WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

IOT Based Evaluation of Internal Fault Detection In Transformer Using V-I Characteristics

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DOI: https://doi.org/10.55248/gengpi.2022.3.5.1

A B S T R A C T

The common problem in operating the power transformer is the winding deformation due to the internal and external conditions. It should be controlled and rectified soon as it emerge, as it is progressive in nature. Unfavorably,theonlytechniquetodetect and identifysuchfaultsatthis stage is the frequency response analysis technique which is conducted offline. In this paper, we are proposing an idea to detect power transformer incipient winding deformations in real time by measuring voltage and current level in transformer in online mode. In this method, we are monitoring the live status of transformer using cost efficient and easily available sensors.

Keywords:real time monitoring, embedded systems, ROBOTC, software, internal fault detection of transformer

1. INTRODUCTION

Here introduces the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 9.5 pt. Here follows further instructions for authors.The generating stations, high-voltage transmission lines and distribution lines are the network of the electric grids. Power is generated by three phase alternators which is operating in parallel in the generating stations. An interconnected network is used to transmit and distribute the electricity from the point of generation to the end user properly. For reducing the power wastage, heat generation and for transmitting the electricity over a long distance, the high transmission lines are being used. It is known that when a low voltage power is transmitted over long distance, the power loss acquired will be high. It is important to protect transformers against the electrical faults. The existing methods which available to detect internal faults are all done offline and are not easier to operate. The GSM technique causes traffic as it is used by many simultaneously

This paper introduces a method of detecting internal fault of transformer by using IOT [Internet of Things] and tracking the live status of transformer's current, voltage values. The state of transformer is very important as it causes failure. So, we have used sensors for detecting the oil,smoke and water level of transformer. We have created an app and a website so that the live status of transformer can be monitored online through real time monitoring. By creating an app with the ROBOTC and ARDUINO IDE software, the connected sensors will determine the output values in real time monitoring status.

2. WORKING METHODOLOGY

It is an open-source project that uses micro-controller and interacts the sensors with the physical devices. It contains two important input sections, current sensing unit and voltage sensing unit that measures amount of current and voltage in the transformer respectively. The output values are recorded and compared with the predetermined values by sending the output values to the micro-controller. The results of this comparison are updated through IOT to the central monitoring unit. An intimation will be activated in the central unit if the output values cross the predetermined values at some extent. The V-I technique that conducts can be done online, and the condition of the transformer is controlled by incorporating sensors to monitor the live status accurately. The oil level sensors measure the insulation oil level. Temperature sensors measure the level of heat produced in the transformer and the smoke sensors measure gas quantity in it. The LCD displays the nature of the fault that occurred, and it is plugged into the Arduino cable for the results.

2.1 OPERATION OF THE PROPOSED SYSTEM

Power supply is given to the micro-controller. We connect all the sensors namely oil level sensor, smoke sensor, temperature winding sensor, current sensor, voltage sensor and IOT to ARDUINO UNO through UART communication. The power supply of 230V AC is stepped down to 12V AC and is converted to DC using bridge rectifier and the control switch is operated for switching on. All the updated values in the ARDUINO now calculate the changes. We can view the results in the app/website that we have created by using the username and password and identify the internal fault of the transformer.

