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RESEARCH ARTICLE

Wireless Protection and Monitoring of Power Transformer using PIC

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Abstract: Power transformers are one of the most important electrical equipment that are used in power transmission system as they perform the function of transforming the voltage levels. Hence maintenance of power transformer is mandatory; as they are located at different geographical areas periodical monitoring is not possible all the time due to insufficient man power. Due to this reason transformer failure may occur which leads to unexpected power shutdown. To overcome this shutdown due to transformer failure we proposed a system for monitoring the transformer .The aim of our project is to monitor and protect oil level, oil quality, temperature and voltage level of transformer without involving man power. If any critical condition occurs the SMS will be send to the control unit .This monitoring system consist of PIC 16F877A micro controller, LM35 temperature sensor, level sensor, GSM and LCD.. The proposed system is simulated using LabVIEW and hardware results are obtained using miniature model of transformer. Result obtained in the proposed system with suitable modification can be applied to the real time system.

Keywords: power transformer, oil level, oil quality, temperature

I. INTRODUCTION

The demand of electric power for house hold purpose, commercial purpose and industrial purpose increases day by day. The existing method of management of electrical power system is complex as they are generally interconnected with many operating machine units working together. If any of the machine in this interconnected system faces failure entire power system is affected hence careful monitoring and protection of these machines are necessary. Among the interconnected machine transformer which is a static machine which plays key role of stepping up or stepping down voltage levels in power systems based on electromagnetic induction principle.

In the existing system monitoring of transformer is done using wired network accompanied with temporary test unit and involving man into action , here continuous monitoring is not possible all the time which may lead to malfunction or failure of power transformer. Our proposed system provides effective monitoring and protection of power transformer by measuring it oil level, oil quality, temperature and operating voltage without involving human intervention.

II. BLOCK DIAGRAM

The figure 1.1 block diagram represents the monitoring device mounted near the transformer .the components in the block diagram monitors various parameters associated with the transformer. The components involved in monitoring are:

- Potential transformer
- Light dependent resistor
- Temperature sensor
- Oil level sensor

