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Industrial Motor Protection System Using IoT

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Abstract - Single-phase induction motors are essential in domestic and industrial applications due to their low cost and simple construction. However, they are highly vulnerable to electrical faults such as overvoltage, undervoltage, and overcurrent. This paper proposes an IoT-based system using an Arduino Uno and a PZEM-004T module to monitor electrical parameters including voltage, current, power, and frequency in real-time. The system features an automated protection mechanism that trips a relay when parameters exceed safe limits. Data is uploaded to the ThingSpeak IoT platform for remote monitoring. Experimental results show improved safety and reliability in motor operations.

1. INTRODUCTION

Induction motors are widely used but require continuous monitoring to prevent damage and extend their lifespan. Traditional protection systems often lack remote monitoring and data logging capabilities. This research integrates Internet of Things (IoT) technology to provide a reliable, low-cost solution for real-time fault detection.

2. LITERATURE REVIEW

Recent studies have explored various protection methods:

- Prabakaran et al. (2023) developed an IoT-based system for electric vehicles, though it required constant internet connectivity.
- Kumar et al. (2023) focused on hardware-based protection but lacked real-time user interfaces.
- Prakash et al. (2022) utilized voltage and current sensing to prevent damage, but the system lacked scalability.

The proposed system addresses these gaps by combining local LCD feedback with remote cloud logging.

3. PROPOSED SYSTEM ARCHITECTURE

The system is built using the following core components:

- Arduino Uno: Acts as the central processing unit.
- PZEM-004T Module: Measures voltage, current, power, frequency, and power factor.
- ESP8266-01 Wi-Fi Module: Transmits data to the ThingSpeak cloud.
- Relay Module: Disconnects the motor during abnormal conditions.
- 16x2 LCD: Provides local real-time monitoring.

4. WORKING METHODOLOGY

1. Measurement: The PZEM-004T continuously monitors the motor's electrical parameters.
2. Processing: The Arduino reads these values and compares them with predefined safe thresholds.
3. Protection: If a fault (e.g., overcurrent) is detected, the Arduino triggers the relay to trip, protecting the motor.
4. Communication: Data is simultaneously displayed on the LCD and sent via Wi-Fi to the ThingSpeak platform for

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remote access.

5. CONCLUSION

The implemented system provides an efficient and low-cost solution for the protection of single-phase induction motors. By incorporating IoT, the system enables data logging for analysis and ensures automatic protection, making it ideal for agricultural and industrial applications.

6. FUTURE SCOPE

Future enhancements include:

- Extending the system for three-phase motors.
- Integrating GSM-based SMS alerts.
- Using AI for predictive maintenance.