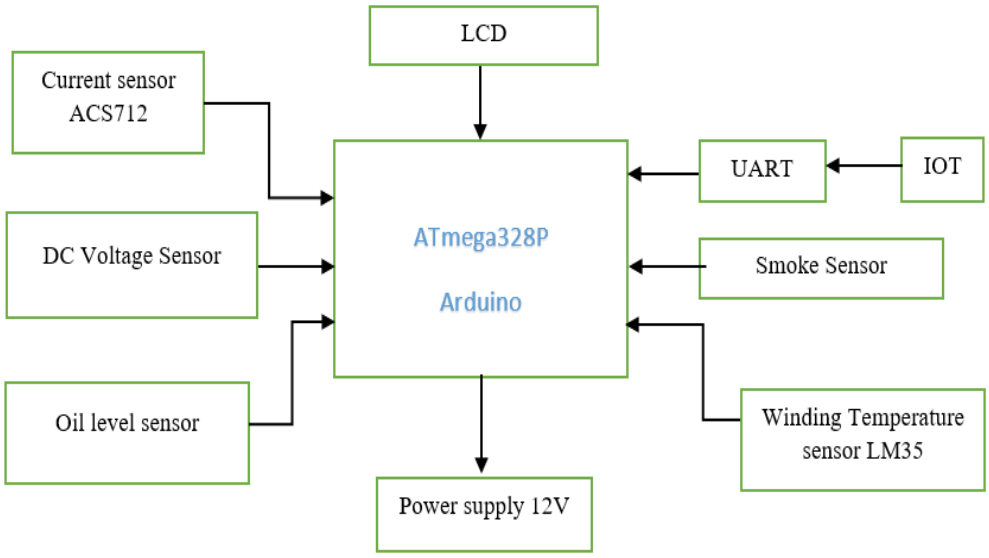

Fig.1. The Block Diagram of the proposed system

3. SOFTWARE IMPLEMENTATION

To launch the Arduino open-source software, connect the AVR ISP programmer into the powered Arduino UNO board via ISP header. The AVR ISP compatible downloader is needed to burn a latest version of the Arduino bootloader to the UNO and install the required components. Every time when the bootloader is called, the Arduino bootloader sets the 'erase address' to zero. The load address is verified by ROBOTC, and the program is written in a whole new page. The user program is written in a memory location 0x7000. Since the 'load address' does not update where to erase, the bootloader erases the information at location zero.

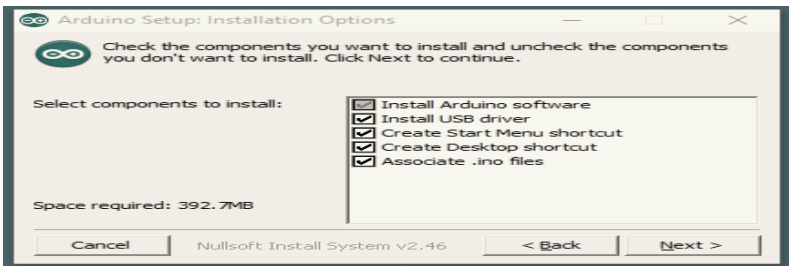

Fig.2. Installation of components

Embedded C provides portability and connects the Arduino code with real time monitoring sensors. Thus with the help of connected sensors , the fault is identified via app and detects the voltage and current level of the transformer. With the neccessary coding the real time values appear in the app. The Expresso's EEP8266EX gives consistent performance, power utility and provide quick solution to wifi problems.It integrates and can operate either independently or dependently of the hardware.This self-subsistent system can serve as energy efficient and enhanced method for the users by reducing the PCB size and circuits, optimizing the memory, and can be fitted to any microcontroller through UART or SPI interface systems. To provide linear voltage to the system, the power supply should be without carrier leakage, phase mismatching, interference in the signals, variation in the voltage,ripple factors,baseband nonlinear qualities. To avoid such improper properties,the voltage should be step downed to dc by rectifier and ripples are filtered at full wave nature

