract

Distribution transformers constitute a critical com-ponent of the power distribution system, and their failure can lead to power interruptions that negatively impact economic activities. Conventional transformer monitoring methods rely on periodic manual inspection, which is inefficient and unable to provide continuous condition assessment. This paper presents the simulation and design of an IoT-based distribution transformer monitoring system using Proteus software. The proposed system employs an ESP32 microcontroller along with temperature, oil level, and ambient condition sensors to monitor transformer parameters in real time. The measured data are displayed locally and transmitted to the ThingSpeak cloud platform for remote monitoring. Protective features such as relay control are incorpo-rated to respond to abnormal operating conditions. Simulation results confirm accurate sensing, reliable communication, and effective fault detection, demonstrating the suitability of the proposed system for smart grid applications.

Index Terms

Distribution Transformer, ESP32, Internet of Things, Condition monitoring, Smart Grid, Proteus