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Remote Monitoring Of Transformer Health Over Internet

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Abstract-- Transformers are widely used for power transmission and the monitoring of various parameters from transformer plays a crucial role in industries by using a particular system for continuous monitoring of transformer health can be done by internet of things. In this system there will be a temperature sensor, oil level sensor are incorporated inside the transformer to continuously monitor the parameters and check the health of the transformer through internet. Temperature sensor (LM35) and Ultra sonic sensor (HC-SR04) are connected to Arduino (AT328P) microcontroller. As the Arduino connects to wifi module which is ESP8266 and to actively transfer the data in bidirectional way of communication with the help of MAX232. This allows programming of the ESP8266 chip's onboard processor to run the application itself without the need for an Arduino. The module comes pre-flashed with the ESP8266 AT command set firmware. So as the ESP8266 is connected to the Internet server and the corresponding data is displayed on to the monitoring device. So by this way a continuous monitoring of data can be monitored and as if the temperature of the transformer rises above a particular threshold then the cooling system is activated to dissipate the excess heat that is present in the transformer if the proper cooling system is not provided then the transformer may get heated up and may cause a severe breakdown and also as if the level of the oil is getting drained then also a proper signal will be initiated and proper action will be taken. So here by a real time monitoring of the transformer can be done with this system.

Keywords— IOT (Internet of Things), Arduino, ESP8266,Level sensor, Temperature sensor, LTV(Lower Threshold Value),HTV(Higher Threshold Value)

1. INTRODUCTION

The IOT based monitoring of distribution transformer is rather more useful as compared with the manual operating system. If we consider a manual operating system there is a lot of disadvantages when compared with the IOT based monitoring system. As the manual operating system is not possible to monitor the rise in oil temperature and also can't monitor the level of the oil. These problems were resolved in the proposed system. So the proposed system is modeled in such a way that online monitoring of main operational parameters of distribution transformers which will give the overall information and condition of the distribution transformer using IOT technique. By that way the power supplying losses can be minimized and the quality of the power supply and reliability is improved. When such a system is employed to each distribution transformer the proposed system will keep on monitoring the each operational parameters.

2. LITERATURE REVIEW

It [1] is proposed that a wireless transformer monitoring parameters. The most important purpose of this system is by monitoring of physical parameters by using Temperature sensor, Level sensor .Ordinary transformer measurement system generally detects a single transformer parameter, such as power, current, voltage. While some ways could detect multi-parameter, the time of acquisition and operation parameters is too long, and testing speed is not fast enough. [2] Detection system itself is not reliable. The main performance is the device itself instability, poor anti jamming capability, low measurement accuracy of the data, or even state monitoring system should is no effect. Timely detection data will not be sent to monitoring centers in time, which cannot judge distribution transformers three-phase equilibrium [3] A monitoring system can only monitor the operation state or guard. Against steal the power, and is not able to monitor all useful data of distribution transformers to reduce costs. Many monitoring systems use power carrier communication to send data, but the power

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carrier communication has some disadvantages: serious frequency interference, with the increase in distance the signal attenuation serious, load changes brought about large electrical noise. So if use power carrier communication to send data, the real-time data transmission, reliability cannot be guaranteed.

3. PROPOSED SYSTEM FOR DISTRIBUTION TRANSFORMER

The Real Time Health Monitoring of a transformer system is designed by using a 230V to 12V Step Down Transformer and that voltage is processed to a bridge circuit and a corresponding DC voltage obtained at the output and that is given to the circuit board .The circuit board contains the components that are interfaced to the transformer and the interfaced sensors are Level sensor and Temperature sensor and these sensors continuously collect the data and process the data to Arduino and as the received data is in the form of a analog signal so it has to be converted into digital in order to do so the Atmega 328P has an inbuilt A/D converter that directly converts the analog data into digital and this data from Arduino transmit to ESP8266 wi-fi module which acts as a transmitter and transmit the data to the receiver end who is at the operator end by this way continuous monitoring of the parameters can be done.

