Substation Equipment Monitoring And Controllig Using IoT

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***Abstract**:* This project is based embedded system used for monitoring the voltage, current, and temperature and oil level of a transformer. Furthermore it is capable of recognizing the break downs caused due to overload, high temperature, over voltage and oil level intimation of transformer. The design generally consists of units, one in the substation unit, called as display unit, display units in the substation is where the voltage, current and temperature are monitored continuously by AVR microcontroller and is displayed through the display unit. The ultimate objective is to monitor the electrical parameters continuously and hence to guard the burning of transformer or power transformer due to the constraints such as overload, over temperature, input high voltage and double protection of CB operation by using the Internet of Things (IoT).

Keywords: **Transformer, transient voltages, circuit breaker, IoT**

1. INTRODUCTION

In an existing system power transformer or substation don't has an automated system to protect from the variations of voltage, current, oil level and temperature. Power transformer will fail due over temperature, fail due to low oil level and high current also affects to other devices due high voltage.

Drawback of existing system:

- No automated over voltage protection
- No automated over current protection
- No automated over temperature protection
- No low oil level intimation system
- No remote monitoring and alerting system

Proposed system

This innovative design to develop a system based on AVR micro controller that is used for monitoring the voltage, current, and temperature and oil level of a transformer. In a substation and to protect the system from the rise in mentioned parameters. Providing the protection to the transformer can be accomplished by shutting down the CB with automated system and switching CB.

Advantages of proposed system:

- The monitoring voltage, intimate and shut down the transformer if voltage beyond or less than defined voltage.
- The monitoring current, intimate and shut down the transformer if voltage beyond or less than defined current.
- The monitoring temperature, intimate and shut down the transformer if voltage beyond or less than defined temperature.
- The monitoring the oil level and intimates if oil level is low.

- You can also monitor the CB by application by PC or mobile.

2. BLOCK DIAGRAM

Fig.1 Block diagram

2.1.HARDWARE REQUIREMENT

- ARDUINO Micro Controller
- Regulated Power Supply Unit
- 16x2 LCD
- Voltage sensor preset, current sensor preset
- Temperature sensor
- Oil level sensor by distance relay or by voltage sensing unit
- module
- Relay

2.2 SOFTWARE REQUIREMENT

- ARDUINO Software tool

Power supply is the main part of the circuit; the circuit needs the 12V DC supply. But in our home 230 AC supply is available. So it has converted it to 12V DC and 5V DC by Rectifier circuit by regulator IC 7812 and 7805 respectively.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without working too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

LCD (Liquid Crystal Display) 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 even segments and other multi segment LEDs. The reasons being: LCDs are Steps Followed in Designing the System.

Voltage Sensor: Voltage input range: 0-25 V DC Voltage Detection range DC0.02445 V-25 Voltage analog resolution: 0.00489 Operating voltage output: 3.3V – 5V MAX 5) 100% Arduino Compatible

Current sensor: Accurate sensor to measure AC/DC current up to 20A. The sensor can even measure high AC mains current and is still isolated from the measuring part due to integrated hall sensor. The board operates on 5V

LM35 is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature. LM35 is three terminal linear temperature sensors from National semiconductors. It can measure temperature from-55 degree Celsius to +150 degree Celsius. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. LM35 can be operated from a 5V supply and the stand by current is less than 60uA. Internet of Things () : is a network of physical objects or people called "things" that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster. Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. The application program for the microcontroller will be written in embedded 'Embedded C' /Assembly and will be stored in the flash memory of the microcontroller.

3. WORKING PRINCIPLE

Working Method: Monitors continuously the voltage value and gives intimate and shut down the transformer if voltage beyond or less than defined voltage. Monitors continuously the current value and gives intimate and shut down the transformer if voltage beyond or less than defined current.
Monitors continuously the temperature and gives intimate and shut down the transformer if temperature beyond or less than defined temperature. Continuously monitors the oil level and intimates if oil level is low. You can monitor CB by application by PC or mobile. Each and every parameter like voltage, current, temperature displays & oil level on LCD.

