Iot Based Transformer Health Monitoring System Using Simulation

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***Abstract*—This paper is about the design and implementation of a system that uses the internet of things to monitor the health of distribution transformers in time. Distribution transformers are important parts of the power grid. If they fail it can cause financial losses and power outages. The system we made uses sensors to keep an eye on things like voltage and current and temperature. These things are looked at by a computer and then sent to the Thing Speak internet of things platform using a Wi-Fi module, which is called ESP8266. We tried this out. It shows how we can look at the data from far away and stop really bad things from happening by taking care of the transformers before they break. The system for distribution transformers is very useful, for distribution transformers.**

***Index Terms*—Transformer, Arduino/PIC Microcontroller, Thing Speak, ESP8266.**

I. INTRODUCTION

Transformers usually work in conditions and with changing loads.

People used to monitor them but this is not done often. As a result, some internal faults are. Sudden failures happen.

By using the Internet of Things, we can monitor transformers continuously. From a distance.

This project is about simulating a health monitoring system.

It tracks electrical stress on the transformer.
This ensures that the power distribution network lasts long and works reliably.

The IoT system helps to monitor the transformer.
The transformer monitoring system is very useful.

II. SYSTEM ARCHITECTURE

The system has three parts:

- Sensing Unit: This part simulates inputs for temperature (LM35) voltage and current.
- Processing Unit: This is an Arduino or microcontroller that turns sensor data into information and manages logic.
- Communication Unit: This is a Wi-Fi module that sends data to the cloud using the HTTP protocol.

The IoT platform, ThingSpeak is used to monitor health.
The ESP8266 plays a role in sending data to ThingSpeak.
The Arduino/PIC Microcontroller is used for processing data, from the transformer.
The transformer is monitored for its voltage, current and temperature.
The IoT system helps in monitoring the transformer.
The transformer monitoring system uses technology.

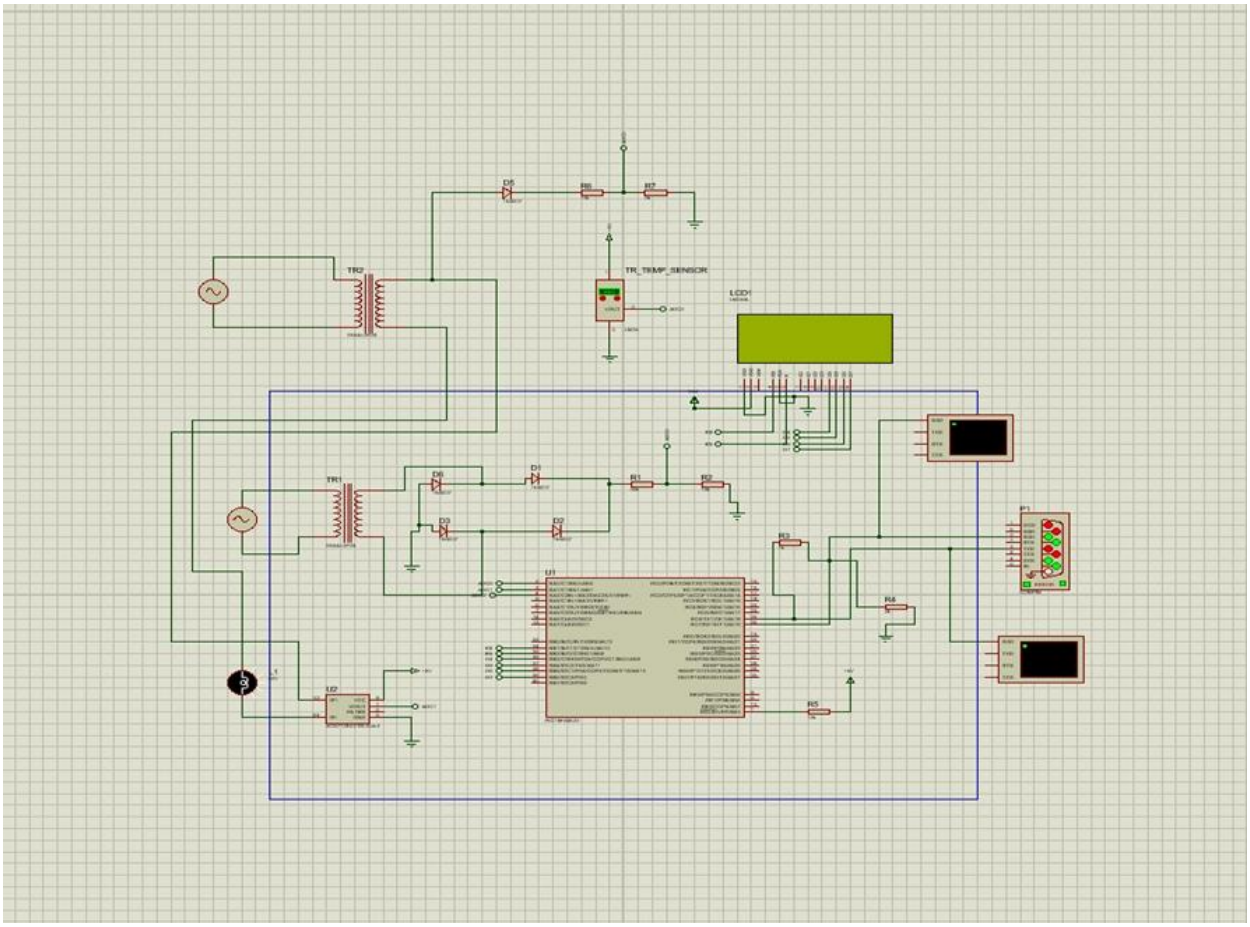
III. IMPLEMENTATION AND CIRCUITRY:

