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ENABLED SMART TRANSFORMER MONITORING AND CONTROL SYSTEM USING (WSN)

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ABSTRACT - A transformer is very important in substation and power system. The data assets and provision of transformer is an very important aspect in electric network as huge number distribution transformers are distributed a huge area. Through this paper we are presenting an idea for designing and new accoutrement of GSM based system and software is used to programme running purpose, and recording main operation constant of a substation transformer relating a voltage measurement, transformer oil measurement, heat of transformer (temperature) measurement of three phases. The proposed plan of online observe system of transformer proportion in a Global Service Mobile modem (GSM) Modem, with the use of microcontroller chip and sensors. Parameters of working condition of distribution transformer is received in the form of short message service and it will be saved in the phone or internal storage.

Keywords- **Transformer, IOT, Temperature Sensor, Ultrasonic Sensor.**

I. INTRODUCTION

The Enabled Smart Transformer Monitoring and Control System is an innovative project that harnesses the power of WSN technology to revolutionize the way transformers are monitored and managed in power distribution networks. By leveraging wireless sensors deployed on transformers, this system enables real-time monitoring of various critical parameters such as temperature, oil level, load conditions, and other operational metrics. The data collected by these sensors are transmitted wirelessly to a central control unit, where it is processed, analyzed, and utilized to make informed decisions regarding transformer maintenance and

II. SYSTEM OVERVIEW

The Enabled Smart Transformer Monitoring and Control System operates on the foundation of Wireless Sensor Networks (WSN), revolutionizing the monitoring and management of transformers within power distribution networks. This system integrates wireless sensor nodes strategically positioned on transformers to collect critical operational data, including temperature, oil level, and load conditions. These sensors communicate wirelessly with each other and with the central control unit, eliminating the need for physical connections and enabling flexible deployment evenin remote or inaccessible locations. The collected data is transmitted to a Data Acquisition Unit (DAU), which serves as the interface between the sensors and the central monitoring system. The DAU aggregates the data and forwards it to the centralcontrol unit in real-time. The central monitoring system employs advanced algorithms and machine learning techniques to analyze the data, detecting patterns, anomalies, and potential faults. Operators can access the monitoring system through a user-friendly interface to view real-time data and receive alerts and notifications. Additionally, the system offers remote control capabilities, allowing operators to adjust transformer settings and parameters based on real-time data analysis. Thisproactive approach to maintenance and optimization enhances the efficiency,reliability, and safety of power distribution networks, leading to cost savings,

improved grid resilience, and enhanced customer satisfaction.

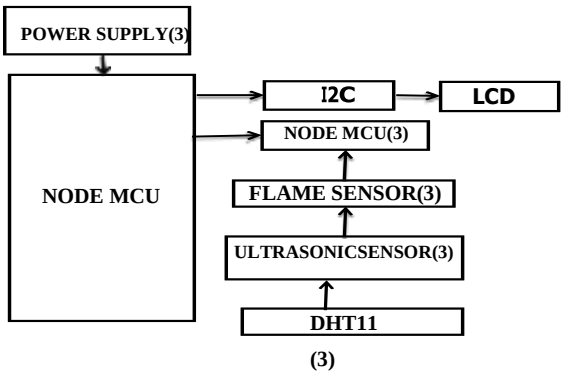


Figure 1. System architecture of the system

In this proposed system node MCU is work like as a brain of the system. In this system 3 ESP8266 interconnected with main node. Ultrasonic sensor is used to detect the level of the oil in the transformer oil storage tank. Flame sensor is used to detect intransformer fire is occurred or not. DHT11 is used to monitor the temperature level of the transformer. The value of 3 sensors is continuously send the values to the main node. After receive the data from the sub nodes the main node mcu send the details to the cloud website. Lcd is used to update the all details on display.

