REAL TIME TRANSFORMER CONDITION OBSERVING SYSTEM

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Abstract - In this modern world, we cannot imagine a moment without electricity. In the electricity supply system, the transformer plays an important role in the transmission and distribution system. The electricity is given through a transformer to every household. The power demand is very high. Transformers get overloaded due to the excessive use of electricity. Overloading affects the efficiency of the transformer and gives a drawback to the electricity distribution system. Continuous monitoring is a major issue in traditional systems. To overcome this kind of issue various new devices are used to monitor the condition of the transformer. IoT-based transformer monitoring system is developed to monitor the health conditions of transformers at regular intervals. Whenever there is a change in Voltage, Current, Temperature humidity, and load ability, it indicates a change in transformer. Which is measured using various sensors, if any one of the values getsto the critical point the information would be sent to an Adrfruit.io web server with the help of Raspberry Pi Pico W. This program has pre-set instructions to check for any unusual situations. It helps us to identify or recognize unexpected situations before any serious failure which leads to greater reliability and significant cost savings. We are not only monitoring the transformer parameter but also controlling the operations of the transformer like turning on/off the transformer to prevent failure of a transformer, so this proposed system provides higher reliability and accuracy than the other traditional system.

Index Terms - Adrfruit.io, IoT, Sensors, Raspberry Pi Pico W

I.INTRODUCTION

Without a doubt, distribution transformers are a crucial component of the electrical power system. Therefore, data collection and monitoring the condition of transformers are absolutely essential to prevent any possible transformer failures. To monitor the transformer, the operator must 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 Sensors networks used to obtain transformer parameters. This system has the ability to reduce workload, enhance accuracy, reliability, and efficiency. Which is measured using various sensors, if any one of the values gets into the critical point the information would be sent to an Adrfruit.io web server. This method assists in detecting and resolving issues proactively, without the need for human intervention, thereby preventing potential failures.

II.LITERATURE SURVEY

1. Sachin Kumar B S (2016)
   Journal: - IEEE

Sachin Kumar B S discussed a compact design for remote monitoring of a 3-phase transformer. Arduino microcontroller and ZigBee based wireless device are used for monitoring the operating point of three phase transformer remotely. The Arduino microcontroller helps in monitoring the three-phase current, voltage, temperature, and power of the transformer.

2. Vishwanath R (2015)
   Journal: - IEEE

Vishwanath R has proposed design uses a temperature sensor, PIC microcontroller, LCD display GSM board and Xbee which is used to send the message at electricity board. Using the GSM modem, this system detects multiple faults in three-phase transmission lines, allowing users to monitor temperature, voltage, and current.

3. Satya Kumar Behera (2014)
   Journal: - IEEE

Satya Kumar Behera has discussed the implementation of automatic control circuits for PLC system to monitor conditions of transformer like transformer temperatures, load current and voltage. This PLC monitoring system will help to detect the internal faults as well as external faults of the transformer. This PLC system is useful for monitoring and controlling the voltage, current and temperature of a distribution transformer.

4. V. Thiyagarajan and T. G. Palanivel (2010)
   Journal: - IEEE

V. Thiyagarajan and T. G. Palanivel proposed a design to protect from rise in current due to overloading. The system is based on a microcontroller that was used for monitoring the current of a distribution transformer at a substation.

III. PROPOSED SYSTEM

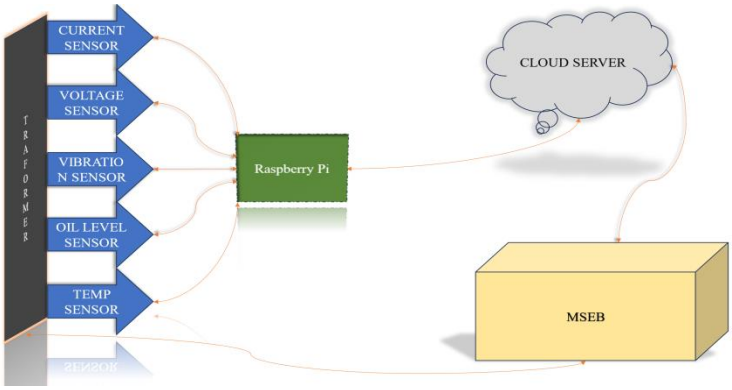


Fig.1BlockDiagramof our Transformer Observing System.

