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# IOT Based Transformer Monitoring System Using Arduino

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**ABSTRACT:** In this project, the design aspects of an embedded device that can monitor the Distribution Transformer and record the parameters of a distribution transformer like load currents, voltage, and ambient temperature. The main objective of the project is to control the Distribution Transformer using wireless technology. The aim of the project is to on, off, and monitor the parameters like load voltage, load current, and temperature of the Distribution Transformer by using IOT. It is installed at the distribution transformer site and the given parameters are recorded by using the Arduino Mega microcontroller. The controller is extremely handy at places where we have to control the ON and OFF switching of the devices but no wired connection to that place is available. IoT-controlled Distribution Transformer is an automatic control system that is capable of receiving a set of command instructions in the form of the internet of things and performs the necessary actions like monitoring, ON, and OFF. The transformer monitoring system is a safe and easy approach to help in easy operation and identification of problems before any costly failure. [1,6].

**KEYWORDS:** Distribution Transformer, Internet of Things, Health Monitoring, Matlab, Arduino Mega Microcontroller

## I. INTRODUCTION

As we all know that electricity has become an essential need for us in the past recent years, and to fulfil the demand all over the world, the electrical power system is spread all over. To meet the needs of the end-users there is a transfer of large electrical power from generating station via a distribution system. The Transformer is the key component of this distribution system, thus it is essential to monitor the parameters to keep them safe from any fault condition. These faults must be foreseen and safety precautions applied to the power system. Distribution Transformers are directly connected to load; hence they are more prone to faults due to sudden load variations. As of now, the distribution transformers are monitored manually which cannot give the correct value of some parameters such as current overload, overheating of transformer which has a significant effect on its life. The transformers must be operated in rated condition for their long life. This is not possible during the entire working period. Overloading and deficient cooling of transformers can cause unexpected failure in transformers which can disturb the delivery of electricity over many consumers. The manual check-up of the rise in voltage, rise in ambient temperature, load current, etc. tends to be more complex as incidental parameters cannot be accessed. An electrical power system consists of various components such as generators, switches, transmission cables, transformers, capacitor banks among other components. It cannot, therefore, operate without an effective protective device to keep these components safe and the system stable. Faults in a power system refer to the undesired conditions that occur in the electrical power system. These conditions may

include short circuits, over current, overvoltage, high temperatures among others. Here IOT is used for communicating the monitored parameters [7,8]

This paper is about the real-time monitoring of the distribution transformer, and to reduce human labour and error to enhance its life span.

## II. TRANSFORMER FAULT ANALYSIS

There are many types of faults a distribution transformer undergoes, in which some of them are the major faults, which should be checked regularly and monitored to minimize or avoid them. Some of the major faults are shown below:

- i. **Over Load:**  
Over load/ over current is the current flowing through the transformer resulting from faults on the power system. Usually this type of fault condition is short in duration (Less than 2 seconds) because the protection relay operates and isolate the faults from system. Fault currents that do not include ground are generally in excess of four times full-load current.
- ii. **Over/ Under Voltage:**  
The flux in the transformer core is directly proportional to the applied voltage and inversely proportional to the frequency. Over excitation can occur when the per-unit ratio of voltage to frequency (Volts/Hz) exceeds 1.05 p.u. at full load and 1.10 p.u. at no load.
- iii. **Temperature:**  
Excessive load current alone may not result in damage to the transformer if the absolute temperature of the windings and transformer oil remains within specified limits. Transformer ratings are based on a 24-hour average ambient temperature of 30°C (86°F). Due to over voltage and over current, temperature of oil increases which causes failure of insulation of transformer winding.

## III. PROPOSED SYSTEM

Fig 1. Shows the block diagram of the proposed system for screening the important parameters of distribution transformer. The model is based on a microcontroller that monitor the value of voltage, current, and temperature, and display it on LCD Screen using THINKSPEAK. The monitored values provided by the microcontroller is compared with the rated values of the transformer and microcontroller is programmed in such a way that when monitored values exceed the rated values it takes the appropriate action and display the values on the LCD. The microcontroller is programmed in such a manner so as to continuously take the parameter values at regular time interval.