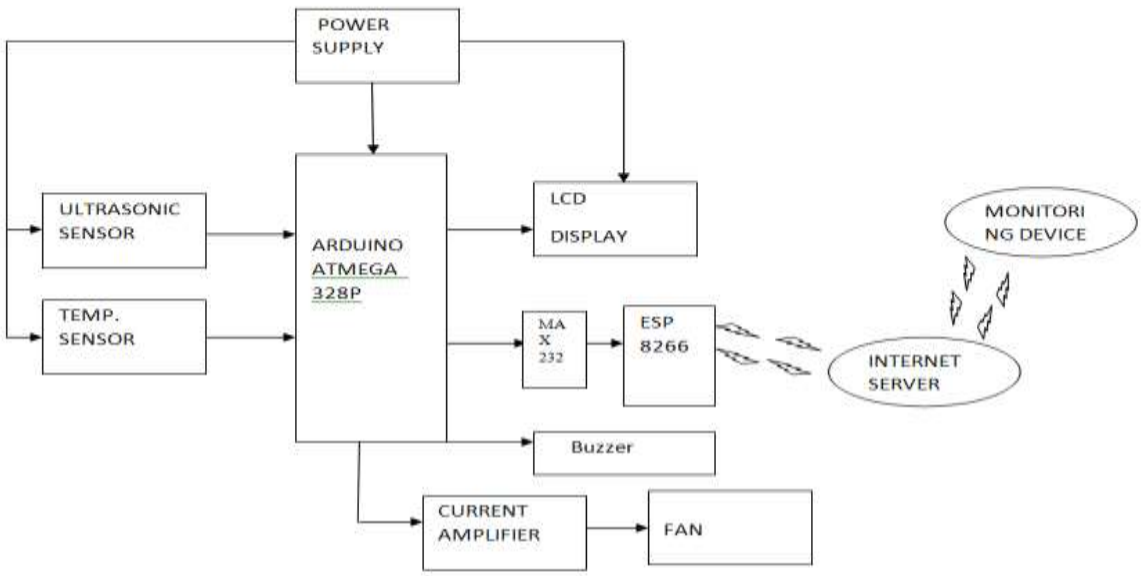

Figure 1. Block Diagram

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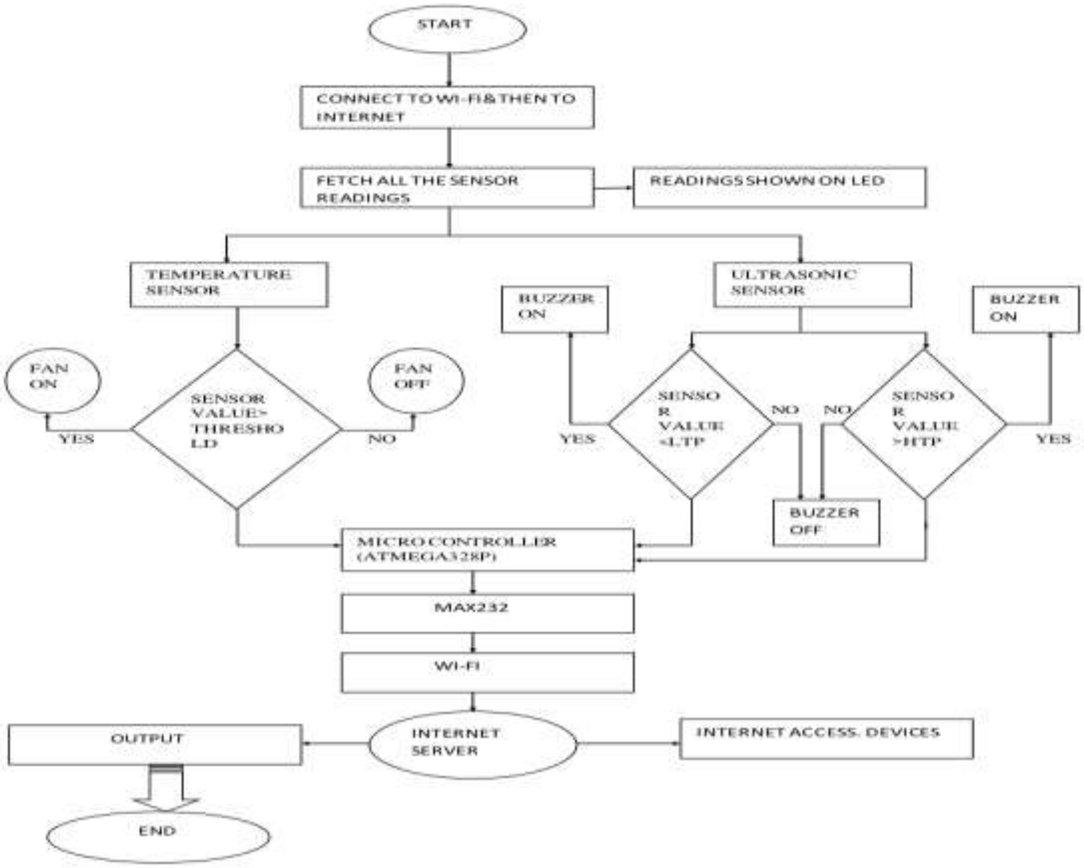