Data Acquisition: The sensors, which are LM35, Voltage and Current send information to a PIC microcontroller in the Proteus simulation. This information is not digital it is analog.
Local Processing: The microcontroller takes these analog signals. Turns them into digital signals using something called ADC 0808. Then it sends these values to a Virtual COM Port.
Python Cloud Bridge: There is a Python script that works like a bridge. It reads the information that comes from the simulation and sends it to the internet.
IoT Integration: This information is sent to the ThingSpeak API using something called HTTP GET

requests. This allows people to see what is happening in time from anywhere and it also makes graphs to help visualize the Data Acquisition, which is what the sensors, like LM35, Voltage and Current are doing.

Circuit Description:

- Microcontroller: This is the brain of the system it collects information, from the transformer.
- ESP8266/Serial Bridge: This helps the system connect to the internet.
- LCD Display: This shows what is happening with the transformer now so we can see it locally.



Advantages:

It lets us keep an eye on the transformer's health all the time from any place using the ThingSpeak cloud. We do not need to be in person.

Early Fault Detection is another benefit. It finds voltage, current or temperature rises right away. This means we can do maintenance before something bad happens.

Applications:

It is great for monitoring transformers that send power to homes and businesses in cities and towns. This helps keep the power supply stable.

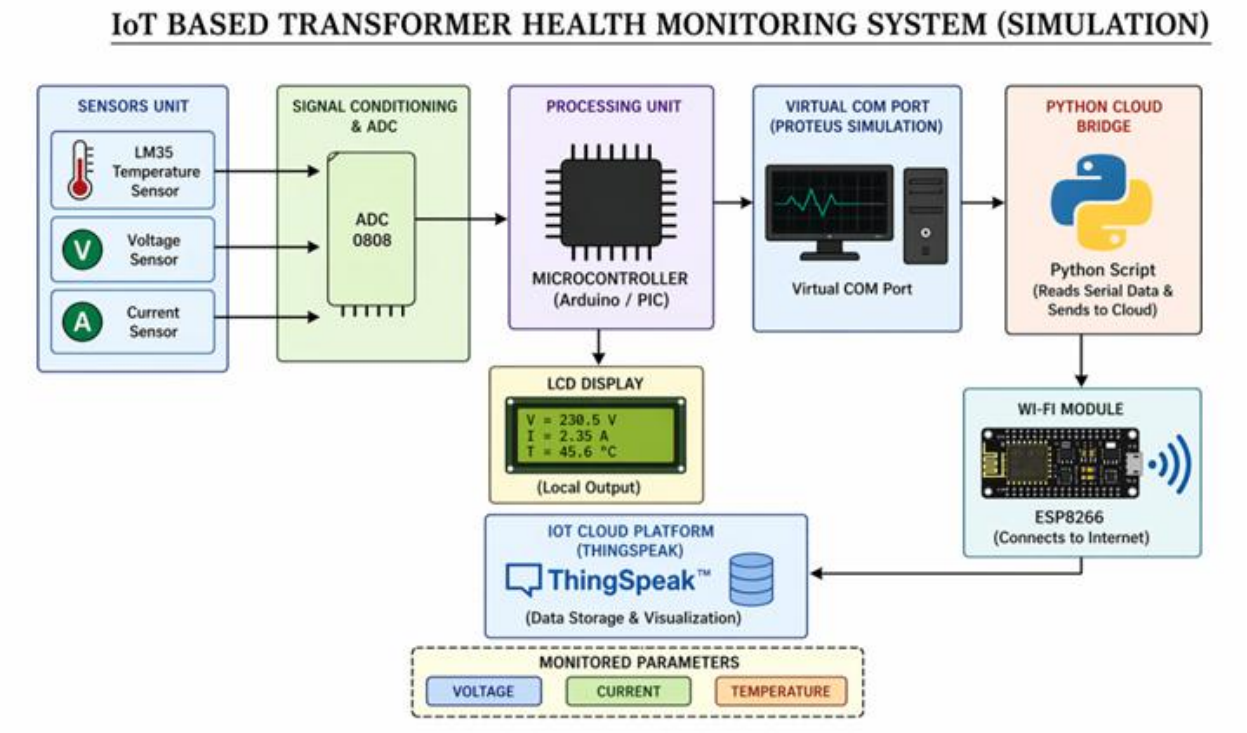
We can use it in factories to monitor transformers and prevent the production line from stopping.