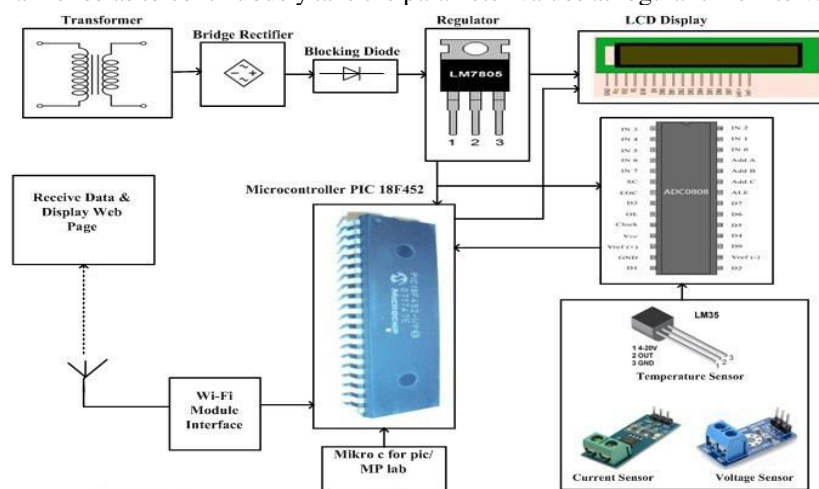


Fig 1. Block Diagram

**Transformer:** The transformer used in this model is for step down the 220V ac into 12V ac as the microcontroller cannot work on so high voltage. It consists of two windings and works on the principle of mutual induction.

**Bridge Rectifier:** The bridge rectifier is used for converting the ac voltages into dc and is connected at the output of transformer.

**Blocking Diode:** The blocking diode is used for blocking the reverse polarity current.

**Voltage Regulator:** The voltage regulator is used for regulating the 12V dc into 5V dc. It is connected at the output of bridge rectifier, the LM 7805 voltage regulator have been using in this system.

**LCD Display:** The LCD display is used for displaying the monitoring data such as temperature, current and voltage etc. of the connected transformer.

**Microcontroller PIC 18F452:** The microcontroller is used for the intelligent control of this system. It 40 pins microcontroller and is programmed in c language with the help of mikro/c software. It is powered up with 5V dc and is interfaced with Wi-Fi module, ADC 0808 and LCD display.

**ADC 08080:** The ADC 0808 is used for converting the analogue data into digital data for giving the logic signal to the microcontroller. It is 16 pin integrated circuit IC and is powered up with 5V dc.

**Wi-Fi Module:** The wi-fi module is used connecting this system to the wi-fi network for the remote monitoring of data of transformer or generator. It is interfaced with microcontroller for receiving the logic data.

**Temperature Sensor:** The temperature sensor is used for sensing the temperature of cross ponding transformer. For this purpose, the LM 35 temperature sensor have been using here.

**Voltage Sensor:** The voltage sensor is used for sensing the voltage of corresponding components such as transformer.

**Current Sensor:** The current sensor is used for sensing the current of cross ponding transformer or generator. It senses the current in amps and give output in milli amps. It is interfaced with ADC 0808 for giving him analogue input.

#### IV. CIRCUIT DIAGRAMS

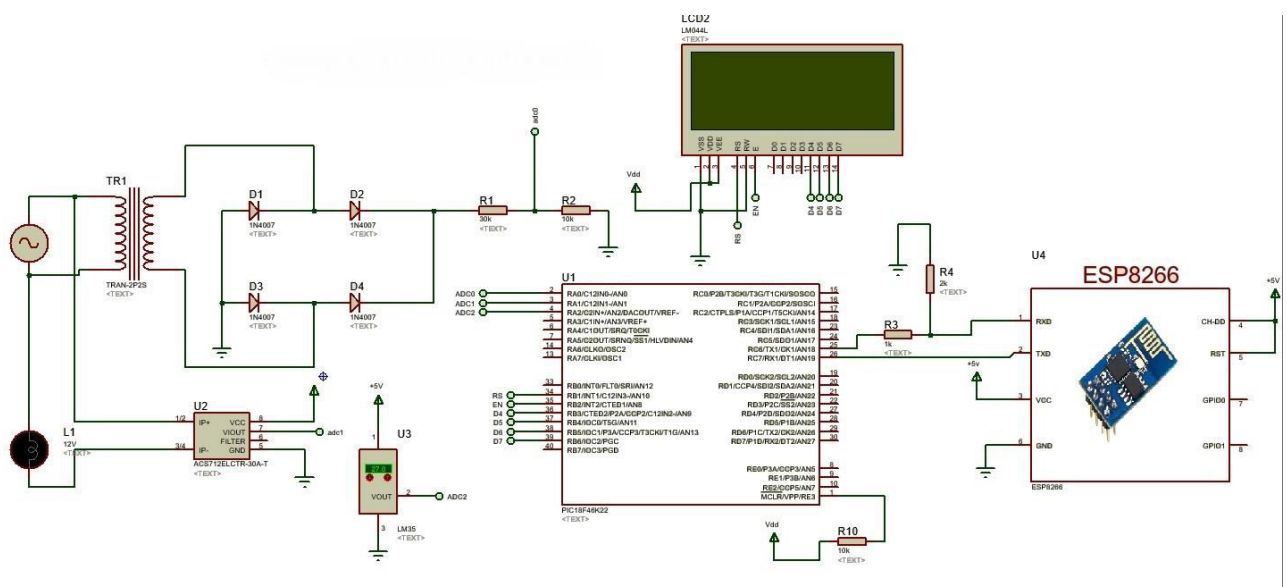


Fig 2. Interfacing Current, Voltage, Temperature Sensors and LCD with Microcontroller.