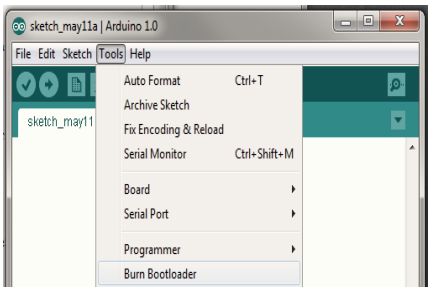

Fig.3. Click the Burn Bootloader

4. CIRCUIT DIAGRAM OF THE INTERNAL FAULT DETECTION SYSTEM

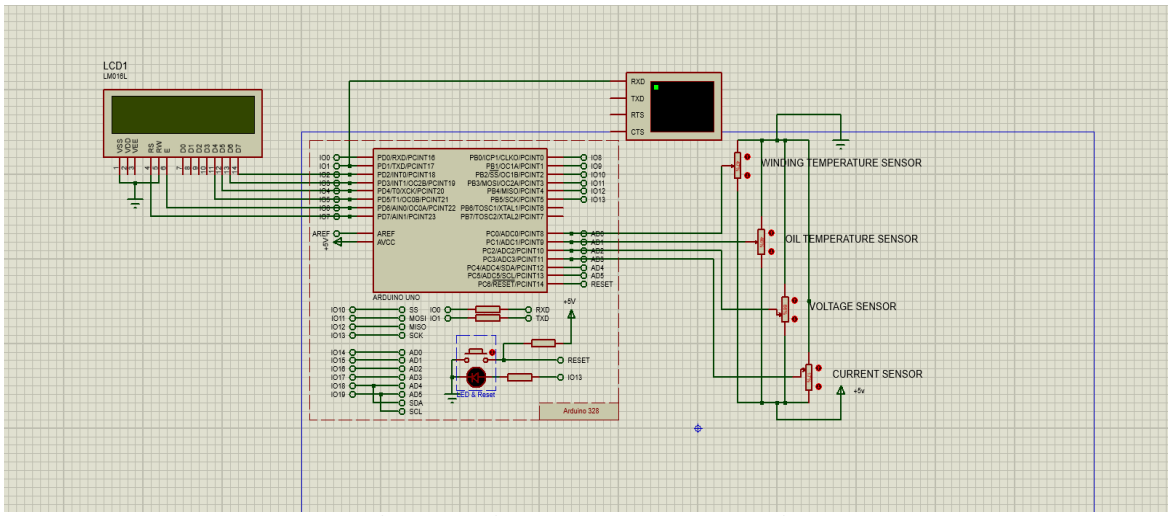

Fig.4. Circuit diagram of the internal fault detection system in the transformer using sensors

5. RESULTS AND DISCUSSION

The proteus software is used for obtaining the simulation for the internal fault detection in the transformer. It involves the designing of PCB with the components, drawing of the circuit schematics and helps in viewing the output in 3D format. After Installing the software and tools, the source code is implemented, and the schematic circuit is formed. The circuit involves microcontroller, IoT module, power supply, oil and winding temperature sensor, gas sensor, current sensor, voltage sensor. On Running the simulation with the actual determined value, the LED displays no fault detected.

When the transformer gets heated above certain level of temperature [90 degree], the oil level increases and detects the fault as high oil temperature fault. When the voltage level in the transformer is decreased, it detects low voltage fault, and this prevents the internal damage.

With the help of Proteus software and ARDUINO IDE software, the output values of the voltage and current are obtained and compared with the predetermined value for fault analysis quickly. The simulation variation shows the various fault that occurs in the transformer and that can be controlled with real time monitoring. The workspace design can be easily modified according to the need of components and can be created with easy understanding steps. Here the errors are autocorrected and tracks the connection of the tools for detailed version.

