DESIGN AND IMPLEMENTATION OF SMART TRANSFORM MONITORING AND CONTROLLING THROUGH IOT

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ABSTRACT:
Electrical Transformers are the most significant component during the transmission and distribution of power. Transformer is the costliest segment of Electrical Industry. As we probably aware, Distribution transformers are one of the most significant gear in power system and its right working is essential to framework activity. In light of, the enormous number of transformers dispersed over a wide zone in power electric frameworks, the information procurement and health monitoring is a significant issue. This paper projects the execution of a mobile inserted framework and novel programming to screen and analyze state of transformers, by record key activity markers of a distribution transformer like load currents, transformer oil, oil temperature, winding temperature and voltage. The proposed internet monitoring framework coordinates a Global Service Mobile (GSM) Modem, with independent single chip microcontroller and sensor bundles. Information of activity state of transformer gets in type of SMS (Short Message Service) and will spare in web server. Utilizing the recommended web based monitoring framework will assist utility administrators with keeping transformers in administration for longer of time.

Keywords: Distribution Transformer; PIC Microcontroller, GSM/GPRS Module

1. INTRODUCTION

Power assumes a significant job in our life. Each needs of our life relies on power. Power has a few segments and appliances helping human to move and direct the distribution as indicated by

use. The most essential gear of transmission and distribution of electric power is transformer. In power frameworks, an electrical gear distribution transformer legitimately disperses power to the low-voltage clients and its activity condition is a significant model of the whole system activity. Most of these gadgets have been in administration for a long time in various (electrical, mechanical and natural) conditions. They are the primary segments and establish a huge segment of capital venture.

Activity of distribution transformer under appraised condition (according to determination in their nameplate) ensures their long assistance life. In any case, their life is altogether decreased on the off chance that they are exposed to overloading, warming, low or high voltage/current coming about to sudden disappointments and loss of supply to an enormous number of clients accordingly affecting framework unwavering quality.

Irregularity in distribution transformer is practiced with variety in various parameters like:

- Load current
- Load voltage
- Oil level
- Oil temperature
- Winding temperature

Overloading, oil temperature, load current and incapable cooling of transformer are the significant reason for disappointment in distribution transformer. At the point when a transformer comes up short, an unfavorable impact happens in the progression of transmission and distribution framework bringing about increment of power framework cost and decline of unwavering quality in electric conveyance. As transformer is a mix of numerous parts, this all parts must be checked consistently to keep up the transformer in immaculate working conditions. The monitoring gadgets or frameworks which are currently utilized for monitoring distribution transformer have a few issues and inadequacies.

The drawbacks of current techniques:

- Ordinary transformer estimation framework just identifies a solitary transformer parameter, for example, power, current, voltage, and phase. While a few different ways

could recognize multi-parameter, the time taking and activity parameters are excessively long and testing velocity isn't so quick.

- Detection framework itself isn't dependable. The exhibition is simply the gadget precariousness, poor sticking ability, low estimating precision information or much another system should isn't influenced.
- Timely discovery information won't be sent to monitoring focuses in time, which can't pass judgment on distribution transformers three-phase harmony.
- The monitoring framework can screen the operational state or protect from stealing the power, and it can't screen all client information of transformers to diminish costs.

Many monitoring frameworks use power carrier correspondence to send information, yet the power carrier correspondence has a few disservices: serious frequency interference, with the increase in distance the signal attenuation serious, load changes brought the about large electrical noise. At that point on the off chance that we use bearer correspondence to send information, real-time information, dependability can't be ensured. As indicated by the above necessities, we need a distribution transformer real time monitoring framework to screen every single basic parameter activity, and send to the monitoring location in time. It prompts web based monitoring of fundamental utilitarian parameters of distribution transformers which will give vital data about the health of transformers. This will help and guide the utilities to ideally utilize the transformers and keep this hardware in activity for a more extended period. Transformer Health Monitoring System will distinguish or perceive startling circumstances before any genuine disappointment which prompts more noteworthy unwavering quality and critical cost investment funds. Across the board utilization of mobile systems, GSM (Global System for Mobile communication) modems and IOT (Internet Of Things) module have made them an alluring choice both for voice media and wide territory organize applications. The remainder of this paper was sorted out as pursues the segment 2 briefs about the writing study, segment 3 depicts about different procedures utilized in this framework lastly area 4 finishes up the paper with future degree.

