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Real-Time Health Monitoring System of a Distribution Transformer

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ABSTRACT

All Transformers are vital components of power systems, and their failure can significantly disrupt the balance of the entire system. Damage to transformers is often caused by overcurrent or excessive temperatures. This project aims to monitor the health of distribution transformers in real time to prevent such failures. Key parameters, including current, voltage, temperature, and oil level, are continuously monitored using sensors.

The system leverages IoT technology, with a Wi-Fi module transmitting recorded data via the HTTP protocol, allowing remote access from anywhere. By automating this process, the system eliminates human error and enables quick responses to potential issues. Alerts are sent when parameters exceed predefined thresholds, helping prevent critical failures.

The solution is scalable, adaptable to varying operational demands, and designed to enhance current monitoring practices. Data visualization and analysis are implemented using platforms such as ThingSpeak, which provides graphical representations of monitored parameters. Notifications are sent through IFTTT protocols, enabling timely and efficient maintenance responses.

This real-time monitoring system ensures the reliable operation of distribution transformers, reduces manual intervention and improves overall efficiency. Its cost-effectiveness and versatility make it an ideal solution for modern power systems, offering a proactive approach to transformer health management.

Keywords: *IoT, HTTP, Wi-Fi module*

1. INTRODUCTION

Distribution transformers are an integral part of the grid. They are responsible for providing power supply to the general public. Any problem occurring in the distribution transformer can disrupt the power supply for a certain region. Therefore, the transformer should be operated within rated conditions to improve its longevity. But this is easier said than done. Incipient faults and external faults can create unexpected situations and even damage the transformer permanently. These scenarios can occur at any point in time making it difficult to predict and to respond. That is why the working conditions need to be monitored round the clock. Using IoT Technology, no human intervention is required to carry out this task. The working conditions can be monitored at all times. This can give us a head start in responding to these kinds of unexpected situations. Using different sensors, many parameters of the transformer can be monitored at the same time. All these parameters will be monitored in real-time which will help us to identify a problem within the transformer to reduce further damage.

FLOW DIAGRAM

The center-tapped transformer (12-0-12V) operates on a 230V AC supply. If a failure occurs during operation, it can be detected using various sensors. A bridge rectifier measures voltage, while a current sensor monitors current. The DHT11 sensor is used to measure temperature. The ThingSpeak platform is utilized to display these values graphically. Threshold values can be set for each parameter, and if any value exceeds its threshold, an alert is sent to the maintenance department via IFTTT software.

OPERATING PRINCIPLE

The functionality of a transformer can deteriorate due to poor cooling and overloading, leading to improper electricity distribution. Manually checking the transformer's condition and recording parameter values is a lengthy and tedious process. Parameters such as temperature, voltage, and current are monitored, analyzed, and recorded by servers. Leveraging IoT technology and the HTTP protocol, the recorded data can be transmitted via Wi-Fi, making it accessible from anywhere in the world. This approach enables issue detection without relying on manual intervention.