Figure 2.Flow Chart

Figure 3. Proposed System

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A. ULTRASONIC RANGING MOUDLE

HC-SR04 is an ultrasonic ranging module that provides 2 cm to 400 cm non-contact measurement function. The ranging accuracy can reach to 3mm and effectual angle is < 15°. It can be powered from a 5V power supply. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work: (1) Using IO trigger for at least 10us high level signal, (2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. (3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time×velocity of sound (340M/S) / 2.

Figure 4. HC-SR04 Ranging Module

B. 16*2 LCD MODULE

Operating Voltage is 4.7V to 5.3V. Current consumption is 1mA without backlight. Alphanumeric LCD display module, meaning can display alphabets and numbers. Consists of two rows and each row can print 16 characters. Each character is build by a 5×8 pixel box. It can work on both 8-bit and 4-bit mode.
It can also display any custom generated characters. Available in Green and Blue Backlight.

We know that each character has (5×8=40) 40 Pixels and for 32 Characters we will have (32×40) 1280 Pixels. Further, the LCD should also be instructed about the Position of the Pixels. Hence it will be a hectic task to handle everything with the help of MCU, hence an Interface IC like HD44780is used, which is mounted on the backside of the LCD Module itself. The function of this IC is to get the Commands and Data from the MCU and process them to display meaningful information onto our LCD Screen.

Figure 4. 16*2 LCD MODULE

C. ATMEGA328P

The ATmega328P provides the following features:32K bytes of In- System Programmable Flash with Read-While-Write capabilities,1K bytes of EEPROM,2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Inter- face, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot pro- gram running on the AVR core. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega328P is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.

Figure 5. ATMEGA328P

D. ESP8266

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements. Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface. ESP8266 on-board processing and storage capabilities allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. With its high degree of on-chip integration, which includes the antenna switch balun, power management converters, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area. Sophisticated system-level features include fast sleep/wake context switching for energyefficient VoIP, adaptive radio biasing for low-power operation, advance signal processing, and spur cancellation and radio co-existence features for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation

Features

- 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- Supports antenna diversity
- Power down leakage current of < 10uA
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU

Major Applications Major fields of ESP8266 applications to Internet-of-Things include

- Home Appliances
- Home Automation
- Smart Plug and lights
- Mesh Network
- WiFi Location-aware Devices
- Security ID Tags

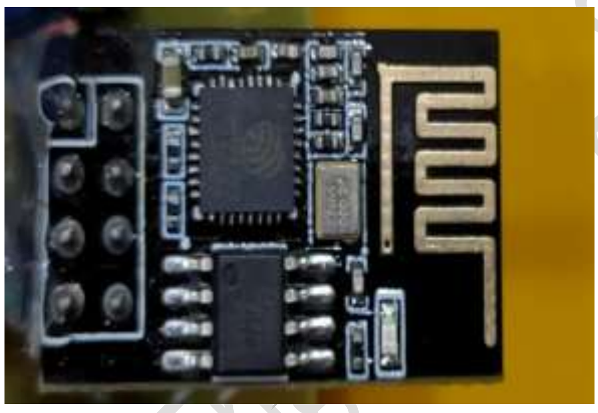

Figure 6. ESP8266

Figure 7.FAN

Figure 8. BUZZER

4. IMPLEMENTATION

Transformers are widely used for power transmission and the monitoring of various parameters from transformer plays a crucial role in industries by using a particular system for continuous monitoring of transformer health can be done by internet of things. In this system there will be a temperature sensor, oil level sensor are incorporated inside the transformer to continuously monitor the parameters and control the health of the transformer through internet. Temperature sensor (LM35) and Ultra sonic