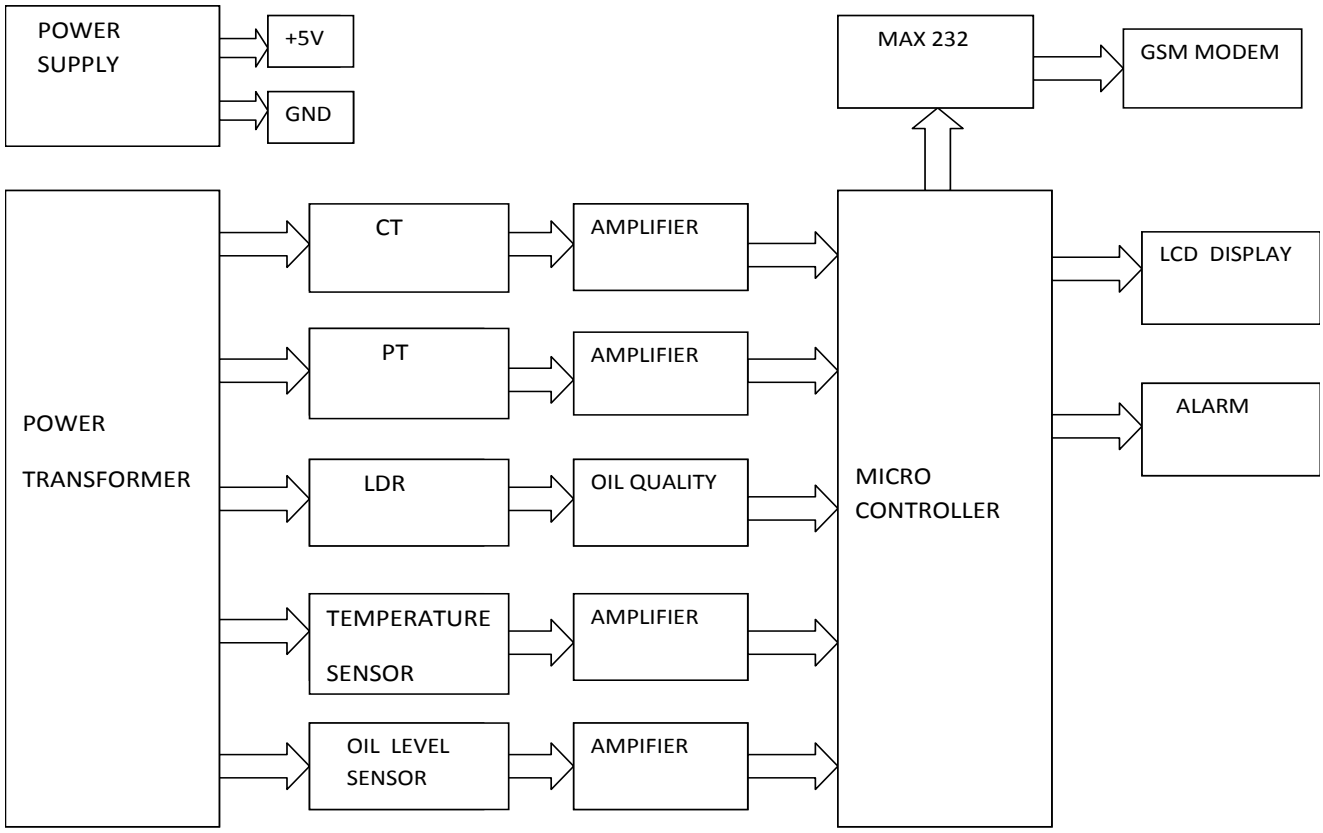

Figure 1.1-block for monitoring transformer

A. Potential transformer:

It is coupled with input line in order to measure the voltage input to the transformer winding output of the potential transformer is amplified and fed to microcontroller .If the value that is being monitored increases beyond the rating of the transformer SMS is send to the control room and relay trips and alarm starts functioning in the control room.

B. Light dependent resistor:

LDR is mounted inside the transformer tank it monitors the transformer oil quality. It is predicted by the intensity of light passing through oil. Its resistance varied when quality of the oil changes. The output of LDR is fed to PIC and it is continuously monitored if its value increases beyond limit SMS is sent to control room through GSM module.

C. Float sensor*:*

Float sensor is mounted inside the transformer tank immersed into the oil. As the level of the oil inside the tank decreases below 70% the signal is send to micro controller hence SMS is send to control room through GSM. If the level of oil decreases below critical level alarm start functioning in the control room.

D. Temperature sensor*:*

LM35 temperature sensor is kept immersed in the oil of the transformer tank. The resistance of the temperature sensor varies as the temperature of oil varies is the temperature values increases beyond 90^{o}c SMS is send to the control room through GSM .If the temperature reaches the critical level alarm operates at control room.

E. GSM module:

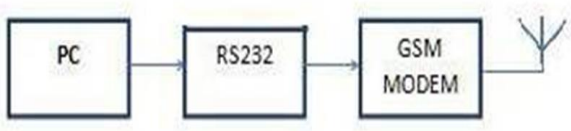

Figure 1.3 –GSM receiver side

The figure 1.3 shows the wireless GSM receiver set up at the receiver end. Here we are using GSM SIM900 with in built GPRS. The signals are transmitted through GPRS which is received in the control room and also through SMS.