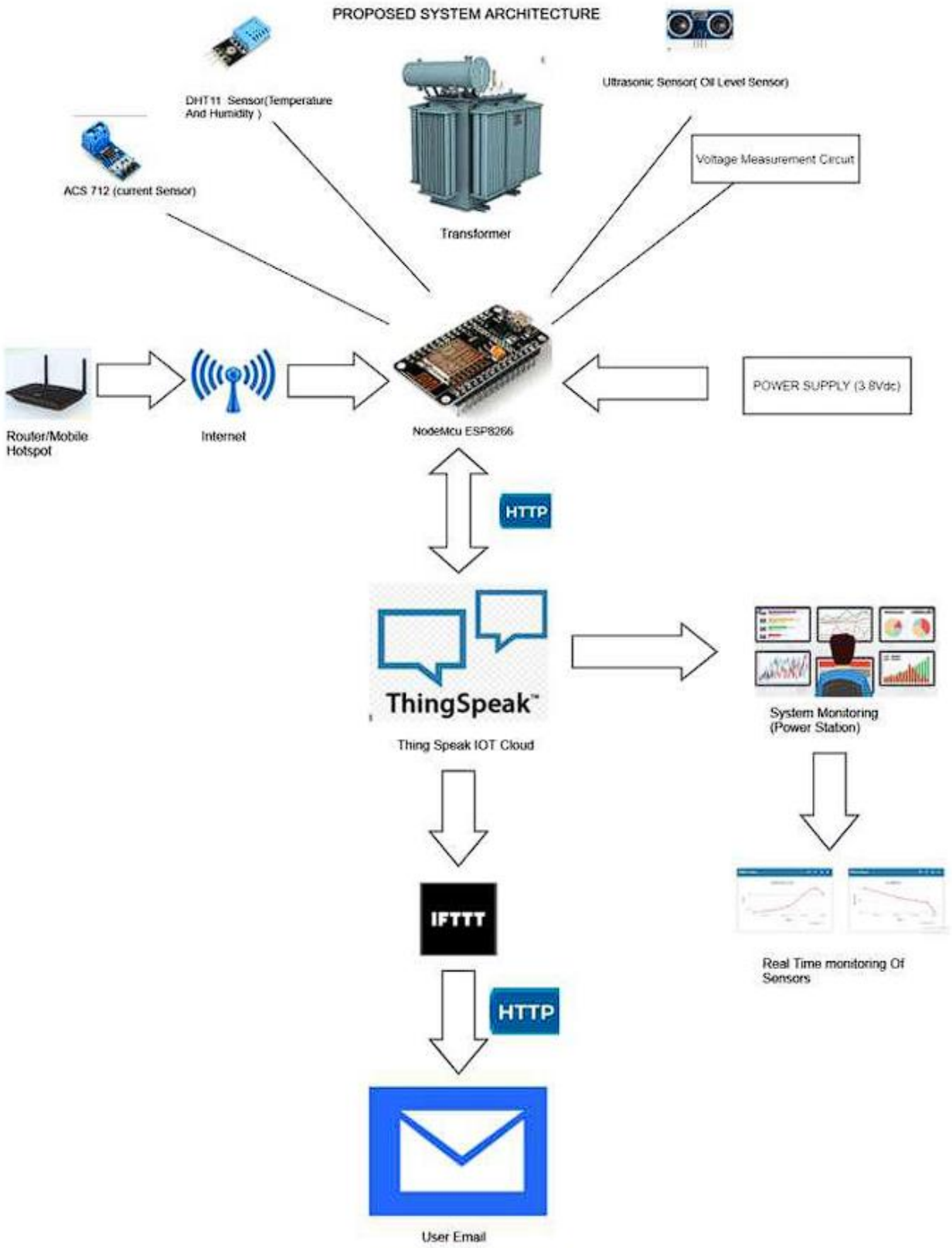

Chart -: Flow Diagram

2. CONCLUSION

The data collected from various sensors connected to the Node MCU is transmitted to the ThingSpeak platform, where it is displayed in graphical form. This data can also be downloaded in Excel format for further analysis. Email notifications are sent using webhooks and the IFTTT protocol. These emails include information such as the specific device experiencing a problem, the date, time, and other relevant details. The email content can be customized to make it more specific and informative based on requirements.

This project facilitates day-to-day monitoring of these machines and is both cost-effective and highly versatile. It can be easily scaled, allowing multiple modules to be connected to a single ThingSpeak platform and monitored simultaneously. However, challenges such as synchronization and data redundancy need to be addressed.

