International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 5 May 2021, pp: 1407-1412www.ijaem.net ISSN: 2395-5252

Remote Monitoring of Transformer Using IOT

Kathirvel C[#1], PrakashP[#2], Pravin KumarG [#3,] Palani Manoj Kumar P [#4]

[#1]*Associate professor, Department of Electrical and Electronics Engineering, Sri Ramakrishna Engineering College, Coimbatore 641022, Tamil Nadu, India.*
[#2, #3, #4]*Students, Department of Electrical and Electronics Engineering, Sri Ramakrishna Engineering College, Coimbatore 641022, Tamil Nadu, India*

Submitted: 15-05-2021 Revised: 26-05-2021 Accepted: 28-05-2021

ABSTRACT---Transformers play a major role in the electrical system. It is the most important component in transmission and distribution in the electrical system. Monitoring the parameters of the transformer is important in order to protect it from major damage. Our idea is to wirelessly monitor the parameters of the transformer such as oil temperature, winding temperature and oil level. The parameters are displayed in the LCD display and the mobile app. In case of any of the temperatures exceeding the limit or the oil level receding the limit, the warning buzzer makes a sound and the alert notification is sent to the mobile app. Once the user is alerted, necessary action could be taken by controlling the relay using the mobile app to disconnect the load from the transformer. Likewise, transformers could be monitored continuously by overcoming the traditional method of monitoring through meters thus preventing any major damage which causes high repairing costs.

KEYWORDS —Arduino Uno, ESP8266, Transformer, Temperature, Oil level, IOT

I. INTRODUCTION

In this paper, the transformer is monitored wirelessly using IOT. Conventional systems use digital or analog meters such as OTI and WTI meters to measure the oil and winding temperatures respectively and oil level meters to measure the oil level in the conservator of the transformer.

Conventional systems have a major disadvantage that the parameter values could be taken only by looking into the meters by going to the site where the transformer resides. Therefore, continuous monitoring of transformers is not possible especially if the transformers are far away from the place we live. So there is a high possibility of a transformer to get damaged if we do not monitor it manually. This leads to high cost of repair or replacement.

This major concern brings us the idea of wireless monitoring of the transformer parameters such as oil temperature, winding temperature and oil level through our mobile app so that in case of any parameters vary out of the limits, user can disconnect the load by using mobile app wirelessly so that major damage could be prevented for transformer as well as load.

II. MATERIALS AND METHODS

The hardware and software components used for this project are listed below.

Hardware Components:

- Arduino Uno
- Temperature sensor (Thermistor)
- Float sensor
- ESP8266 Wi-Fi module
- Relay module
- Power supply

Software Components:

- Arduino IDE
- Blynk app

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 5 May 2021, pp: 1407-1412www.ijaem.net ISSN: 2395-5252

BLOCK DIAGRAM

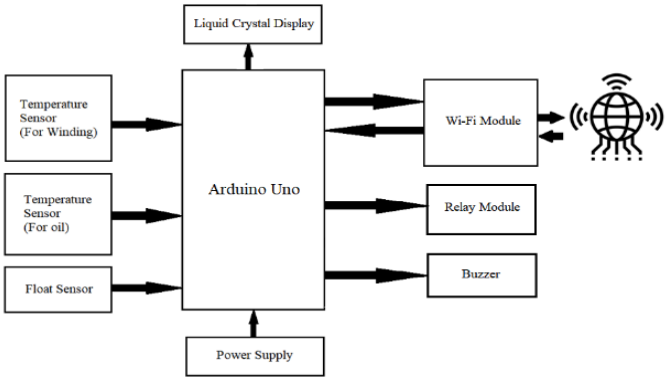

Figure 1 Block Diagram

The block diagram representing the project is shown in the figure 1. Arduino Uno is the central microcontroller which controls the whole process. The temperature sensors and float sensor act as input. The Wi-Fi module communicates with Arduino to send and receive data with the Arduino. The relay module and buzzer acts as output.

