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TRANSFORMER HEALTH MONITORING USING ARDUINO AND GSMAND LOCAL MONITORING DISPLAY

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ABSTRACT

Transformer monitoring system is basically used where monitoring of a transformer is pretty difficult.Major problems are the weather conditions such as rainy conditions or sunny weather which affects the transformer in different ways. Parameters which we are going to measure are Temperature, Oil, and any overload at transformers. The most crucial equipment of transmission and distribution of electric power is transformer. In Power system, an electrical component transformer directly distributes power to the low-voltage users and its operation condition is a criterion of the entire network operation. The majority of the devices have been in service for many years in different (electrical, mechanical, environmental) conditions. They are the main components and constitute thelarge portion of capital investment. Operation of distribution transformer under rated condition (as per specification in their name plate) guarantees their long service life. However, their life is significantly reduced if they are subjected to overloading due to high current consuming, overheat, and low oil level resulting in unexpected failure and loss of supply to a large number of customers thus is affecting system reliability. As a large number of transformers are distributed over a wide areain present electric systems, it’s difficult to measure the condition manually of every single transformer. So, we need a distribution transformer system to monitor all essential parameters operation, and send it to the monitoring system (SMS mode) in time. It provides the necessary information about the health of the transformer.

INTRODUCTION

In the context of power distribution systems, transformers play a pivotalrole in ensuring the stability and efficiency of the electrical grid. To maintain an uninterrupted power supply, it's imperative to monitor the health and performanceof transformers closely.

The "Transformer Health Monitoring Using Arduino and GSM" project is designed to address this crucial need. By harnessing the capabilities of Arduinoand GSM technology, the project

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aims to provide a reliable and cost-effective solution for real-time monitoring of transformers within power distribution systems.

The "Transformer Health Monitoring Using Arduino and GSM" project aims to enhance transformer maintenance practices by implementing a comprehensive monitoring system. It involves the installation of specializedsensors within the transformer, including the ACS712 current sensor, DHT11 temperature sensor, and an oil level sensor.

These sensors collect data related to current flow, temperature, and oil level, which is then processed by an Arduino Uno microcontroller in real-time. The Arduino Uno applies predefined algorithms to analyse the incoming data anddetect anomalies such as high current, elevated temperature, or low oil level. Upondetecting an anomaly, the system activates a Relay module to trigger alarms or safety mechanisms within the transformer.

Simultaneously, the system utilizes a GSM module to send SMS alerts to a designated mobile number, providing detailed information about the detected anomaly.

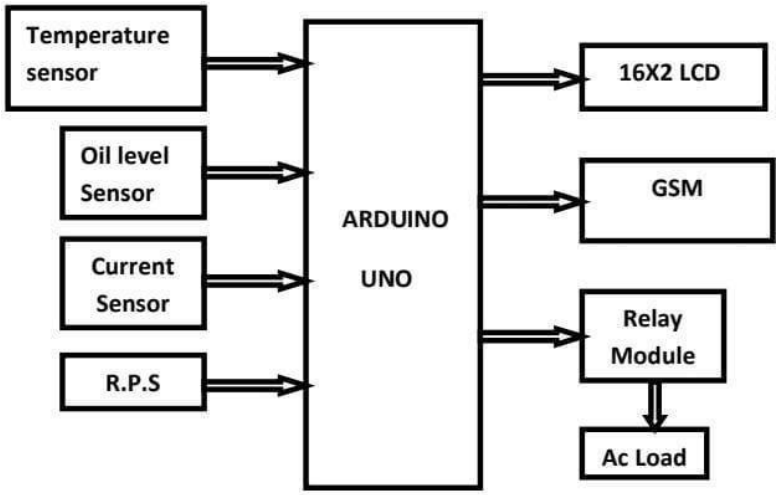

Figure.1 Block Diagram

PROPOSED SYSTEM

The "Transformer Health Monitoring Using Arduino and GSM" project employs a systematic data collection and transmission process to monitor the health of the transformer, detect anomalies, and enable timely action. The process begins with the installation of specialized sensors: the ACS712 current sensor, the DHT11 temperature sensor, and an oil level sensor. These sensors are strategicallyplaced within the transformer to collect vital data.