One of the main reasons for transformer failure is due to sudden fluctuations in incoming power or a rise in temperature and low transformer oil levels. To prevent such damage, our system consists of various sensors such as current, voltage, oil level, temperature, and humidity sensors. These sensors observe the incoming parameters that can affect the transformer's health. To avoid damage, the data collected from the sensors is processed in real-time by the Raspberry Pi Pico W. If any of the parameters, such as temperature, voltage, current, and oil level exceed the threshold limit, the system sends signals to the relay to stop incoming power. The data is displayed in real-time through IoT using Adafruit IO as a web server. The dashboard represents the data graphically.

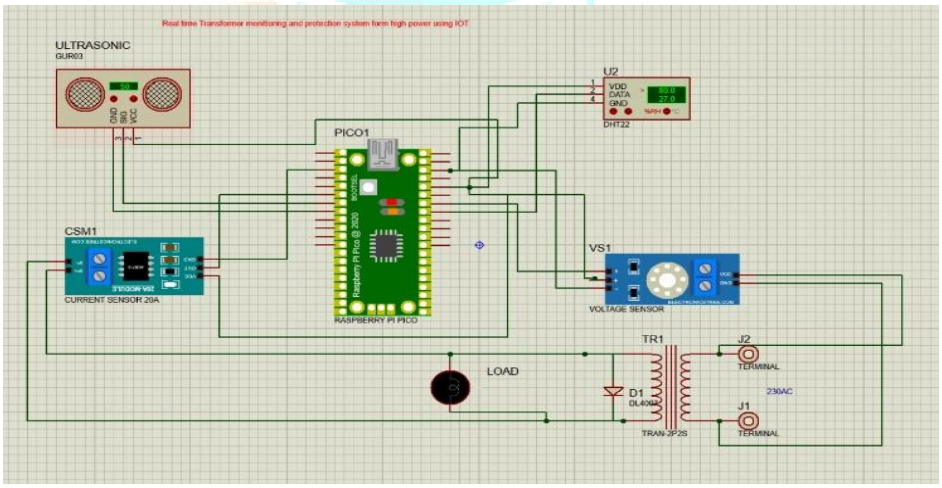
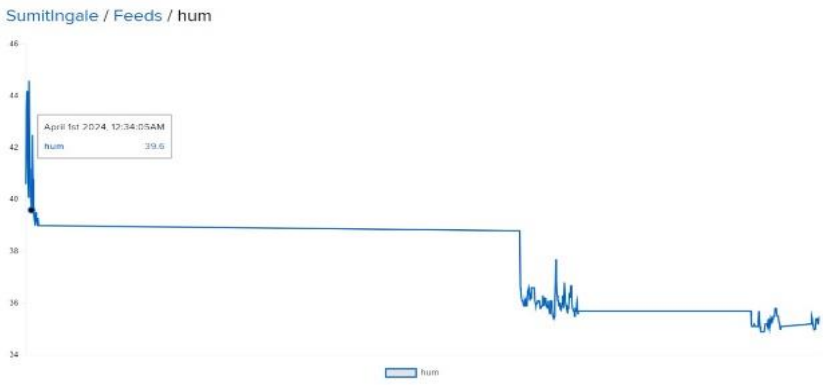


Fig. 2 Schematic Diagram of Transformer Condition observing system.