2. LITERATURE SURVEY

In most power organizations, for web based monitoring of power transformers, utilize Supervisory Control And Data Acquisition (SCADA) framework, however for web based monitoring of power transformer, the broadening the SCADA framework is a costly suggestion.

Power transformers are currently observed physically, where an individual visits a transformer site, for support and taking records reason. Yet, primary downsides of these frameworks are, it can't give data about overloads (Voltage & Current) and overheating of transformer oil & windings. Due to these, the transformer life is decreased.

Monika Agarwal et al. [1] This paper speaks to that they are planning a framework where there exits correspondence among framework and administrator. For this we are utilizing Transformer, microcontroller, logic level converter and GSM for example worldwide framework for mobile correspondence modem. This GSM modem screens transformer health by sending message to the framework.

Hongyan Mao,et al. [2] This paper speaks to an enormous number of power distribution transformer stations and they are far away from city, remote GPRS transmission gives a decent correspondence answer for oversee power distribution transformer stations.

The plan of remote monitoring framework for power distribution transformer station dependent on GPRS remote system was structured in this paper. A control terminal framework actualize was for the most part given, which received LPC2132 as primary processor, GR47 as the date correspondence module. The screen terminal programming and stream outline were likewise planned. Finally, the method for arranging the GPRS module to interface system is broke down.

Pathak A.K, et al. [3] This paper speaks to a structure and usage of a mobile installed framework to screen and record key parameters of a distribution transformer like load currents, oil level and encompassing Modem, with an independent single chip microcontroller and various sensors. It is introduced at the distribution transformer site and the above parameters are recorded utilizing the analog to digital converter (ADC) of the implanted framework.

The acquired parameters are prepared and recorded in the framework memory. In the event that any variation from the norm or a crisis circumstance happens the framework sends SMS (short message administration) messages to the mobile telephones containing data about the anomaly as per some predefined guidelines modified in the microcontroller. This mobile framework will assist the transformers with operating easily and distinguish issues before any calamitous disappointment.

3. METHODOLOGY

This paper is an introduction of the plan and usage of Real Time Transformer Health Monitoring System (RHMS) through PIC microcontroller. Cost viability and remote area will be offered need to this venture. If there should arise an occurrence of programming driven framework it requires lot of connection and apparatus and technically skilled personnel. Then again the designed system has less complexity to install and doesn't require any sort of skilled personnel and can be notified remotely. Automatic decision making is the principle highlight of RHMS. Basic intelligence of proposed system was given in a Fig. 1, which demonstrates how the framework takes choice.

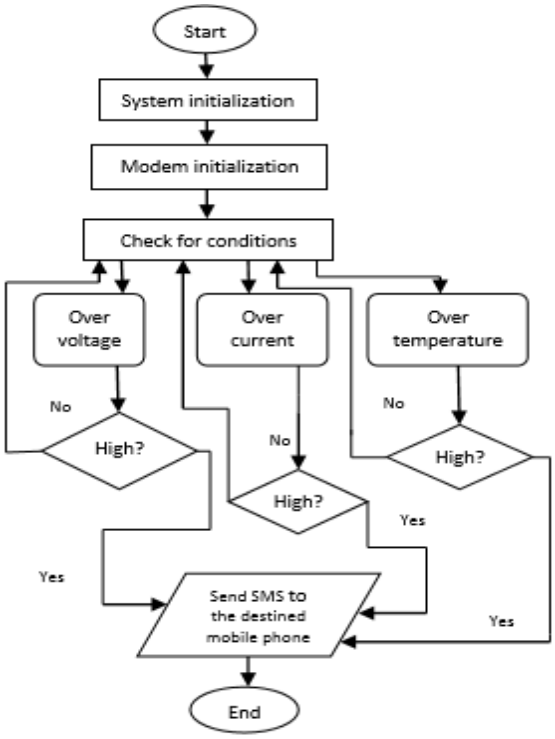

Figure 1: Flow graph of Proposed framework

- At first every one of the sensors, microcontroller, GSM modem and IOT initialization happens. After the initialization procedure, required information are estimated from sensors and some basic utilized parts at the same time.
- Then the PIC begins to comparing the recieving values with the stored values in the memory. When there is at any rate one parameter's value denied the stored value, at that

point the modem makes a move to send this message to the monitoring focus by means of IOT server.

