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Automatic Monitoring and Controlling of Distribution Transformer using Power Line Communication

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***Abstract*— The load monitoring and protection of distribution transformers are vital element of the power distribution infrastructure, they should be observed habitually to keep any potential shortcomings. Failure in transformer can without much of a stretch expense from a few thousands to lakhs of rupees to either repair or supplant, and will likewise bring about a loss of service to client's until the manifestations is discovered and repaired. This paper work portrays the mechanization of the transformer utilizing ARM 7 microcontroller. Different parameters for example, temperature, current, and voltage, oil level of the transformer, over load and short circuit conditions are observed. Indeed, even the sparkle around the transformer will be identified. The power line modem uses the power line cable as communication medium. All the information will be correspondence through the existing PLC (Power Line Communication) which provides a communicating medium. In case of any abnormal condition the buzzer will beep indicating faulty condition and causes the microcontroller to trip the relay and disconnect the load automatically. Consequently the transformer is shielded from serious harm and makes the distribution more strong, solid, and precise and spares enormous economic misfortunes. This framework can supplant existing physically checking of the transformer. In this paper Keil µvision4 software is used to code the microcontroller for controlling and monitoring the system.**

***Index Terms*— ARM7, Sensors, GSM, GPS**

I. INTRODUCTION

A distribution transformer is a transformer that gives the last voltage change in the energy conveyance system, going down the voltage utilized within conveyance offering of the level utilized toward those clients. Distribution transformers are a standout amongst the most imperative hardware in power system, due to the substantial number of transformers circulated more than a wide range in power frameworks. The information procurement and condition observing of distribution transformer is a vital issue, since it is a necessary piece of substation, strategic bottle necks happen in the event if we neglect to screen the transformer. A few parameters of the transformer operation are level of oil, electrical burden levels, voltage and current level and temperature variety. This work demonstrates the continuous observing and control of framework utilizing sensors for perusing the estimation of diverse parameters of distribution transformers.

In this paper the voltage, current, temperature and oil level as the parameters to be checked as the transformer demonstrates its top affectability also the short circuit condition and over load condition are detected. Consequently, a mechanization framework in view of microcontroller which continuously screens the transformer is designed. PLC is used as a conveying medium between microcontroller and the computer. Microcontroller monitors and controls all the parameters of the distribution transformer and all the monitored and controlled data and status of the distribution transformer is sent from microcontroller to the computer through the existing power line without compelling reason to introduce any additional link.

II. POWER LINE COMMUNICATION

PLC is in view of electrical signals, conveying data, engendering over the power line. A communication channel is characterized as the physical way between two communication hubs on which the communication sign is spread. PLC as the name recommends, gives network utilizing existing power line as the correspondences medium. In this paper power line communication is utilized as a communicating medium between microcontroller and the computer.

X-10 is a communication protocol intended for sending signals over 230V AC wiring. Power Line Communications for automatic transformer monitoring and controlling of distribution transformer applications applies the modulation of frequency signals in a carrier wave between 20 kHz-200 kHz into the 230V AC wiring at the transmitter. This carrier is modulated by digital signals. The

recipient in the framework has a particular address and can be separately charged by signs transmitted more than 230V AC wiring and decoded at the collector. The gadgets can be either connected to customary electrical plugs, or forever wired set up.

III. METHODOLOGY

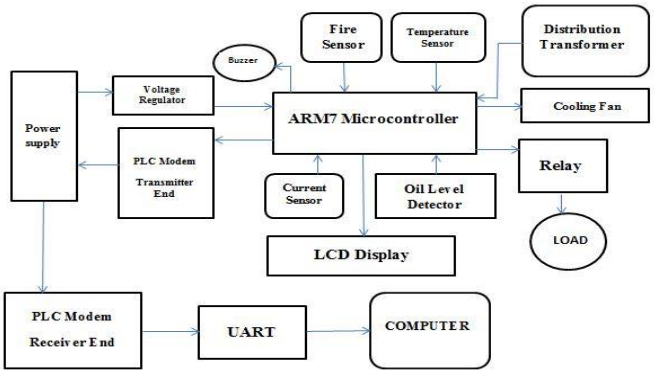

Fig. 1. Block Diagram

The distribution transformer monitoring and controller developed in the present is designed to work autonomously. The framework is based on ARM7 microcontroller that is utilized to screen and control the various parameters of the transformer like temperature, oil level, and voltage and overload and short circuit conditions. The composed framework screens all the said above parameters alongside over-load and short out conditions routinely all through its operation. Thus the distribution transformer protection can be accomplished, consequently making the distribution transformer more robust, secure, dependable and proficient. Fast response and accurate fault detection can be obtained. In this work power line communication modem is utilized where all the information is corresponded with the existing power line.