4. DESIGN

Three general steps can be followed to appropriately select the control system:

Step 1: Identify measurable variables important to production. It is very important to correctly identify the parameters that are going to be measured by the controller's data acquisition interface, and how they are to be measured.

Step 2: Investigate the control strategies. An important element in considering a control system is the control strategy that is to be followed. The simplest strategy is to use threshold sensors that directly affect actuation of devices.

Step 3: Identify the software and the hardware to be used. Hardware must always follow the selection of software, with the hardware required being supported by the software selected. In addition to functional capabilities, the selection of the control hardware should include factors such as reliability, support, previous experiences with the equipment (successes and failures), and cost.

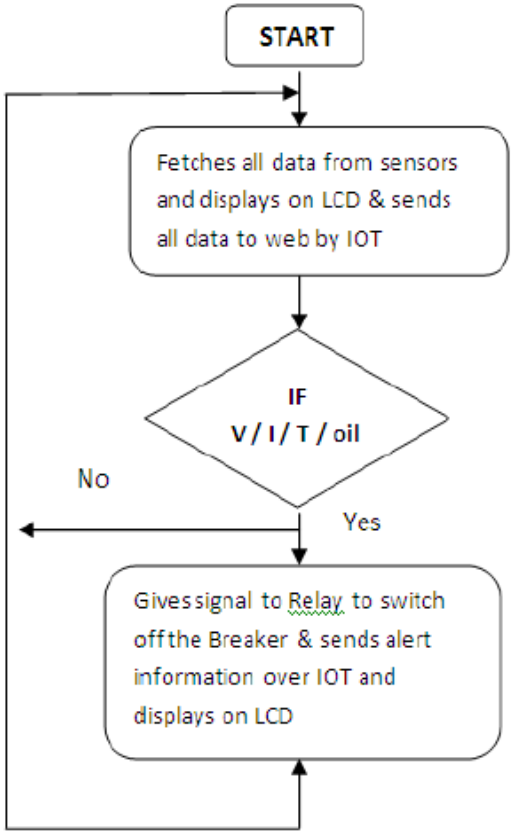

Fig.2 Flow chart

5. APPLICATION AND FEATURES

- Monitors continuously voltage and gives intimate and shut down the transformer if voltage beyond or less than defined voltage.
- Monitors continuously current and gives intimate and shut down the transformer if voltage beyond or less than defined current.
- Monitors continuously voltage and gives intimate and shut down the transformer if voltage beyond or less than defined temperature.
- You can know the present parameters of station you can get it whenever you by texting an SMS.
- Each and every parameter like voltage, current, temperature displays on LCD.
- Each and every parameter like voltage, current, temperature displays & oil level on LCD.

6. CONCLUSION

Our project microcontroller based substation monitoring and control system with module will be able to protect the equipment substation automatically with the help of sensors and technology when ever fault occurs in the system. It will help in safe and consistent power supply. It will reduce the human contact for maintenance purpose and becomes self operating system. Also reduces the cost and maintenance.

In future we can also add modem device and we can easily operate the devices like fans, lights, motors etc.., through a based mobile phone.

The system has a IoT a modem, temperature, current, voltage sensors and the devices to be operated through the switches like relay which are interfaced to the micro controller.

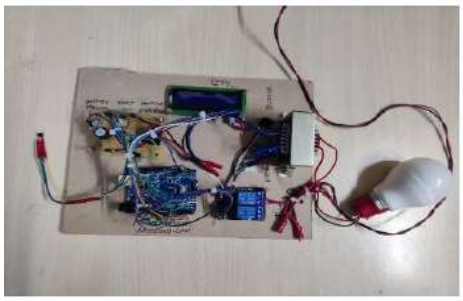

Fig.3 working model

7. REFERENCES

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