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IOT based Transformer Health Monitoring System on Thingspeak

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ABSTRACT: Distribution Transformers are a critical part of the electrical power system. Data collection and transformer condition monitoring are very important for preventing transformer failures. In order to monitor the transformer, the operator has to visit the transformer premises. The main purpose of the project is to monitor the transformer parameters such as temperature, current, voltage, and oil level using IoT. Sensor networks are used to obtain transformer parameters. This system can minimize work effort; improve accuracy, reliability, and efficiency. This received data is sent to the Arduino UNO microcontroller. The recorded data is sent through ESP 8266 Wi-Fi module and accessed from anywhere around the world using IOT technology using HTTP protocol. This helps in identifying without human dependency.

I. INTRODUCTION

Electricity plays a major role in our life. Electricity has various components and equip ment used to transfer and control the supply in accordance with demand. Transformer is the most crucial equipment of transmission and distribution of electric power. A distri bution transformer is a key components of the overall network operation are the power supply for low voltage users and its operating circumstances and constitutes a large por tion of capital investment. Distribution transformer have a long life if performed under evaluated circumstances. However, their life is significantly reduced when subjected to heating, overloading, resulting from low or high voltage/current catastrophic failure and loss of supply to a huge number of Customer behavior affects system dependability. There is a transformer anomaly accomplished with variation in different parameters like load current, load voltage, oil level, oil temperature, and ineffective cooling are major cause of failure in distribution transformer. At present the usage of SCADA, for webbased monitoring of, for example, Supervisory Control and Data Acquisition of distribution transformer which is a costly suggestion. The existing system can be improved by the use of internet of things (IOT) which is all about connecting the unconnected things. Site for support and records the important Currently, distribution transformers can be seen physically where a man occasionally vis its a transformer and monitors the parameters. This kind of monitoring cannot provide information concerning overheating of transformer oil and windings and incidental over load. Each of these factors has the potential to reduce transformer life. A monitoring system can only keep an eye on the operation condition and cannot keep track of all relevant data of distribution transformers to reduce costs and stability of the equipment.

II. MAIN FEATURES OF THE PROJECT

1. The system provides real-time data on the transformer's health

2. The system can detect faults and abnormalities early, allowing users to avoid replacing transformers prematurely.

3. he system can send SMS notifications if any parameters exceed their threshold Reducing operational risks and maintenance costs. Project Overview: The transformer health monitoring system on Thing Speak is designed to provide real time insights into the operational status of transformers. By utilizing various sensors to collect data on critical parameters such as temperature, humidity, voltage, and current, the system enables continuous monitoring of transformer conditions. This data is transmitted to the ThingSpeak platform, where it can be visualized and analyzed. The project aims to enhance the reliability and efficiency of transformers by detecting potential issues early, allowing





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for proactive maintenance and minimizing downtime. Overall, this system serves as a vital tool for improving the management and performance of electrical infrastructure

III. METHODOLOGY

The Arduino UNO consists of a sensing unit which collects the data from parameters such as current, voltage and the oil temperature of the transformer. The android application connected to the processing unit via Wi-Fi module, which displays corresponding parameter values at the substation for any technical operations. The controller also senses the over load and high current flow, temperature and oil level that may lead to breakdown of the corresponding unit.

The Arduino controller is programmed in such a manner so as to continuously scan the transformer and update the parameters at a particular time interval. In the given circuit diagram we have used the 5Vregulated power supply, sensing elements, display unit and IOT module.

Step 1: Verification and validation of Problem statement and finding practical scope of the project.

Step 2: plotting down the observation and approaching the literature survey of the project, referring to various eBooks, journal papers, technical articles, videos and Books.

Step 3: Based on the literature survey finalizing the components. Preparing virtual circuit design and simulating it to find the errors, and replace any component is found dysfunction.

Step 4: Once the expected result is obtained, the circuit diagram is finalized and components are purchased. The PCB design is then traced using Dip Trace software.