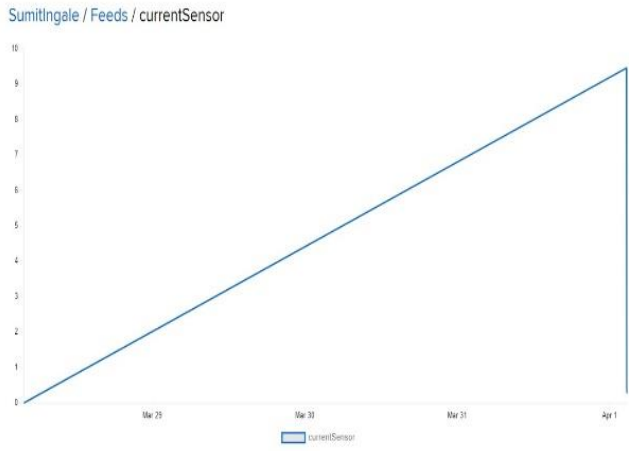
IV. RESULTS



Created at	Value	Location
2024/04/01 02:44:15AM	32.80	
2024/04/01 02:44:09AM	32.80	
2024/04/01 02:44:04AM	32.80	
2024/04/01 02:43:58AM	32.80	
2024/04/01 02:43:53AM	32.80	
2024/04/01 02:43:47AM	32.80	
2024/04/01 02:43:42AM	32.80	
2024/04/01 02:43:36AM	32.80	
2024/04/01 02:43:31AM	32.80	
2024/04/01 02:43:25AM	32.80	
2024/04/01 02:43:20AM	32.80	
2024/04/01 02:43:15AM	32.80	

Fig. 3 Humidity and Temperature Output.

We used dht22 temperature sensor which gives accurate and precise output of temperature and humidity in text form.



Created at	Value	Location
2024/04/01 02:42:32AM	0.27	
2024/04/01 02:42:23AM	0.39	
2024/04/01 02:42:15AM	0.42	
2024/04/01 02:42:06AM	0.41	
2024/04/01 02:41:57AM	0.39	
2024/04/01 02:41:48AM	0.54	
2024/04/01 02:41:39AM	0.42	
2024/04/01 02:41:30AM	0.40	
2024/04/01 02:41:21AM	0.38	
2024/04/01 02:41:10AM	0.49	
2024/04/01 02:40:47AM	0.51	
2024/04/01 02:40:25AM	0.53	

Fig. 4 Current sensor Output.

We used SCT-013-030 Clamp AC current sensor which will calculate the current without even touching live wire. The output of current sensor does not give ampere value directly so to get the proper value we have to use Vrms/√2, by this formula we get precise value of current.

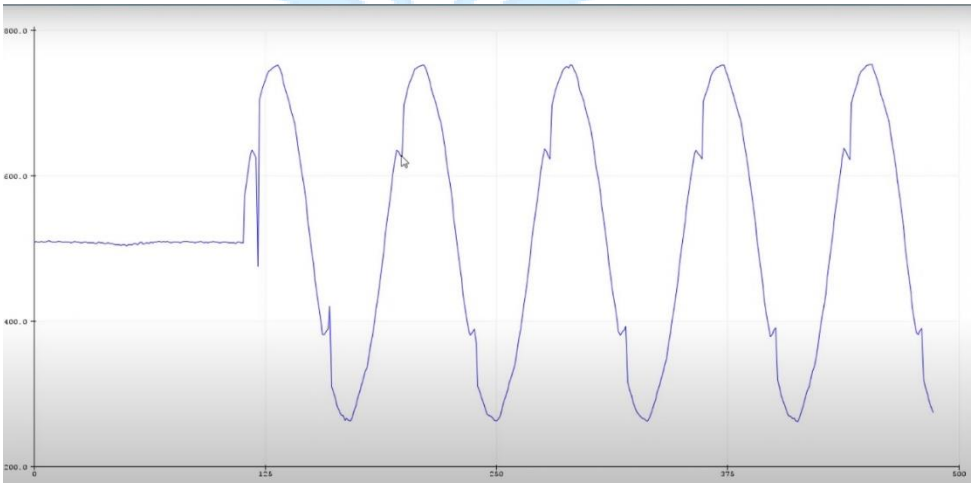


Fig. 5 Voltage sensor Output.

We used (zmpt101b) AC voltage sensor which measure accurate AC voltage with a voltage transformer.

