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TRANSFORMER MONITORING AND CONTROLLING SYSTEM USING IOT.

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Abstract:

The integration of Internet of Things (IoT) technology with transformer monitoring and control systems has revolutionized the way transformers are managed in modern electrical grids. This paper presents a comprehensive overview of a Transformer Monitoring and Controlling System (TMCS) utilizing IoT principles. The system employs various sensors to continuously monitor key parameters such as temperature, oil level, and power consumption, providing real-time data transmission to a central server via the internet.

The TMCS utilizes cloud computing and data analytics techniques to process the incoming data, enabling predictive maintenance strategies and fault detection algorithms. Through a user-friendly interface, operators can remotely monitor transformer health, receive alerts for abnormalities, and schedule maintenance activities efficiently.

Moreover, the TMCS incorporates advanced control mechanisms facilitated by IoT-enabled actuators, allowing for remote adjustment of operational parameters and load balancing. This enhances grid resilience and optimizes transformer performance, contributing to improved reliability and cost-effectiveness in power distribution networks.

Keywords: -The Transformer Monitoring and Controlling System is designed to enhance the operational efficiency and reliabilityof power distribution systems by employing advanced sensors, IoT technology, and automatic control mechanisms. The system consists of two 12V transformers, each equipped with a 1-wire temperature sensor, two ultrasonic sensors for monitoring oil levels, and a voltage sensor. The Nedelcu controller acts as the central processing unit, interfacing with sensors and facilitating communication with an IoT mobile application, Blynk.

Introduction:

n today's rapidly evolving technological landscape, the Internet of Things (IoT) has emerged as a transformative force, revolutionizing various industries with its ability to connect devices, collect data, and enable smart, efficient systems. One critical area where IoT is making significant strides is in the monitoring and controlling of transformers.

Transformers play a crucial role in electricity distribution, converting voltage levels to facilitate efficient transmission and distribution. However, they are susceptible to various operational challenges, including overheating, voltage fluctuations, and insulation degradation, which can lead to failures, costly repairs, and even safety hazards. Traditional monitoring methods often lack real-time insights and require manual intervention, making it difficult to detect and address issues promptly.

To address these challenges, a Transformer Monitoring and Controlling System (TMCS) leveraging IoT technologies is proposed. This system integrates sensors, communication devices, data analytics, and control mechanisms to provide comprehensive monitoring, analysis, and management of transformer operations in real-time.

Working of the Transformer Monitoring and Controlling System in Steps:

1. Initialization:

- Upon power-up, the Nedelcu controller initializes the system, establishing connections with sensors and the Blynk IoT platform.

2. Sensor Data Acquisition:

- The 1-wire temperature sensors continuously measure the temperatures of both transformers, while ultrasonic sensors monitor the oil levels. The voltage sensor captures real-time voltage readings.

3. Data Processing:

- The Nedelcu processes the acquired sensor data to determine if any temperature or oil level has crossed predefined thresholds. If a critical condition is detected, the system proceeds to the next steps.

4. Blynk App Interaction:

- The Nedelcu communicates with the Blynk app to retrieve user-defined settings, including threshold temperatures for automatic switching and manual transformer selection.

5. Automatic Transformer Switching:

- If the temperature of one transformer exceeds the predefined threshold, the system triggers an automatic switch to the other transformer. This ensures continuous power supply while preventing overheating.

6. User-Defined Transformer Selection:

- Users can manually select which transformer is connected to the load through the Blynk app. This feature provides flexibility and control over the power distribution process based on specific operational requirements.

7. Oil Level Monitoring:

- The system continuously checks oil levels in both transformers. If the oil level in any transformer falls below a critical threshold, the Nedelcu generates a notification to alert users through the Blynk app.

8. Voltage Display on Blynk App:

- Real-time voltage readings from the voltage sensor are displayed on the Blynk app, allowing users to monitor the electrical health of the transformers remotely.

9. LCD Display Update:

- The LCD 16x2 display is updated with real-time information, including temperature, oil levels, and voltage, providing a local visual interface for on-site operators.

10. Notification System:

- The system sends notifications to the Blynk app in the event of critical conditions such as automatic transformer switching, low oil levels, or any other predefined alarms.

11. Remote Monitoring:

- Users can remotely monitor the transformer parameters and receive real-time notifications through the Blynk app, providing a convenient and accessible means of managing the system from anywhere.

COMPONENT USED

1. Transformer Parameters Monitoring:

- Two 12V transformers are equipped with 1-wire temperature sensors to continuously monitor temperature variations.

- Ultrasonic sensors are employed to check the oil levels in each transformer, ensuring optimal operational conditions.

2. Voltage Sensing:

- A voltage sensor is integrated to monitor the electrical voltage of the transformers, providing crucial information about the power distribution system's health.