CIRCUIT DIAGRAM

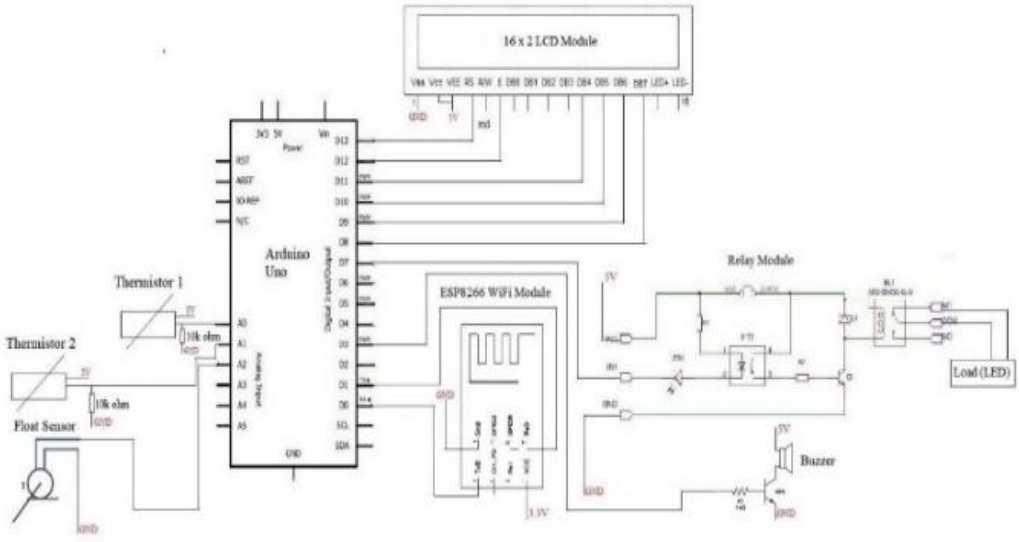

Figure 2 Circuit Diagram

Arduino Uno is the central microcontroller. Thermistor 1 is connected to analog pin 0 and thermistor 1 to analog pin 1 of the Arduino. The float sensor is connected to analog pin 2 of the Arduino. The Tx and Rx pins of the ESP8266 module are connected to digital pins 0 and 1 of the Arduino respectively. The buzzer is connected to the digital pin 0 of the Arduino. The relay has connected to digital pin 7 of the Arduino Uno. The data pins of the LCD such as DB7, DB6, DB5 and DB4 are connected to Arduino digital pins 8, 9, 10 and 11 respectively. The enable and reset pins in LCD are connected to Arduino digital pins 12 and 13 respectively. The load is connected to the output of the relay at the NC (Normally Closed) side.

III. WORKING

The circuit consists of components such as Arduino Uno, ESP8266 Wi-Fi module, LCD Display, Thermistors, Float sensor, Relay module

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 5 May 2021, pp: 1407-1412www.ijaem.net ISSN: 2395-5252

and Buzzer. Arduino Uno is a microcontroller which controls the whole process. ESP8266 Module is used to send and receive data between Arduino and mobile apps, thus connecting the system to the cloud (IOT). Thermistors 1 and 2 measure the oil and winding temperature of the transformers respectively. The float sensor measures the oil level in the transformer conservator. The LCD shows the temperatures and oil level. The load (LED) is connected to the output of the relay module.

At normal conditions, the oil temperature, winding temperature and oil level are displayed in the LCD display and in the mobile app. The load is initially closed. When any of the temperature rises above the limit (say 60 degree Celsius) or oil level decreases below the limit (say height of 10 cm), the buzzer makes sound and a corresponding alert notification is sent to the mobile app. Then the relay can be controlled using a mobile app to disconnect the load thus the LED turns off. When the temperature and oil level returns to the normal state, the buzzer stops the sound and the relay can be controlled to connect the load.

IV. RESULTS AND DISCUSSION

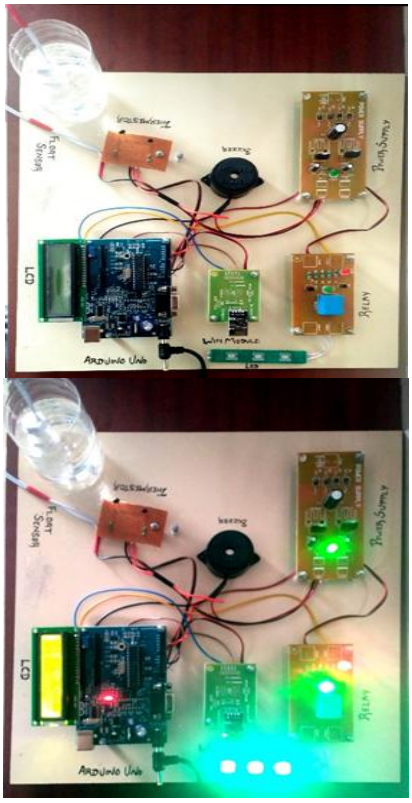

Figure 3 Hardware Snapshot

The whole circuit setup at both OFF and ON state is shown in the figure 3.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 5 May 2021, pp: 1407-1412www.ijaem.net ISSN: 2395-5252

Figure 4 App Interface

The app interface is shown in the figure 4. We have used Blynk app to interface app components of our project. There are four main components: winding temperature indicator, oil temperature indicator, oil level indicator and load control button.