IV. FLOWCHART

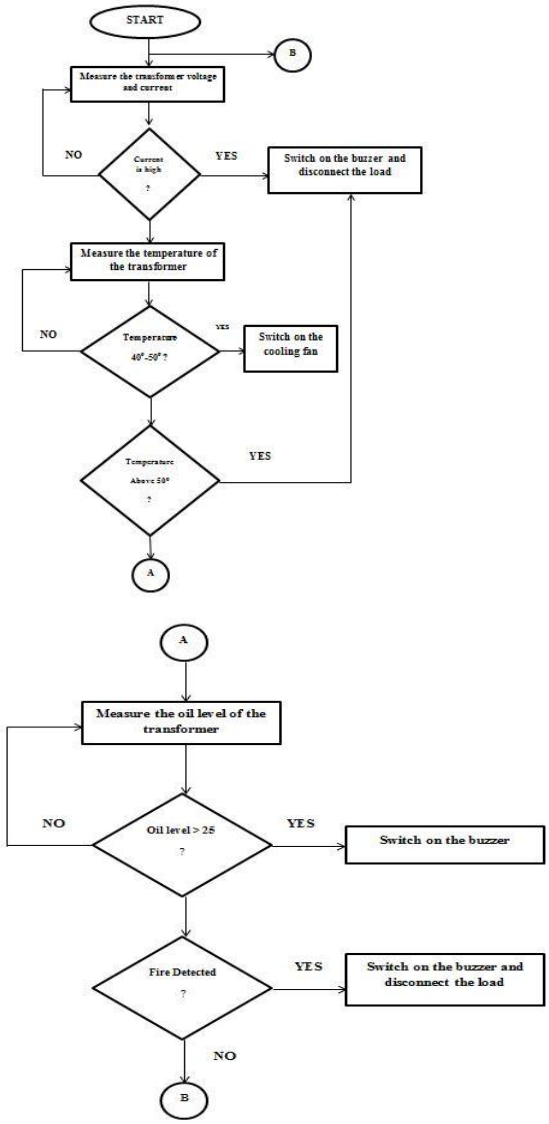

Fig. 2. Flowchart of the system

Figure 2 demonstrates the working of the power line communication based automatic monitoring and controlling of distribution transformer. The framework will consistently screen the voltage and current appraisals of the transformer. If there should be an occurrence of over-burden condition the current of the transformer increments. When the current increases the buzzer beeps showing defective condition and outings the transfer. The microcontroller will be observing temperature of the transformer. If the temperature 40^0 the cooling fan will turn on and if the temperature increments over 50^0 the buzzer will beep again and trips the relay in this manner separating the load. Oil level will be observed consistently, if the oil level is under 25% the signal will beep demonstrating defective condition. Likewise spark

across the transformer will be detected and the load will be disconnected.

V. HARDWARE INPLEMENTATION

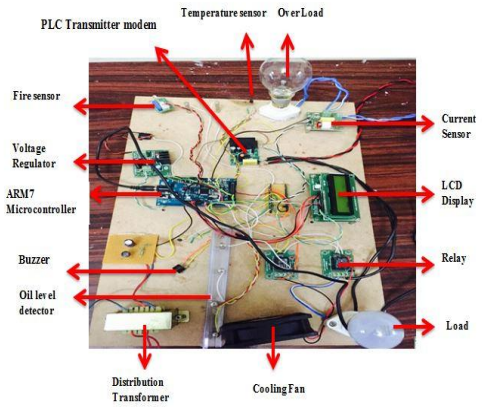

Fig. 3. Hardware Implementation of the system

As shown in the figure 3, the framework comprises of a distribution transformer, ARM7 microcontroller, voltage regulator, PLC modem, UART, LCD display, relays, different sensors like temperature sensor, fire sensor, voltage and current sensors. Additionally it also contains oil level indicator, cooling fan and buzzer.