III.MODULES NAME

- Flame detection
- Oil level monitoring
- Temperature monitoring.

a) FLAME DETECTION

In this proposed system node MCU is work like as a brain of the system. In this system 3 ESP8266 interconnected with main node. Here flame sensor is used to monitor flame detected or not in the transformer. Lcd is used to show the all details in the display

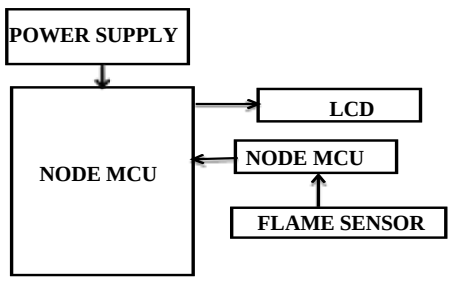


Figure 2 Architecture of the FLAME DETECTION

b) OIL LEVEL DETECTION

In this proposed system node MCU is work like as a brain of the system. In this system 3 ESP8266 interconnected with main node. Here ultrasonic sensor is used to monitor oil level in the transformer. Lcd is used to show the all details in the display

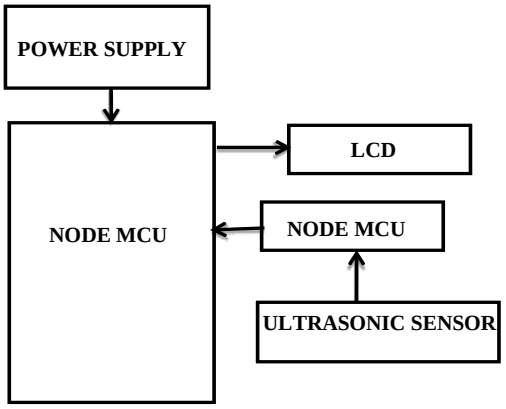


Figure 3. Architecture of the OIL MONITOR

b) TEMPERATURE MONITORING

In this proposed system node MCU is work like as a brain of the system. In this system 3 ESP8266 interconnected with main node. Here DHT11 is used to monitor temperature level in the transformer. Lcd is used to show the all details in the display. All details are update on the main node

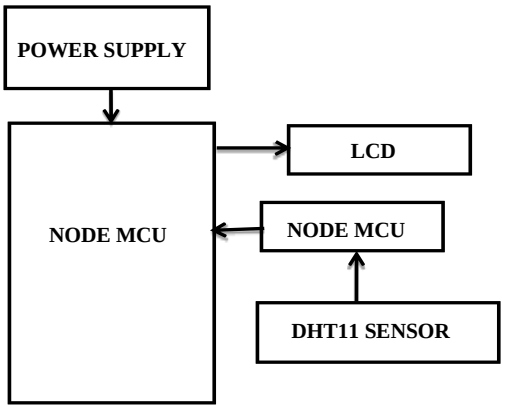


Figure 4 Architecture of the TEMPERATURE MONITORING

system.

IV . HARDWARE DISCRIPTION

i) ESP-12E BASEDNODEMCU

The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge fromexisting micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect NodeMCU devkit to yourlaptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

Figure 5 ESP-12E BASEDNODEMCU

ii) LIQUID CRYSTAL DISPLAY

LCD screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

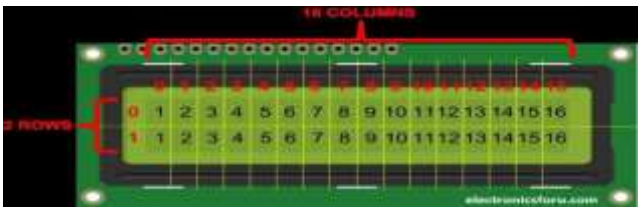


Figure 6 LCD

iii) FIRE/FLAME SENSOR

A **flame detector** is a sensor designed to detect and respond to the presence of aflame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression

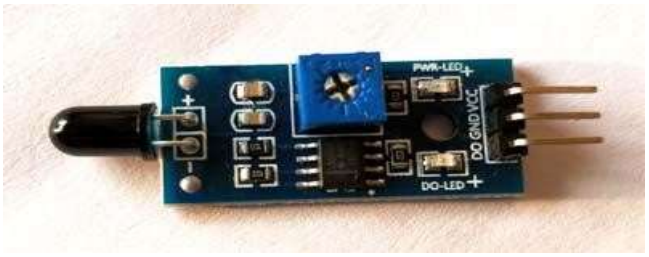


Figure 7 FLAME SENSOR

iv) ULTRASONIC SENSOR

Ultrasonic detection is most commonly used in industrial applications to detect hidden tracks, discontinuities in metals, composites, plastics, ceramics, and for water level detection. For this purpose the laws of physics which are indicating the propagation of sound waves through solid materials have been used since ultrasonic sensors using sound instead of light for detection.