Limitations:

The system needs a Wi-Fi connection to send data to the cloud. If the network fails, we lose monitoring.

Since it is based on a simulation model the results might be slightly different when we use it with high-voltage hardware. This is because of noise.

Block Diagram



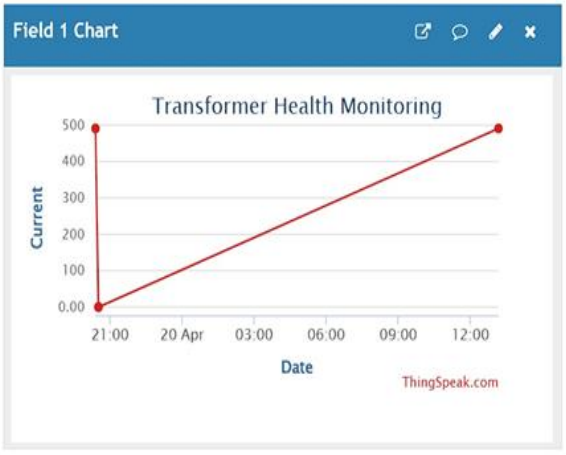
IV. RESULTS AND DISCUSSION

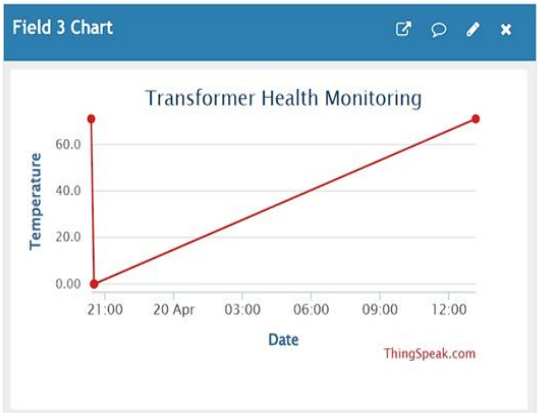
The simulation results were monitored via the Thing Speak dashboard. The system successfully captured and displayed:

- Voltage Levels: This is for monitoring over-voltage or under-voltage conditions.
- Current Load: This is for identifying overloading scenarios that lead to overheating.
- Temperature: This is for tracking of the distribution transformer oil/winding temperature.

Analysis of Graphs:

The uploaded graphs show a relationship between load current and temperature. As the load increases a proportional rise in temperature is observed, confirming the accuracy of the monitoring logic. The data points were updated every 15–20 seconds on the cloud platform allowing for a real-time response. The IoT-based system is very useful, for monitoring the distribution transformer.





V. CONCLUSION

The IoT-based Transformer Health Monitoring System does a job of giving us a cost-effective way to keep an eye on important transformer parameters. We can monitor things like voltage and current and temperature using a Proteus simulation and the Thing Speak cloud platform. This means we can do diagnostics on the Transformer Health Monitoring System which helps prevent really bad failures. If we use the Transformer Health Monitoring System to stay on top of things we can fix problems before they happen of waiting for something to go wrong. This is a change, from just fixing things when they break to actually predicting when the Transformer Health Monitoring System might have a problem. It helps reduce the amount of time the transformer is not working makes the grid more reliable and helps the transformer longer.

VI. FUTURE SCOPE

The simulation confirms that IoT integration provides a low-cost, reliable solution for transformer diagnostics. Future enhancements include adding oil level and gas sensors, as well as implementing Predictive Maintenance using AI to forecast failures before they occur.

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