The distribution transformer is connected to ARM7 microcontroller. Microcontroller persistently screens the parameters of the distribution transformer displaying the readings in LCD and sends all the information to computer through PLC modem. The PLC modem comprises of transmitter end and receiver end. Transmitter end is connected to microcontroller board and the receiver end is connected to communication port. In this paper all the information is communicated using existing power line without introducing additional cable. The buzzer is also included in the system so that whenever there is any faulty condition the buzzer will beep automatically demonstrating the defective condition and giving a caution.

VI. FUNCTIONAL OUTPUT

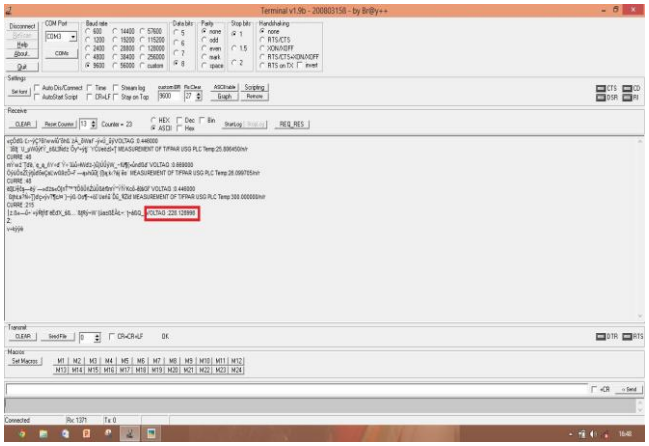

Fig. 4. Voltage detected

The microcontroller will continuously monitor the voltage and current values of the transformer and the data is sent to computer using power line communication. Figure 4 shows the voltage of the distribution transformer.

Fig. 5. Oil level too low

Fig. 6. Oil level detected at 65%

Fig. 7. Oil Level detected at 80%

The oil level of the transformer will be detected at three levels, when the oil level is too low, when the oil level is at 65% and when the oil level is 80%. Figure 5 shows the oil level when it is too low, figure 6 shows the oil level at 65% and figure 7 shows the oil level at 80%. When the oil is too low the buzzer will beep indicating the fault condition.

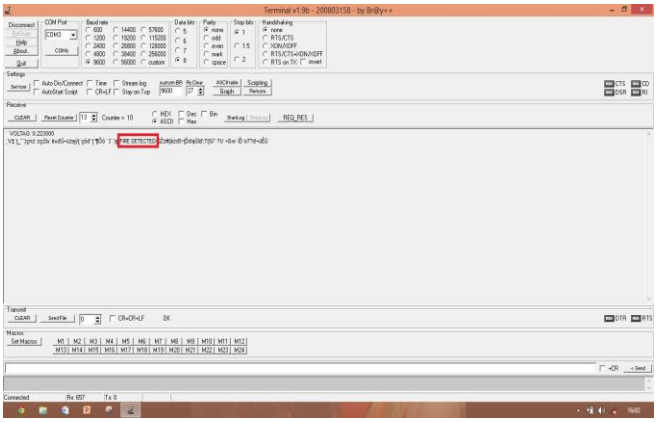

Fig. 8. Fire detected

Various other conditions detected by microcomputer across the transformer like over load condition, short circuit condition, increase in temperature and fire across the transformer will be displayed in the computer. Figure 8 shows the fire detected across the transformer and figure 9 shows the short circuit condition of the transformer displayed in the computer.

Whenever the faulty conditions occur in the transformer the buzzer will beep and microcontroller trips the relay and disconnects the load. Thereby we can protect the transformer from further damage. The parameters will be continuously measured by the microcontroller and displayed in the computer. With the help of the displayed data the operating personnel can take further actions during faulty conditions.

VII. CONCLUSION

In this paper, the distribution transformer is monitored and controlled using ARM7 microcontroller and the data is communicated using power line communication. The microcontroller based system continuously monitors the voltage, current, and temperature and oil level of a distribution transformer and automatically. The faulty conditions like over load and short circuit conditions are also screened. The system is also designed to sense if there is any fire across the transformer and immediately shut down the system. The readings of the transformer are continuously recorded and are displayed on the LCD. All the data in the system are communicated to the computer through the existing power line communication without installing extra cables. Whenever the fault occurs or there is any increase in the above mentioned parameters the relay automatically disconnects the load and with the help of the data displayed in the computer further actions can be taken. This system provides fast response and accurate fault.

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BIOGRAPHY

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