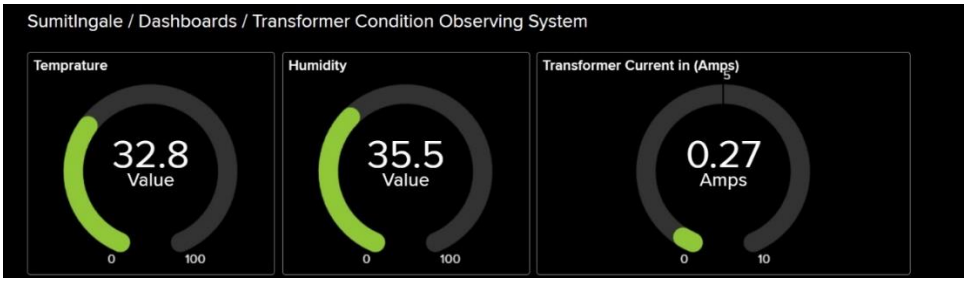


Fig.6 Adafruit IO Dashboard sensors output.

Above figure is the output of different sensors shown on web server in graphical manner.

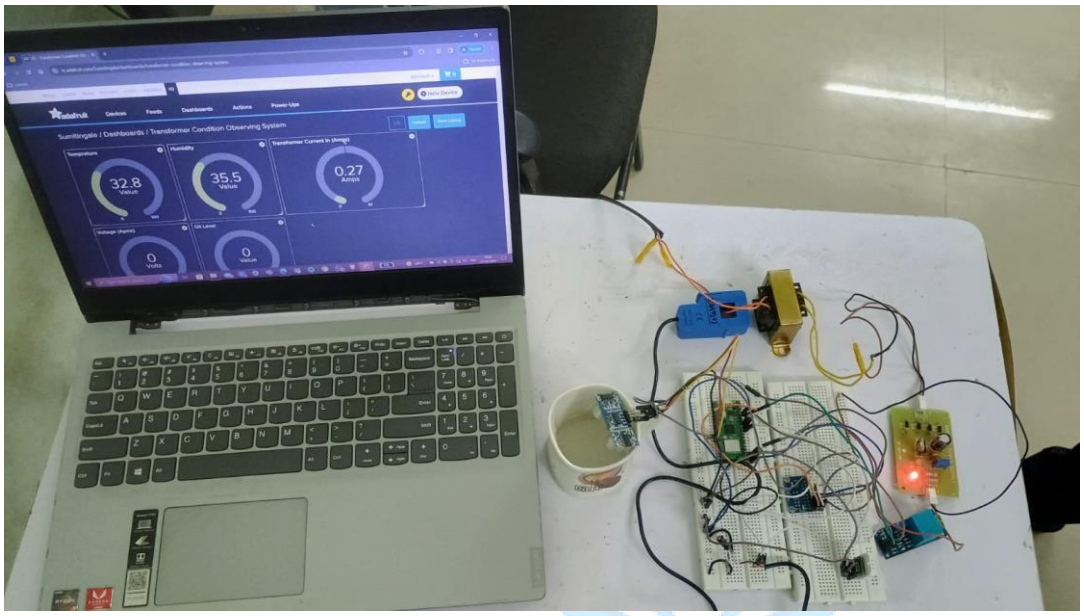


Fig.7 Actual Hardware

V. ACKNOWLEDGEMENT

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VI. CONCLUSIONS

The distribution system's network efficiently carries electricity through the transmission system and delivers it to load centers. Therefore, it is imperative to ensure high efficiency, reliability, and service quality in a distribution system. The sensors in the system accurately collect crucial health metrics such as voltage, temperature, and current. This data is then reliably transmitted to Adafruit io, an IoT platform, using the MQTT protocol. This seamless process offers a clear and comprehensive view of the working conditions to both the utility and consumers. This study decisively addresses the challenges of identifying the causes of transformer faults and effectively overcomes the limitations of previous methods. At the monitoring node, upon receiving an alert about any abnormalities, we can swiftly intervene and avert potential catastrophic transformer failures.

VII. REFERENCES

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