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IOT BASED DISTRIBUTION TRANSFORMER MONITORING AND CONTROLLING SYSTEM

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Abstract - *One of the most crucial pieces of equipment in the electricity network are distribution transformers. Data collection and condition monitoring are significant issues in power electric systems because of the numerous transformers that are dispersed across such a big area. This system's primary goal is to use Internet of Things to monitor and regulate distribution transformers. Additionally, it uses the modem to transmit messages to a central database for additional processing. Online monitoring systems combine various sensors, a global service mobile modem, and a chip micro controller. In this case, transformers are harmed by oil damage. Different factors and environmental factors might affect oil damage. We are currently focusing on the viscosity of the oil and the temperature of the transformer in this system. The microcontroller is used in this system to monitor and control temperature and viscosity. After connecting the necessary components, an embedded-c application programme has been created. The temperature, voltage, and current are continuously read by the controller and displayed on the display.*

***Key Words*: GSM, microcontrollers, sensors, and IoT (Internet of Things).**

1. INTRODUCTION

As the primary piece of equipment in a power system that directly distributes electricity to low-voltage customers, the distribution transformer is essential to the smooth operation of the distribution network. Distribution transformers' long lives are ensured by operating them under rated conditions [1]. However, if they are subjected to overloading conditions, their life is dramatically decreased, leading to abrupt failures and loss of supply to a significant number of customers, which affects system reliability [2-5]. The main reasons distribution transformers fail are overloading and an increase in the temperature of the transformer's oil and windings. Our solution, which is based on the online monitoring of crucial distribution transformer operational characteristics, can provide vital information about the health of transformers, allowing utilities to utilize their assets more effectively and keep them operational for longer periods of time. This technology will enable us to spot issues before to any unwelcome failures, extending the useful life of transformers. Due to the previously described use of a microcontroller, this system is an embedded system. One way to conceive of an embedded system is as a computer system that was built with maximum efficiency, allowing it to carry out specified functions as quickly as possible. Embedded systems are typically set to a specific task. Additionally, it offers the benefits of significant cost savings, lower power usage, and higher dependability.

2. PROPOSED SYSTEM

The next-generation electric power grid, or "smart grid," actually transmits electricity digitally. Digital technology makes it possible for utilities and customers to communicate ingeniously on a two-way basis. Our idea, which is based on online monitoring of transformers' primary operating indicators, can give utilities vital information about the health of their transformers, enabling them to use the asset more effectively and maintain it for a longer period of time. This technology will enable us to spot issues before to any unwelcome failures, extending the useful life of transformers. We employed four sensors in the transformer monitoring system: a voltage sensor, a current sensor, a temperature sensor, and an oil level sensor. We used a power supply to run the global service mobile (GSM) module and AT mega 16 microprocessor. Figure illustrates how all other devices and the microcontroller is connected. Sensors gather the data and show it on an LCD display while

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a GSM module sends the message (data) to the user at the designated number in accordance with the programme. We can protect the device and prevent failure if we learn any insecure information about the transformer.

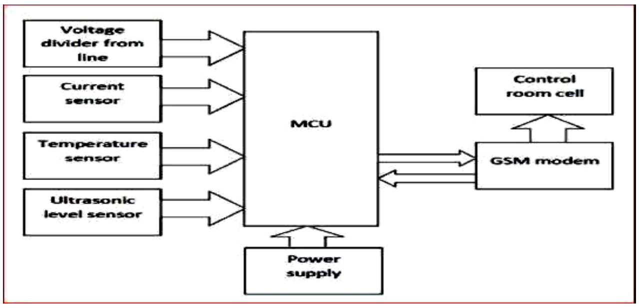

Fig -1: Block diagram of Transformer monitoring system

3. COMPONENTS

VOLTAGE SENSOR

A voltage sensor is a tool that measures the electrical voltage (AC or DC) present in a wire and produces a signal corresponding to that value. Analog voltage or current could be the signal created. It can be used to regulate an electrical device or to show the measured voltage in a voltmeter or to store it for later analysis in a data gathering system.

CURRENT SENSOR

A current sensor is a device that measures the electric current flowing through a wire and produces a signal corresponding to that current. Analog voltage or current can both be created as signals. The measured current can then be used to show in an ammeter, be stored for later study in a data gathering system, or be used for control.

OIL LEVEL SENSOR

A tool called an oil level sensor is used to monitor the transformer's oil level. Overheating causes the oil to start evaporating, which lowers the oil level. The transformer may be in risk as a result of this oil level drop. As a result, this sensor provides a level indication, making us aware of the level.

TEMPERATURE SENSOR

Temperature sensors range from straightforward ON/OFF thermostatic devices that regulate a household hot water heating system to very sensitive semiconductor versions that can regulate intricate process control furnace systems. We recall from our high school science lessons that heat is produced by the movement of molecules and atoms, and the more movement there is, the more heat is produced. Temperature sensors quantify the quantity of heat energy or even coldness that is produced by an object or system, enabling us to "sense" or detect any physical change to that temperature, generating either an analogue or digital output.