F. PIC microcontroller:

Figure 1.2-microcontroller 16F877A

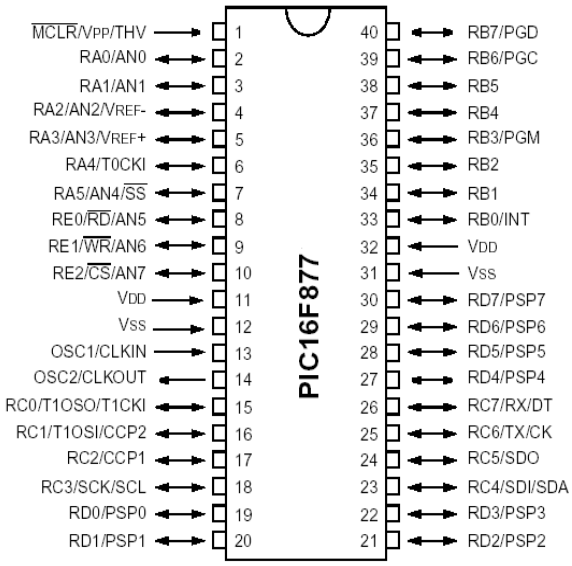

Figure 1.4 Pin diagram of 16F877A

PIC microcontroller of series 16F877A is used in the proposed model. The various parameter that are monitored in this system arefed to the microcontroller is fed to various ports. The quality of oil is monitored through LDR its signal is fed to the controller through the port E_0. The signal from the float sensor is fed to the port E_1. The relay terminals are connected across D port. The signal from LM35 is fed to port A_0 .LCD will get the signal from D and B port.

III. SIMULATION WORK AND RESULT

A. Front panel:

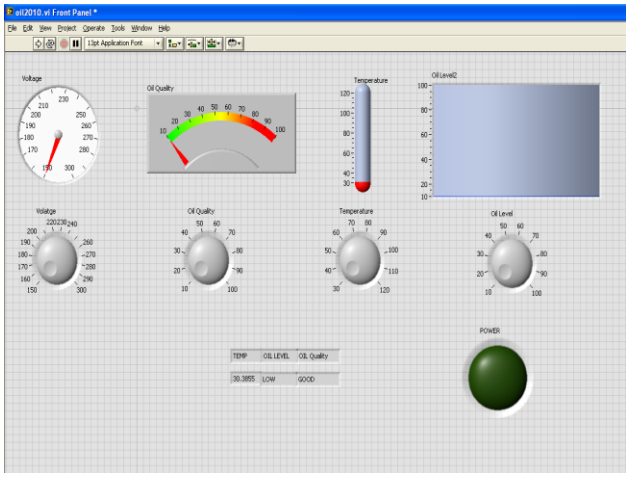

Figure 1.5- Front panel of simulation

The figure 1.5 shows the front panel diagram in the simulation of the proposed model the tag names are given for each block in the model and it shows the various parameter to be monitored in the transformer .The tag name voltage represents the input voltage level of the transformer, oil quality tag represents the quality of the oil in the transformer tank, temperature tag indicates the temperature level of the transformer oil ,oil level tag indicates the level of oil in the transformer tank. The button with the tag name power is used to start the simulation process.

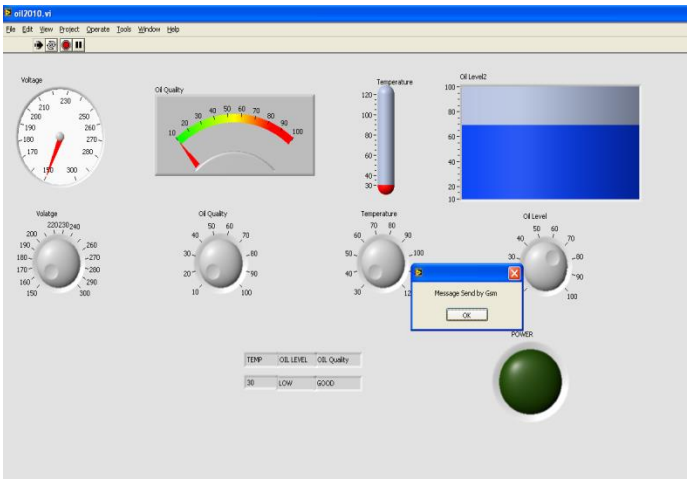

Figure 1.6- Indication of oil level variation

In the figure 1.6 indication of the level of transformer oil is monitored and shown . Here in the oil level block as the oil level reaches level of 70% SMS is sent through the GSM module to the control room and the corresponding values are also shown in the display in the control room. If the level of the oil is critically low that's below 30% alarm starting functioning in the control room.