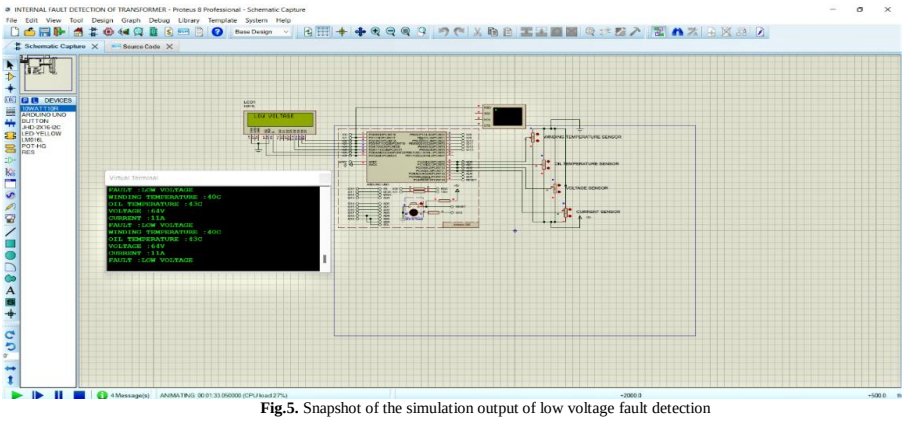

Fig.5. Snapshot of the simulation output of low voltage fault detection

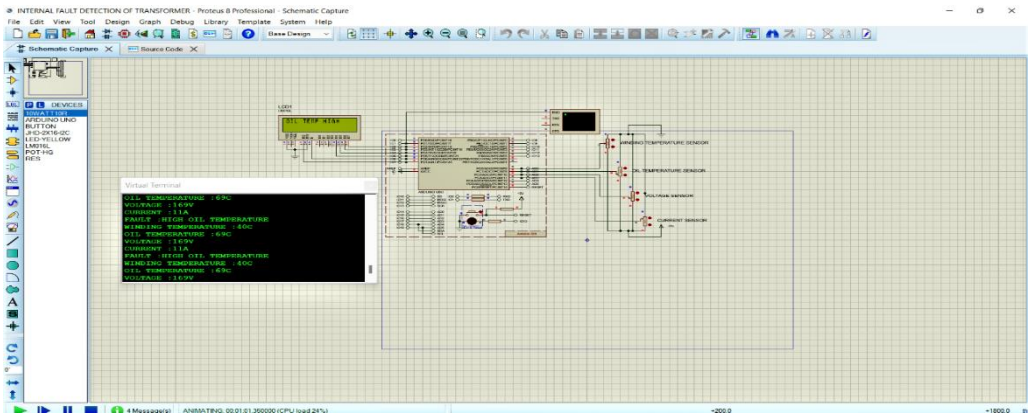

Fig.6. Snapshot of the simulation output of high winding temperature fault detection

6. HARDWARE AND RESULT ANALYSIS

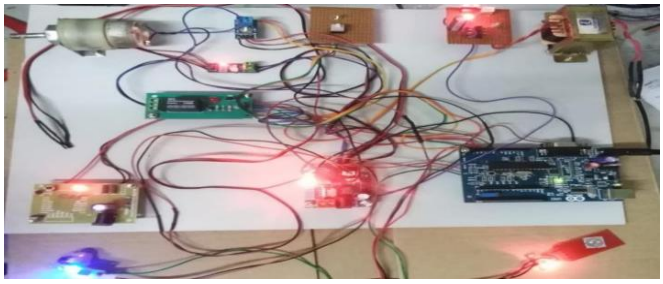

Fig 7. Power supply given to the transformer

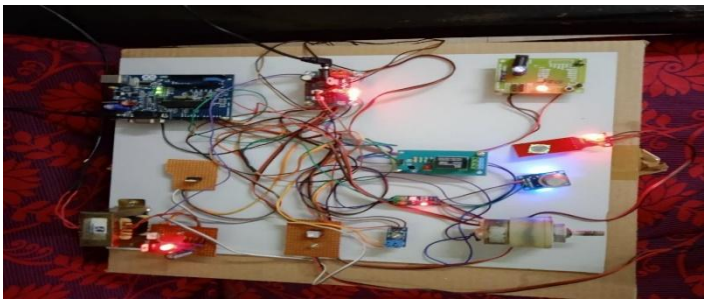

Fig 8. IoT module collects data from microcontroller

In this hardware setup, we use the ,"THINGSHOW APPLICATION" for getting the graphical results of the fault detected in the transformer. The hotspot connection is given to the IoT module and values are collected from the micro controller. The motor runs for giving the power supply for current calculation.The voltage stays constant here. The oil and gas sensors gives various output results according to the temperature given.The results are shown in different dates and time. The whole hardware setup is activated to get the experimental values and compared with with real time values obtained from the application.

6.1. Results obtained from app:

Fig 9. Results obtained from the app

7. CONCLUSION

By using the method of IoT based real monitoring sensors, the internal fault in the transformer is easily detected, monitored and resolved. It locates the fault in the three-phase transmission line and highly reliable by having data storage. As it works on the real time, we can monitor without any traffic and maintain all data sheets and prevent future issues in the transmission line.

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