- If there are no over evaluated estimations of current and voltage or the oil temperature is in the predefined value range, at that point the framework bounces back to the testing technique. This procedure proceeds until the decision making logic's output negative.
- When the decision making logic's output is positie, at that point right away framework will make a move for further execution.
- After sending the data, the circle proceeds once more.

We isolated our framework into four sections. These are information authority, information converter, information processor and conveying part.

The information authority unit is really unique sensor modules which is situated at the transformer site. It is used to gain the constant information from the transformer side. The information converter unit contains an ADC for the transformation procedure. At that point the changed over information are handled and estimated in the PIC microcontroller. In the conveying part IOT module is associated. This module is utilized for the information correspondence from transformer to the monitoring focus utilizing server. In the message getting segment an administrator can make strides by perusing the message about what issue happens. Subsequently the PIC can disengage the fault transformer before any monstrous fault.

As we probably aware, in our power framework the transformer is a costly and significant hardware. On the off chance that it is harmed or stumbled because of any reason, for example, temperature, current or voltage then the entire distribution would be turned off. At that point the time and cash both would be squander, so the real-time monitoring of transformer health is required for providing smooth supply to the consumer. Here we have planned a framework that is known as the real-time monitoring of transformer health monitoring framework over web shown in fig.2 with the assistance of temperature sensor, current sensor, voltage sensor, analog to digital converter, GSM modem and IOT.

By utilizing this framework, or supply organization can without much of a stretch check the moment status of their transformer at their work environment through the web.

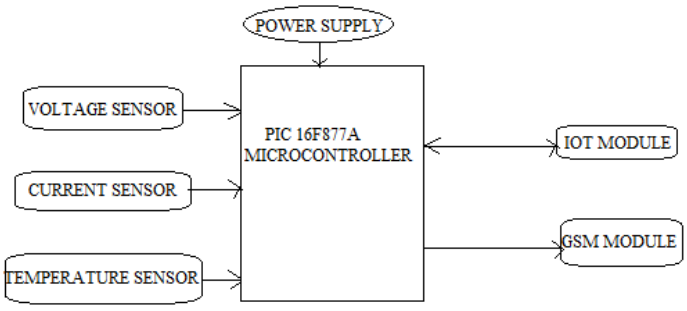

Figure 2: Block Diagram of Proposed System

A. Transformer:

In this remote monitoring of transformer health over web framework, the transformer utilized for step down the 220V AC into 12V AC. It comprises of two windings and chips away at the standard of mutual induction.

B. ADC:

In this framework, the ADC is utilized for changing over the analog information into digital information for giving the logic signal to the PIC. It is powered up with 5V dc.

C. Temperature Sensor:

In this framework, the temperature sensor is utilized for sensing the temperature of corresponding transformer or generator. For this reason, the LM 35 temperature sensor have been utilizing here.

D. Voltage Sensor:

In this remote monitoring of transformer health over web framework, the voltage sensor is utilized for sensing the voltage of corresponding parts, for example, transformer or generator.

E. Current Sensor:

In the framework, the current sensor is utilized for sensing the current of corresponding transformer or generator. It detects the current in amps and give output in milli amps. It is interfaced with ADC for giving analog input.

The proposed RHMS incorporates PIC microcontroller, GSM modem, Current sensor, Temperature sensor, Voltage sensor and IOT module. The RHMS constantly measures the line voltage, line current and temperature sequentially. Framework peruses comparing values for further estimation for monitoring reason and does the capacities as per the program loaded in it. The each information was frequently uploaded to the server. The framework begins with building up a serial communication between the ADC and PIC, after an effective correspondence the framework begins to check the parameters. To quantify the voltage in essential side a capacitor divider was utilized and afterward the isolated voltage changed over to DC for estimation purpose and then through an ADC channel. As the deliberate value fluctuates much of the time various 1000 samples taken and the average value determined and afterward increased with specific consistent to get real AC RMS value.

Current transformer circuit used to calculate current which gave an ADC value corresponding to the current through the line estimated from another ADC channel. The deliberate information gives the momentary current value. By taking a few examples and applying RMS equation to get normal RMS current and afterward recorded. LM 35 utilized as temperature sensor which additionally gives an ADC output as voltage differs not many milli volts for each degree Celsius change of temperature. Condition to measure temperature in Celsius unit,

Temp= output_voltage/0.01

Subsequent to estimating the three parameters, the framework checks for the standards applied. For transformer condition inside the given range framework remains checking once more. If there should be an occurrence of any deficiency condition PIC sends signal to the administration location by giving the type of fault through SMS as well as data updation in server. After informing the fault the complete framework again begins to screen the state of the transformer.