Step 5: The PCB is then developed and the components are mounted, the peripherals are then connected to the circuit and the circuit is ready for Implementation.

Step 6: The system is then mounted on a board.

Step 7: The power supply is connected and the system is ready to use. It is tested on several parameters and then made for the public to use.

IV. THESIS

A thesis exploring an IoT-based transformer monitoring system utilizing ThingSpeak involves developing a system to remotely monitor transformer health and performance, leveraging IoT sensors and the ThingSpeak platform for data collection, storage, and visualization. This system can help in predicting transformer life, identifying potential failures, and improving power system reliability.



FIG 1: Block diagram of IOT Based Transformer Health Monitoring System on ThingSpeak





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The main blocks of this project are:

The main components being used in the project are:

- ARDUINO MICROCONTROLLER
- CURRENT SENSOR.
- AC ADAPTOR
- LCD display.
- RELAY.
- ESP 01S
- ESP 015
- TEMPERATURE SENSOR
- BUCK CONVERTOR

CURRENT SENSOR

ACS712 Current Sensor Module - 20A can sense upto 20A of current flow. Sensing and controlling the current flow is a fundamental requirement in wide variety of applications, which includes over-current protection circuits, battery chargers, switching mode power supplies, digital watt meters, programmable current sources, etc.

ACS712 Current Sensor Module - 20A is based on ACS712 sensor, which can accurately detect AC or DC current. The maximum AC or DC that can be detected can reach 20A, and the present current signal can be read via analog I / O port of a microcontroller or an Arduino.



Image: Current Sensor

Specifications:-

Supply Voltage: 4.5V ~ 5.5V DC Measure Current Range: -20A ~ 20A Sensitivity: 100mV/A

ARDUINO UNO

This Arduino Uno is an original microcontroller board from Arduino officials based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

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ARDUINO UNO EXPANSION SHIELD

Sensor Shield allows you to connect to various modules like **sensors**, **servos**, **relays**, **buttons**, **potentiometers** and many more directly to your **Arduino** through this Sensor Shield.

Each functional module has buckled port with VCC, GND, and Output, which has the corresponding port on the Sensor Shield; connected with a plain 2.54mm dual-female cable you may start playing already.



LCD

To display our parameters, 16x2 LCD is used.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.

Specification- LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs



Image: LCD Display





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RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.



TEMPERATURE & HUMIDITY SENSOR

The **DHT11** is a basic, ultra low-cost digital **temperature** and **humidity sensor**. It uses a capacitive **humidity sensor** and a thermistor to measure the surrounding **air**, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data.

Pin Description:-

- Pin 1: Power +Ve (3.3VDC to 5.5VDC Max wrt. GND)
- Pin 2: Serial Data Output
- Pin 3: Power Ground or Power –Ve







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Volume 14, Issue 4, April 2025 [DOI: 10.15680/IJIRSET.2025.1404669] TRANSFORMER



12-0-12 2Amp Center Tapped Step Down Transformer is a general purpose chassis mounting mains transformer. Transformer has 230V primary winding and center tapped secondary winding. The transformer has flying colored insulated connecting leads (Approx. 100 mm long). The Transformer act as step down transformer reducing AC - 230V to AC - 12V.

The Transformer gives outputs of 12V, 12V and 0V. The Transformer's construction is written below with details of Solid Core and Winding.



The ESP-01 ESP8266 Serial WIFI Wireless Transceiver Module is a compact and powerful module that enables Wi-Fi connectivity for a wide range of electronic projects. It is built around the ESP8266 microcontroller, which integrates Wi-Fi functionality, making it an excellent choice for Internet of Things (IoT) applications and wireless networking. With its small form factor, the ESP-01 module is ideal for projects with space limitations. Despite its size, it offers reliable and robust wireless communication capabilities. It operates on the 2.4 GHz frequency band and supports standard Wi-Fi protocols such as 802.11 b/g/n, providing compatibility with a wide range of Wi-Fi networks and routers.