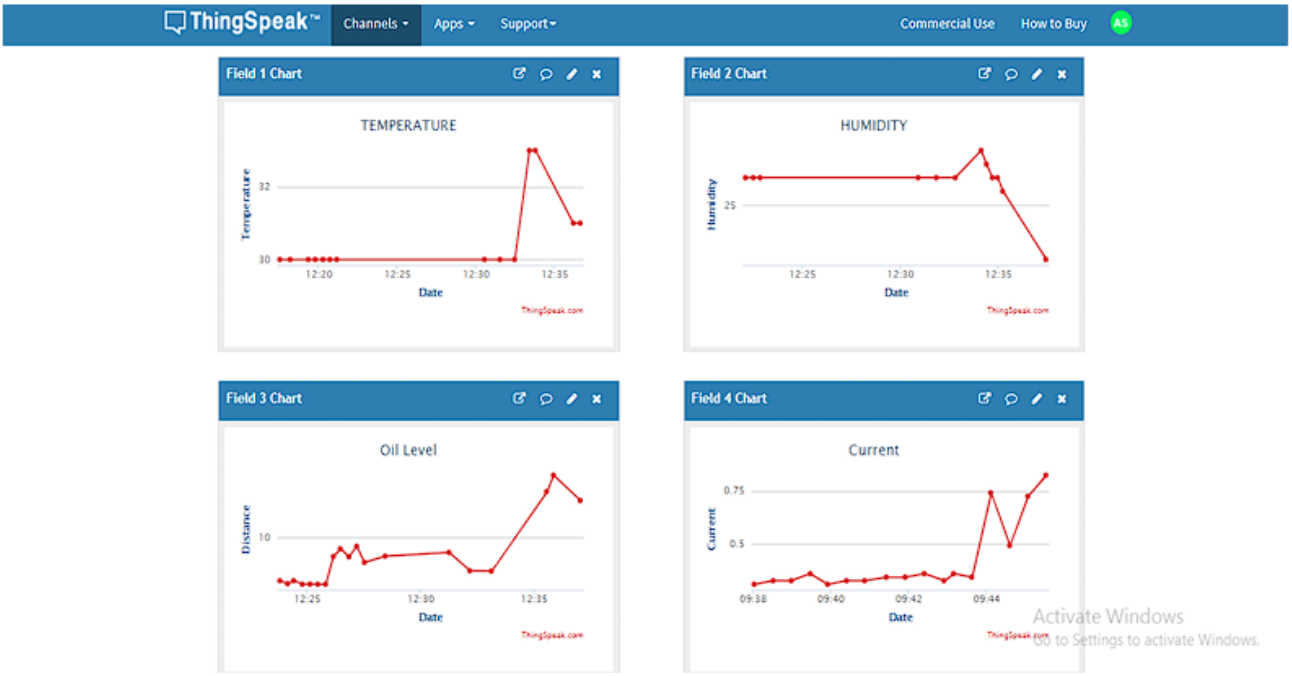

Chart 2 -: Thing Speak Platform

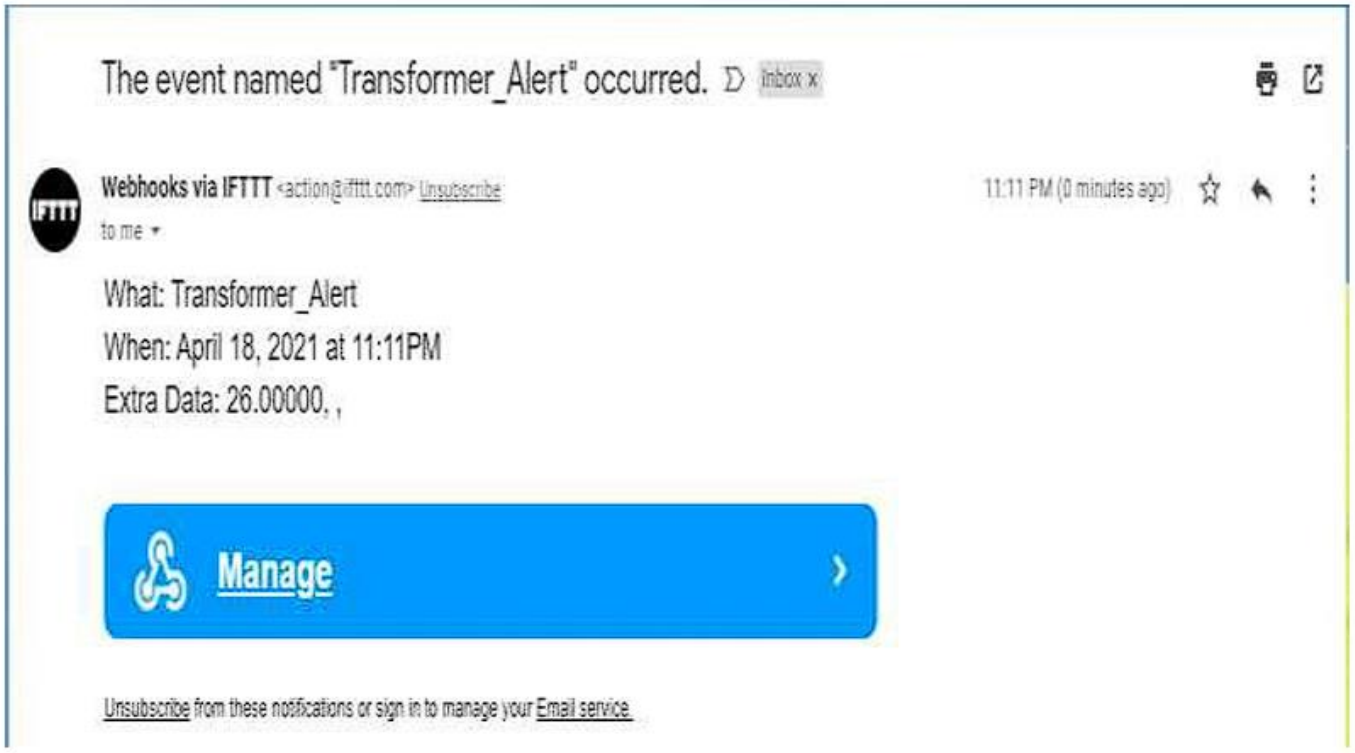

Chart 3 -: Email Notification

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