3.1 Working Principle:

This real-time monitoring of transformer health over web framework takes a work on teansformer segments and program. Assume we need to screen the information, for example, temperature, current or voltage of any transformer, generator, modern or residential load then the framework is straightforwardly associated with these segments or equipment's. At that point we simply switch on the framework straightforwardly from 220V AC. From that point, the current

sensor, voltage sensor and temperature sensor sense their corresponding information however this information is in analog from it is changed over into digital structure through the ADC, which is interfaced with current, voltage and temperature sensors. At that point the information is gotten by the PIC through the inbuilt ADC, then the controller show this information at LCD and send this information to the Wi-Fi module which is in-worked in the chip to the server. Hence we can see this information at any PC or mobile through it's committed IP (web convention) address. This information is shown at devoted site in three distinct segments, for example, current, voltage, temperature outlines. The experimental prototype was shown in fig 3.

3.2 Advantages:

- This framework could be utilized for real time information monitoring of organization loads and residential load.
- This framework is increasingly dependable, modest and reduced when contrasted with different frameworks.
- It can be utilized for long time without the dread of model harm.
- No restriction for sending SMS (Unlimited messages).

3.3 Experimental prototype:

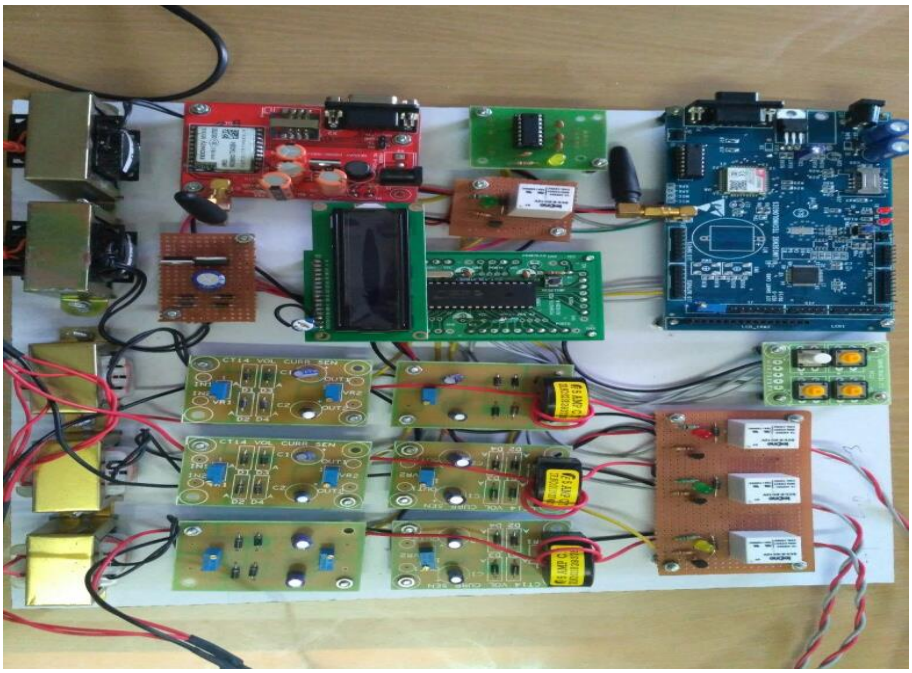

Figure 3: Experimental Prototype

4. CONCLUSION

This research proposes the arrangement of power distribution is the conveyance of power from producing power plants to end clients. Distribution framework's system conveys power by the transmission framework and conveys its load focuses. In this way, it is fundamental to have high productivity, high unwavering quality and high assistance quality in a distribution framework. This investigation gives remedies from the challenges of deciding issue happening causes in transformer and it beats the disadvantages of past working strategies. The venture centers predominantly around the effectiveness of monitoring procedure of the transformer by utilizing remote correspondence that disposes of the utilization of enormous links which are of significant expense, low unwavering quality and support. The IOT systems administration helps in better method for correspondence which upgrades the improvement steps in this procedure. Along these lines, utilization of this makes the framework real time implanted framework and helps especially in industry needs. The structured framework is associated with a distribution transformer and can send unusual things occurs in transformer by data to a devoted server. The framework equipment was developed from the accessible parts. The trial results turned out true to form. In future this framework can be enhanced with extra parameter.

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