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The ACS712 current sensor, installed in series with the transformer's current-carrying conductor, continuously measures the current passing through the transformer and converts it into an analog voltage output. This output is read by an analog input pin on the Arduino Uno. Simultaneously, the DHT11 temperature sensor measures the internal temperature of the transformer in degrees Celsius. The algorithms are designed to detect anomalies bycomparing incoming data with predefined thresholds and ranges. In the event of an anomaly, whether it's high current, elevated temperature, orlow oil level, the Arduino activates a Relay module.

The temperature data is acquired by the Arduino Uno through digital I/O pins. The oil level sensor, immersed in the transformer's oil, provides analog output reflecting the oil level. Another analog input pin on the Arduino Uno captures this oil level data.

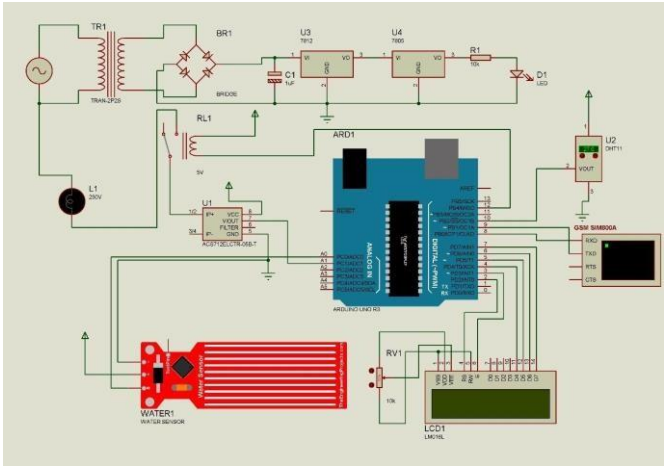

Figure.2 Schematic Diagram

RESULTS

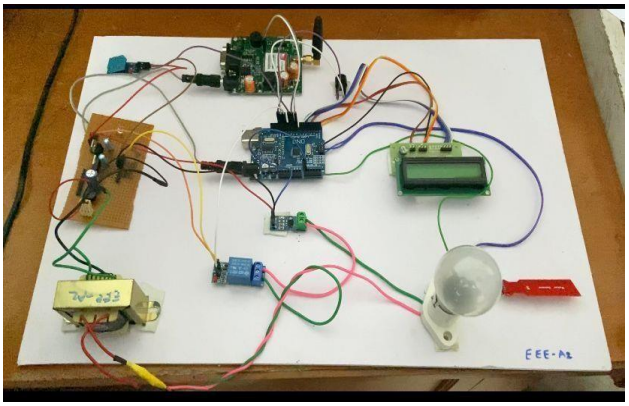

Figure.3 Working Kit

Figure.4 LCD Turn ON

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Figure.5 Reading

Figure.6 Fault Detected

Figure.7 Message sent

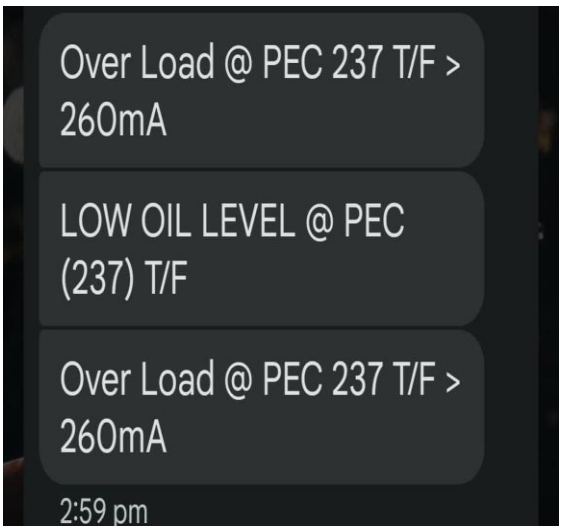

Figure.8 Messages received

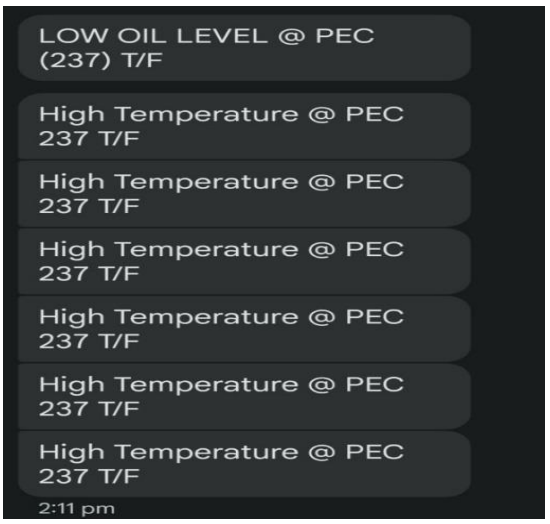

Figure.9 Messages received for temperature

ADVANTAGES

Early Anomaly Detection: The system detects anomalies like high current, elevated temperature, and low oil levels, enabling timely preventive actions to avoid critical failures and downtime.

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Proactive Maintenance: Maintenance tasks can be planned and executed in a timely manner, reducing the risk of unexpected breakdowns and associated repair costs.

Remote Monitoring: Operators and maintenance personnel can receive real-time alerts and monitor transformer health from anywhere, ensuring rapid response to issues.

Improved Reliability: Continuous health monitoring enhances transformer reliability, ensuring they operate within safe parameters and minimizing the risk of unscheduled outages. 5.**Cost Savings:** Early issue detection and proactive maintenance result in significant cost savings by reducing downtime, repair expenses, and potential equipment damage.

APPLICATIONS

Transformer Health Monitoring: Provides real-time monitoring of transformer parameters suchas current, temperature, and oil level to ensure optimal performance and prevent failures.

Anomaly Detection: Detects anomalies such as high current, elevated temperature, or low oil level,enabling timely intervention to prevent potential damage or failures.