ATMEGA 16

• High-performance, Low-power AVR® 8-bit Microcontroller

• Advanced RISC Architecture

– 131 Powerful Instructions – Most Single-clock Cycle Execution

– 32 x 8 General Purpose Working Registers

– Fully Static Operation

– Up to 16 MIPS Throughput at 16 MHz

– On-chip 2-cycle Multiplier

• Nonvolatile Program and Data Memories

– 16K Bytes of In-System Self-Programmable Flash

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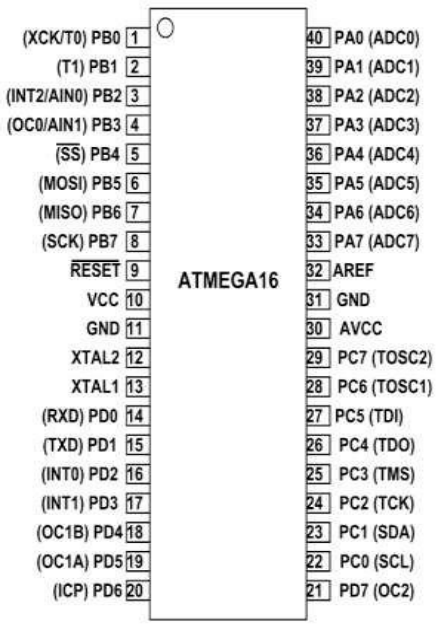

Fig -2: ATMEGA 16 PIN REPRESENTATION

LCD Module

In recent years, LCDs have replaced LEDs in many applications (Seven Segment LEDs or other multistage LEDs). having the capacity to display pictures, letters, and numbers. In comparison, LEDs can only display a few characters and digits.

Fig 3: LCD display

ADVANTAGES

- Low cost.
- Real-time monitoring.
- High efficiency.
- High Accuracy.
- Improve system reliability.

APPLICATIONS

- Distribution Transformer.
- Industrial Applications.
- On High Grade Motors.

4. RESULTS

This system would provide efficiency and accuracy by doing away with the need for human power. This essay will provide precise information on energy theft. It will aid in controlling parameter sensing and record information regarding electricity theft. Additionally, this paper will guarantee safety, aid in lowering the amount of theft, and cause no harm to the environment or surrounds.

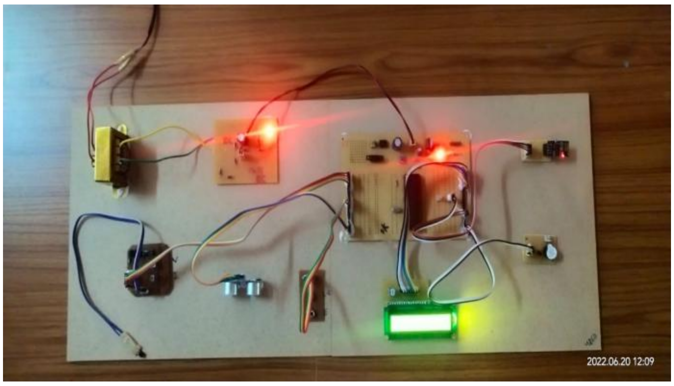

Fig 4: Hardware prototype

The following are the results obtained from ThingSpeak application.

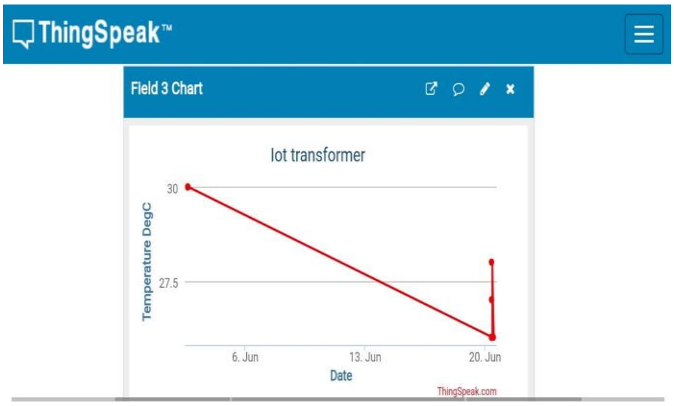

Chart 1

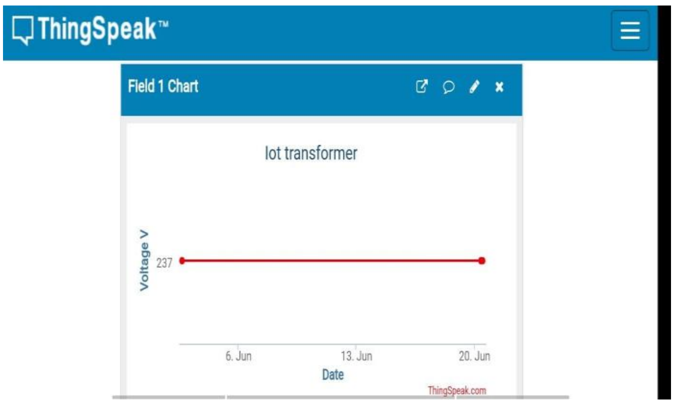

Chart 2

Chart 3

5. CONCLUSION

In comparison to manual monitoring, IOT-based distribution transformer monitoring is highly beneficial. It is also dependable because it is not always possible to manually monitor the load current, ambient temperature rise, or oil level. When we receive a message about an irregularity, we may act right away to stop any undesirable distribution transformer failures. There are numerous distribution transformers in a power distribution network, and by connecting each transformer to a specific system, we can quickly determine which 40 of the transformers is having a problem from the message provided to a mobile device. We can repair the system faster because we won't need to verify all of the transformers and their accompanying phase currents and voltages. Although the public GSM network traffic may cause delays in message delivery, it is still more efficient than manual monitoring.

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