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sensor(HC-SR04) are connected to Arduino(AT328P) and the corresponding data will be transferred to wifi module(ESP8266) The Arduino needs to connect with a wifi module to actively contribute to your projects. With this shield you will be able to provide connectivity or to use the board as one single unit. The ESP8266 WiFi shield is an easy and quick way to add WiFi functionality to Arduino. The ESP8266 WiFi chip has taken the IoT world by storm by breaking the cost barrier and making the IoT truly possible. The ESP8266 WiFi shield is an easy and quick way to add WiFi functionality to your Arduino.This board can be used an Arduino shield as well as a standalone breakout board if you prefer to program the ESP8266 directly.. This allows programming of the ESP8266 chip's onboard processor to run the application itself without the need for an Arduino. The module comes pre-flashed with the ESP8266 AT command set firmware. So as the ESP8266 is connected to the Internet server and the corresponding data is displayed on to the monitoring device. So if the transformer is dissipating more heat than the particular point then the corresponding fan will be switched on so as to dissipate the excess heat from the transformer as it acts as the cooling system for the transformer and also as if the oil level is getting drained then the corresponding signal will be initiated and proper action will be taken. So here by a real monitoring of the transformer can be done with this system

5. RESULTS

The pictures depicted below signifies that the proposed system is able to operate, able to acquire the continuous data that is fetching from sensors is getting updated to the server and monitoring is happening with the help of Thingspeak.com

Figure 9. Temperature Monitoring

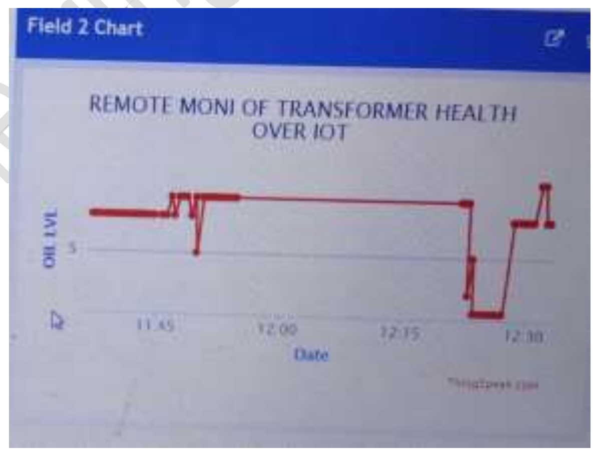

Figure 10. Oil Level Monitoring

Figure 11. Level is High and Temperature is Low

Figure 12. Level is Low and Temperature is High

6. CONCLUSIONS AND FUTURE WORKS

The invention of the power transformer towards the end of the nineteenth century made possible the development of the modern constant voltage AC supply system, with power stations often located many miles from centers of electrical load. Before that, in the early days of public electricity supplies, these were DC systems with the source of generation, of necessity, close to the point of loading.

The Internet of Things is the evolutionary step of the Internet that creates a worldwide infrastructure interconnecting machines and humans. As the Internet became public in the early 1990s, the first wave of its exploitation and deployment was mainly focused on the impact to everyday services and applications that changed the known models for financial transactions, shopping, news feeding and information sharing.

So the proposed system which is very cost effective and replaced the error in measurement from manual reading transformer monitoring scenario. This can be remotely accessed where as the real time monitoring of the parameters can be done with highest accuracy. Furthermore, the system provides an alerting information by an auditory alert mechanism to notify the status as if any emergency occurs in transformer. So the proposed system significantly saves cost as well as this more reliable.

In future, the system can be enhanced with more features by tracking the exact location of the transformation like a GPS module can be included in this system by the way of automation can be implemented by this way location status of each transformer is fetched and sends to the remote locations.

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