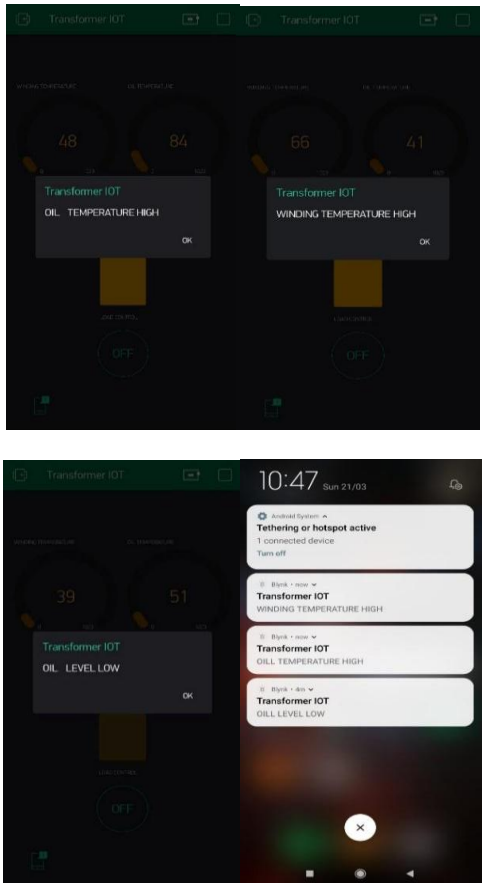

Figure 6 App notifications

The alert notifications in the app which shows if the temperature goes high or oil level goes low is shown in the figure 6. The notification which shows on notification bar is shown on the last figure. When oil or winding temperature goes above 60 degree Celsius or oil level goes below a certain limit, the alert notification is triggered.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 5 May 2021, pp: 1407-1412www.ijaem.net ISSN: 2395-5252

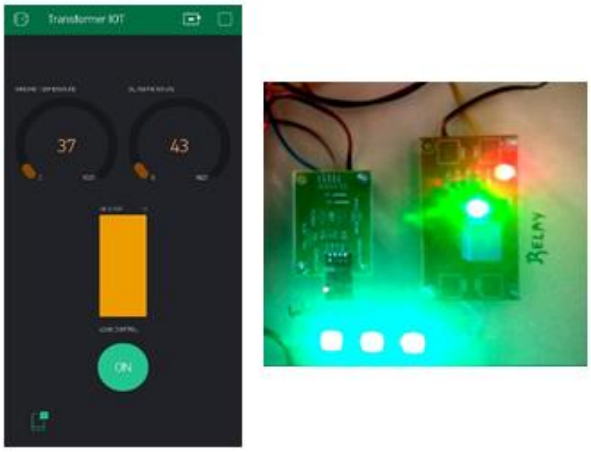

Figure 7 Load control – ON state

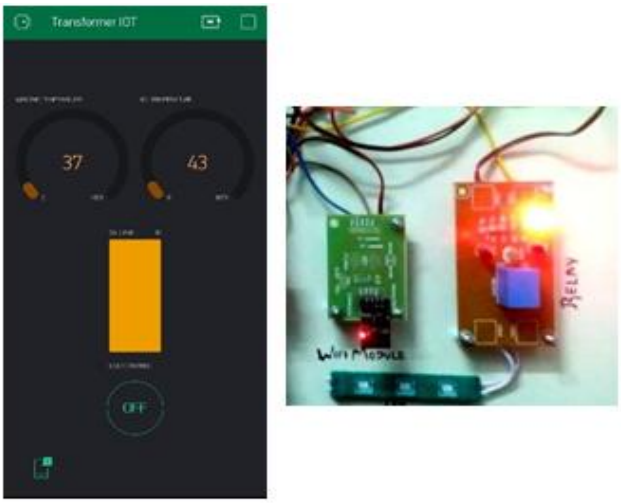

Figure 8 Load control – OFF state

LED strip is used as load. The load state at initial condition is shown in the figure 7 and load state after the load control button is disabled in the app is shown in the figure 8.