Proactive Maintenance: Empowers personnel to address issues before they escalate, minimizingdowntime and optimizing maintenance practices.

Optimizing Performance: Allows for the optimization of transformer performance by identifyingareas for improvement and implementing corrective actions promptly.

Enhanced Safety: Ensures the safety of transformers and surrounding equipment by promptly identifying and addressing potential issues that could lead to accidents or malfunctions.

CONCLUSION

In conclusion, the "Transformer Health Monitoring Using Arduino and GSM" project stands as a pivotal solution for enhancing the reliability and efficiency of transformer operations across various industries. By continuously monitoring crucial parameters such as current, temperature, and oil level, the system provides early anomaly detection, enabling maintenance personnel to take proactive measures and prevent costly downtime. The capability for remote monitoring, driven by real-time alerts sent via the GSM module, empowers operators and maintenance teams to address issues swiftly from any location. The project has the potential to revolutionize how transformers are managed, reducing operational costs and optimizing maintenance practices. It brings to the forefront the importance of data-driven decision-making

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and has widespread applications in power distribution, industrial facilities, renewable energy systems, utilities, transportation, and more.

FUTURE SCOPE

Looking ahead, the future scope of the "Transformer Health Monitoring Using Arduino and GSM" project is promising and expansive. There are several avenues for further development and enhancement. Firstly, the integration of advanced machine learning algorithms could provide predictive maintenance capabilities, enabling the system to anticipate issues before they occur. Additionally, the project could benefit from cloud integration for centralized data storage and analytics. This would allow for historical data analysis and trend prediction. Moreover, exploring the use of other communication channels, such as IoT platforms, could extend its reach and capabilities. The project also has the potential for integration with smart grid systems, contributing to a more resilient and efficient electrical grid. The possibilities are vast, and ongoing research and development will play a pivotal role in realizing the full potential of this innovative transformer health monitoring system.

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