## V. ALGORITHM FOR CENTRALIZED MONITORING

The step by step procedure for monitoring the distribution transformer key parameters like voltage, current and temperature are explained as follows and also with the help of the flowchart.

STEP 1: Start.

STEP 2: Check the connection.

STEP 3: Verify the hardware for the power supply to the kit.

STEP 4: Input the Potential Transformer, Current Transformer, and Temperature Sensor.

STEP 5: Transfer the values of Potential Transformer, Current Transformer, and Temperature Sensor to THINKSPEAK channel.

STEP 6: If the voltage and current values exceeds rated values which are specified in pic program, suitable action is Taken by the microcontroller.

STEP 7: If the temperature exceeds specified rated value, suitable action is taken by the microcontroller.

STEP 8: These data are stored and displayed on LCD using in the Matlab Simulink.

STEP 9: Stop

## VI. OBSERVATION

1. Sensors are initialised to sense current, voltage & temperature of transformer.
2. Microcontroller continuously update & display readings on pc.
3. If transformer parameters such as current and voltage exceeds rated values microcontroller is programmed in such a way that it stops power supply.
4. If temperature parameter exceeds rated value microcontroller is programmed in such a way that it turns on cooling fan[1].

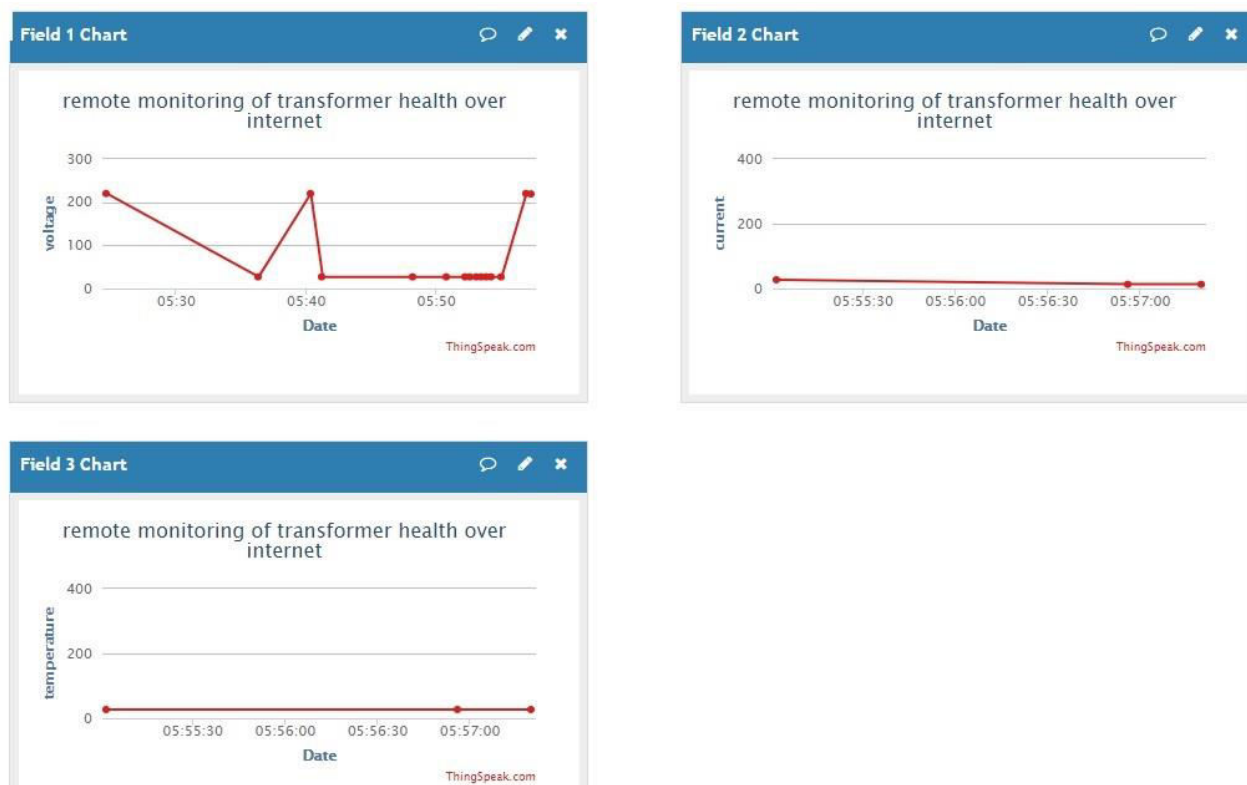


Fig 3. Observed Values



## VII. CONCLUSION

Transformers are among the most generic and expensive piece of equipment of the transmission and distribution system. Regular monitoring health condition of transformer not only is economical also adds to increased reliability. In this paper, the distribution transformer key parameters like voltage, current and temperature are monitored using PIC 18F452 microcontroller. This model protects the transformer from the over loading and overheating. This can be very crucial in transformer health system and extending its life.

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