V. CONCLUSION

Thus, the essential parameters of the transformer such as oil temperature, winding temperature and oil level were monitored wirelessly using IOT and alert notification is made to send in case of any problem to the transformer. This prevents the major damage which could lead to high repairing cost. Since a transformer is essential in the electrical system in processes such as transmission and distribution, this project could save a lot of money.

REFERENCES

[1]. S Goel, A Akula, R Ghosh, and BS Surjan, Condition monitoring of transformer using oil and winding temperature analysis. IEEE Uttar Pradesh Section International Conference on Electrical, Computer and Electronics Engineering (UPCON). 2016; 496-500, DOI:10.1109/UPCON.2016.7894704.

[2]. S Anoop and N Naufal, Monitoring of winding temperature in power transformers — A study. International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), Kerala, India. 2017; 1334-1337, DOI:10.1109/ICICICT1.2017.8342763.

[3]. W Guo, J Wijaya, D Martin and N Lelekakis, Transformer winding temperature estimation based on tank surface temperature. Proceedings of SPIE - The International Society for Optical Engineering. 2017, DOI:10.1117/12.880615.

[4]. GC Jaiswal, DR Tutakne, MS Ballal and Akhil Sai PK, Oil level assessment of Distribution Transformer by development of Capacitance Model, 2016 IEEE 6th International Conference on Power Systems (ICPS), New Delhi, India, 2016; 1-5, DOI: 10.1109/ICPES.2016.7584029.

[5]. RR Pawar, PA Wagh and SB Deosarkar, Distribution transformer monitoring system using Internet of Things (IoT). 2017 International Conference on Computational Intelligence in Data Science (ICCIDS), Chennai, India, 2017; 1-4, DOI:10.1109/ICCIDS.2017.8272671.

[6]. V. Ramesh, M. Sankaramahalingam, M. S. D. Bharathy and R. Aksha, "Remote temperature monitoring and control using IoT," 2017 International Conference on Computing Methodologies and Communication (ICCMC), 2017, pp. 1059-1063, doi: 10.1109/ICCMC.2017.8282633.

[7]. M. A. A. Razali, M. Kassim, N. A. Sulaiman and S. Saaidin, "A ThingSpeak IoT on Real Time Room Condition Monitoring System," 2020 IEEE International Conference on Automatic Control and Intelligent Systems (I2CACIS), 2020, pp. 206-211, doi: 10.1109/I2CACIS49202.2020.9140127.

[8]. E. Paniagua, J. Macazana, J. Lopez and J. Tarrillo, "IoT-based Temperature Monitoring for Buildings Thermal Comfort Analysis," 2019 IEEE XXVI International Conference on Electronics, Electrical Engineering and Computing (INTERCON), 2019, pp. 1-4, doi: 10.1109/INTERCON.2019.8853608.

[9]. A. Roy, P. Das and R. Das, "Temperature and humidity monitoring system for storage rooms of industries," 2017 International Conference on Computing and Communication Technologies for Smart Nation (IC3TSN), 2017, pp. 99-103, doi: 10.1109/IC3TSN.2017.8284459.

[10]. S. Halder and G. Sivakumar, "Embedded based remote monitoring station for live streaming of temperature and humidity," 2017 International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT), 2017, pp. 284-287, doi: 10.1109/ICEECCOT.2017.8284683.

[11]. M. Chen, H. Chiu, K. Tseng, Y. Yang, C. Chou and J. Jiang, "An IoT-based Temperature Monitoring System for Underground Cable Tunnels," 2019 IEEE PES GTD Grand International Conference and Exposition Asia (GTD Asia), 2019, pp. 960-964, doi: 10.1109/GTDAsia.2019.8715849.

[12]. C. Hairu, M. Hanafi, S. M. Shafie, W. F. FazlilIlahi and S. Mashohor, "Remote Monitoring of Surface Temperature and Moisture Content in Urban Greenhouse," 2020 IEEE 8th Conference on Systems, Process and Control (ICSPC), 2020, pp. 101-105, doi: 10.1109/ICSPC50992.2020.9305786.

[13]. M. Quamara, B. B. Gupta and S. Yamaguchi, "MQTT-driven Remote Temperature Monitoring System for IoT-based Smart Homes," 2019 IEEE 8th Global Conference on Consumer Electronics (GCCE), 2019, pp. 968-970, doi: 10.1109/GCCE46687.2019.9015603.