3. Automatic Transformer Switching:

- The system is designed to automatically switch power supply from one transformer to another if the temperature of either transformer exceeds a predefined threshold. This ensures a seamless and continuous power supply.

4. Threshold Configuration via Blynk:

- Threshold temperatures for automatic switching are set through the Blynk IoT mobile application, offering users a convenient and intuitive interface to configure system parameters.

5. Nedelcu Controller:

- The Nedelcu controller serves as the brain of the system, processing sensor data and executing control logic to maintain optimal transformer conditions.

6. LCD Display:

- An LCD 16x2 display is incorporated into the system to showcase real-time parameters, including temperature, oil levels, and voltage, providing operators with a comprehensive overview of the transformers' status.

In conclusion, the Transformer Monitoring and Controlling System ensures the reliable and efficient operation of power distribution by leveraging advanced sensors, automatic control mechanisms, and IoT connectivity. This project enhances the capabilities of traditional transformers, offering a robust and intelligent solution for power distribution system management.

Enhanced Features:

7. User-Defined Transformer Selection:

- The IoT mobile application (Blynk) allows users to manually select which transformer should be connected to the load. This feature provides flexibility and control over the power distribution process, allowing operators to make informed decisions based on specific requirements.

8. Oil Level Notifications:

- The system is equipped with a notification mechanism that sends alerts to the Blynk app if the oil level in any transformer falls below a critical threshold. This proactive notification system helps prevent potential issues related to insufficient oil levels, ensuring the transformers' longevity and reliability.

9. Voltage Display on Blynk App:

- Real-time voltage readings from the voltage sensor are displayed on the Blynk app, providing users with immediate access to crucial information about the electrical health of the transformers. This feature enables quick monitoring and response to voltage variations.

These additional features enhance the user experience and expand the system's capabilities, making it a comprehensive solution for transformer monitoring and control. Users can not only remotely manage transformer connections but also receive timely notifications about critical parameters, contributing to the overall reliability and efficiency of the power distribution system.

LITRATURE SURVEY

1. Until now, only monitoring based system is developed. Monitoring based is effective and efficient but, the only problem is controlling over it requires manpower which is slow and time-consuming operation.

2. To overcome this time lag of the system we need to operate the system as quickly as possible which will increase the efficiency of the system.

We are now adding monitoring in it so that the system can be monitored 24*7.

3. so, if the fault occurs it can be sensed and the load on the transformer will be shifted on another transformer.

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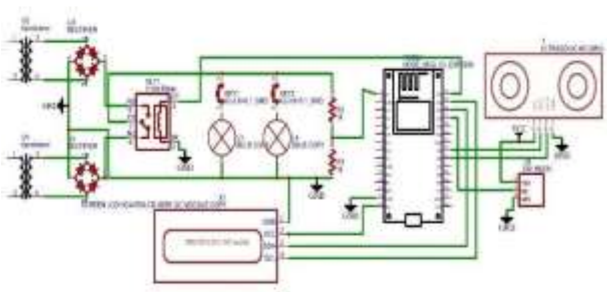
The parameters that will be monitored are Voltage, Temperature and Oil level.

4. As the parameters goes above/below the threshold value the load will be transferred to another transformer and the system will run continuously without any disturbance.

CIRCUIT BLOCK DIGRAM



REFERENCE

- IoT and Remote Monitoring: Explore papers, articles, and books discussing IoT (Internet of Things) applications in transformer condition monitoring, including remote monitoring systems for real-time data collection and analysis.
- Smart Grid and Automation: Investigate resources covering smart grid technologies and automation systems that integrate transformer health monitoring for predictive maintenance and fault detection.
- Data Analytics and AI: Books, articles, and research papers on data analytics, machine learning, and artificial intelligence applied to transformer health monitoring and predictive maintenance strategies.
- Transformer Management Systems: Publications or case studies discussing the development and implementation of Transformer Management Systems (TMS) for effective control, monitoring, and diagnostics of distribution transformers.
- Remember, always refer to the latest standards, research papers, and industry best practices for the most up-to-date information on condition monitoring and controlling of distribution transformers.
- Mrs. A. P. Khandait, Swapnil Kadaskar, Girish Thakare, "Real Time Monitoring of Transformer using IOT," International Journal of Engineering Research & Technology (IJERT), ISSN:2278-0181
- http://www.allegromicro.com/en/Products/Current-Sensor ICs/Zweo-To-Fifty-AmpIntegrated-Conductor-Sensor ICs/ACS712.aspx
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CONCLUSION

The IOT based monitoring of distribution transformer is quite useful as compared to manual monitoring and it is reliable as it is not possible to monitor always the voltage, current, oil level and temperature rise manually. If any abnormality occurs the operator gets a message so we can take action to prevent any failures of distribution transformers, thus we can recover the system in less time and faults before any uncertain failures. Thus, this system is cost saving and as the controller that we used is small size compared to other controllers, the overall size of whole setup is also small.