V. RESULTS AND DISCUSSION

An IoT-based transformer monitoring system, utilizing ThingSpeak, offers real-time data collection, storage, and analysis of transformer health parameters, enabling proactive maintenance and improved operational efficiency. This system utilizes sensors to monitor crucial parameters like voltage, temperature, and current, transmitting the data to ThingSpeak for cloud-based storage and visualization. The results demonstrate the system's ability to detect anomalies and predict potential failures, leading to reduced downtime and maintenance costs

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Results:

Real-time Monitoring: The system enables continuous monitoring of transformer parameters, allowing for prompt identification of anomalies or potential failures.

Improved Fault Detection:

By tracking various parameters, the system can detect faults and deviations from normal operating conditions, leading to quicker responses.

Enhanced Maintenance Scheduling:

The real-time data collected can be used to optimize maintenance schedules, potentially reducing downtime and maintenance costs.

Potential for Predictive Maintenance:

By analyzing historical data, machine learning models can be developed to predict potential failures before they occur, enabling proactive maintenance.

Discussion:

Benefits of IoT:

The use of IoT technology in transformer monitoring provides numerous advantages, including improved reliability, reduced costs, and enhanced operational efficiency.

Advantages of ThingSpeak:

ThingSpeak, as an IoT platform, provides a convenient and scalable solution for data collection, storage, and visualization.

Challenges:

While the system offers numerous benefits, challenges may include the cost of sensors and hardware, the need for robust communication infrastructure, and the complexity of data analysis.

Future Directions:

Future research could focus on exploring more sophisticated data analysis techniques, incorporating advanced sensors, and developing more robust and scalable IoT architectures.



Fig.5. IOT Based Transformer Health Monitoring System on ThingSpeak

VI. CONCLUSION

The transformers play a vital role in distribution part of power system. Therefore the monitoring and protection of transformer is very crucial. This system introduces a new and improved method of transformer health parameter monitoring using IoT. The sensors incorporated in the system collect the data of transformer health parameters such as voltage, temperature and current. These data are send to an IoT platform, ThingSpeak using. These data can be sent and accessed using HTTP protocol. Thus the real time data collection, storage and monitoring of the transformer health parameters health parameters are possible with the system.

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VII. FUTURE SCOPE

1. The project scope for a transformer health monitoring system on Thing Speak en compasses the development and implementation of a comprehensive system designed to monitor the operational health of transformers in real-time. This includes identifying key parameters such as temperature, humidity, voltage, and current that are critical for assessing transformer performance.

2.Develop a data acquisition system that collects data from the sensors. This can in volve using a microcontroller (like Arduino or Raspberry Pi) to read the sensor outputs. The microcontroller should be programmed to gather data at regular in tervals and process it for transmission. Utilize the Thing Speak API to send the collected data to the Thing Speak platform. This typically involves setting up an internet connection for the microcontroller and using HTTP requests to post the data to your Thing Speak channel. Once the data is uploaded to Thing Speak, use its built-in tools to visualize the data in real-time through graphs and charts. This allows for easy monitoring of transformer health. Additionally, analyze the data trends to identify any anomalies or potential issues.

3.Implement a notification system that triggers alerts when certain thresholds are exceeded. This can be done using Thing Speak's alert features or integrating with other services to send notifications via email or SMS. Conduct thorough testing of the entire system to ensure that all components are functioning correctly. Calibrate the sensors as necessary to ensure accurate readings.

REFERENCES

1] Hazarika (2021). IOT Based Transformer Healtth Monitoring System." IEEE

2] Apoorva Chinagudi (2022). "Transformer Health Monitoring System." Inter national Journal of Engineering. 3] Biju Rajan B (2019). IOT Based Distribution Transformer Health Monitor ing System using Arduino, Nodemcu and Thingspeak.

4] Divyank Srivastava (2018). "Transformers Health Monitoring System Using IoT, IEEE International Conference On Power Electronics









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