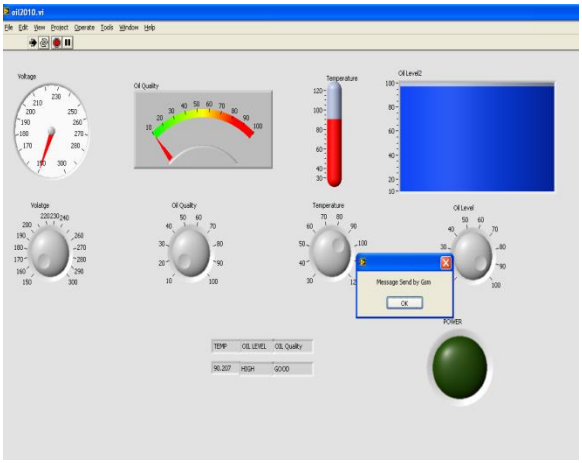

Figure 1.7- indication of temperature of the tank variation.

In the figure 1.7 the temperature of the tank is monitored and shown .As the temperature rises above the value of 90^{o}c SMS will be send through GSM to control room and alarm will start ringing in the control room. The exact value of the temperature will be displayed in the LCD monitor present in the control room.

B. Block diagram:

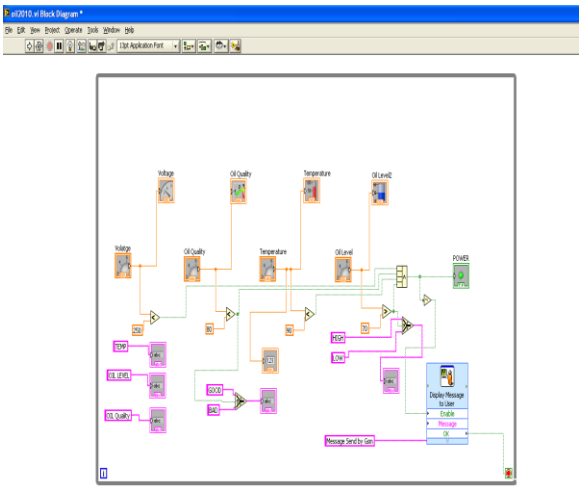

Figure 1.8- Background block diagram for simulation model

The figure 1.8 shows the block diagram behind the simulation model the low and high range values indicated in the front panel are programmed in the above block diagram.

IV. HARDWARE-SETUP:

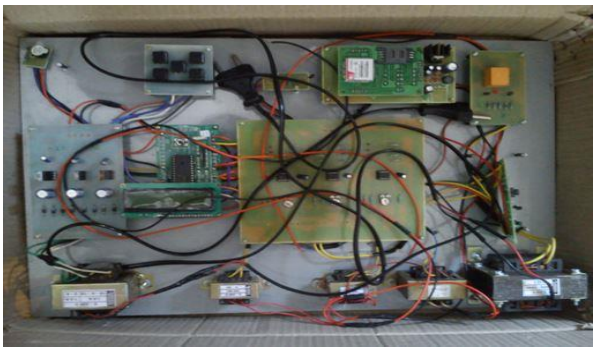

Figure 1.9 –Hardware setup

The figure 1.9 shows prototype model of the real time application. Signals from various sensors are fed to microcontroller terminals and conditions tested. The controller is programmed with the reference values which are rated values of the transformer used in the setup. During the operation if the value exceed the reference value the alarm will start operating and the message will be send to the control room through GSM module.

V. CONCLUSION

The proposed system provides the prototype model of the protection and monitoring of the real time power transformer and simulation is done for the same using LabVIEW module and results are obtained. Hence this can be applied in real time system and satisfactory result can be obtained.

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