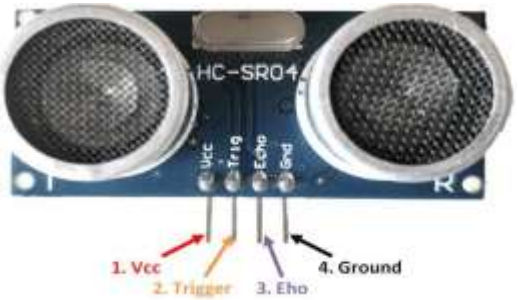


Figure 8 ULTRASONIC SENSOR

v) DHT11

DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measure, process this changed resistance values and change them into digital form.

Figure 9 DHT 11 SENSOR

V) SOFTWARE REQUIREMENTS

i) ARDUINO SOFTWARE (IDE)

The Arduino Integrated Development Environment - or Arduino Software (IDE) contains a text editor for

writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them

Figure 10 ARDUINO IDE

ii) EMBEDDED C

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software.

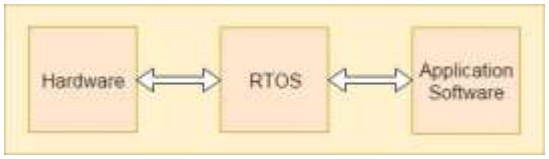


Figure 11 EMBEDDED SYSTEM

VI) PROTOTYPE

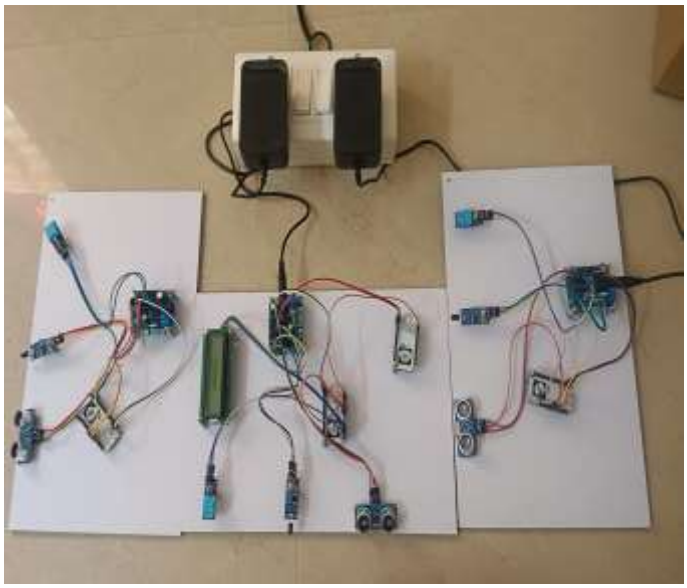
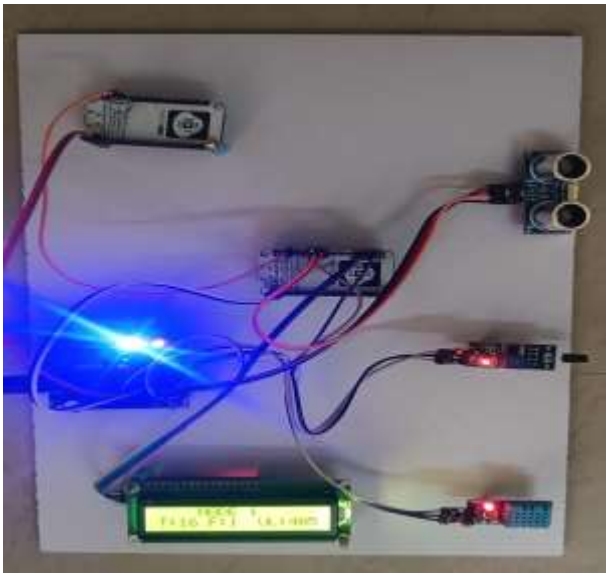


Figure 12 PROTOTYPE

The project is specifically designed for monitoring the oil level, fire occurrence, and temperature in transformer systems. It enables real-time data collection and analysis, facilitating proactive maintenance planning and ensuring optimal performance of transformers.

VII) OUTPUT



VIII) CONCLUSION

The microprocessor devices with RPA functions and transformer conditionmonitoring based on SPM is a promising direction of development of this device type. Reducing the relative cost of the transformer monitoring system by using the capabilities of RPA microprocessor devices will increase their investment attractiveness, especially for the segment of medium-voltage power transformers.

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voltage power transformers,which, as a rule, are not equipped with monitoring systems due to their relative cost.

IX) REFERENCES

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