TRANSFORMER MONITORING AND PROTECTION SYSTEM USING AVR ATMEGA16 MICROCONTROLLER BY RF TECHNOLOGY

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Abstract - *In electrical power systems, distribution transformer is equipment which distributes power to the low-voltage users. For proper operation (i.e., under rated conditions) of the transformers, their operational conditions should be monitored and maintained. Overloading and overheating are two sources of transformers failure that cause power disruption for the customers and reduce the life time of the equipments on the power distribution system. Since it is very costly to repair or replace a single transformer, it also has its impact on the economy of the country. Hence, system that properly monitors the power system and take corrective action should be in place.*

This paper presents the design and implementation of a RF based distribution transformer monitoring system. This system monitors and records key parameters of a distribution transformer like load currents, load voltage, and transformer oil temperatures. These parameters provide useful information about the status of a transformer. The acquired parameters are processed and the data is sent to a central monitoring station through the RF interface. The data will then be further processed and analyzed regularly by the system operator. RF has a very low latency which is best for real time systems. Besides that it provides balance among trade-offs between cost, capacity, performance, and density.

The system is designed and implemented using RF Technology and key parameters were recorded. The variations of the recorded values help us in identifying the possible failure that could occur, if the values are over the rated values. Monitoring of the transformer has been achieved in through our system. The project aims at programming the ATMEGA-16 microcontroller such that it continuously monitors the transformer situated in the industry. If it detects any error in balancing of load, the controller will cause relay to break the circuit and hence completely switching of the transformer.

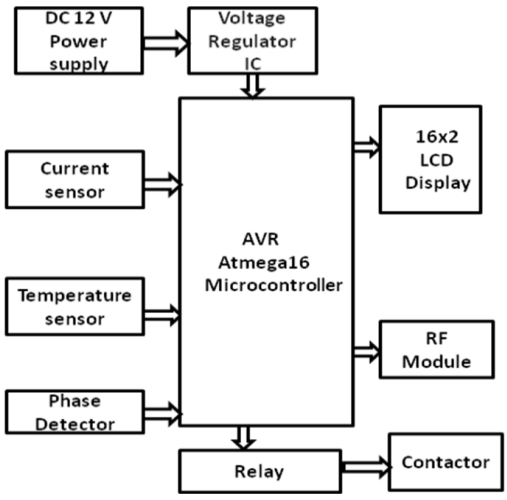
Keywords: RF Technology, distribution transformer monitoring.

1. INTRODUCTION

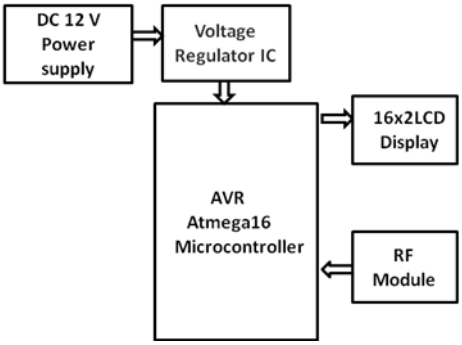
Electric power systems are real-time energy delivery systems. Real time means that power is generated, transported, and supplied the moment it is needed. In power systems, distribution transformers are electrical equipments that distribute power to the low-voltage users directly. It is clear that over time, there has been an increase in human population, economic growth and technological advancement. This has continuously made the demand for electrical power to go high because as technology, human population and economy grows; there is an increase in demand for power as many more electrical loads are introduced into the supply line. An increase in load leads to a lot of current drawn from the power line. At times the demand goes above what the power distributor can supply. The consequence of this is that electrical power overload cases become common thus posing danger to power system components. This therefore throws in the need for devices that can monitor the rate of power consumption in accordance with the level that a given system is designed to sustain. Such a device must be designed to cut off consumption if the system oversteps its ability thus being dangerous to users and the components. In this project, we look at the protection of power transformer from various faults that may occur and may be destructive to the component if left undetected. The transformer is a very important component in an electrical power system as distribution of electrical power to consumers is more efficiently effected. Every transformer is designed to comfortably supply a given load. Cases of overload or short circuits can lead to damaging of transformer. To combat such occurrence, an elaborate system that monitors these excesses in supply parameters needs to be built. Such a device controls the flow of electrical power to the load so that the transformer is not overworked. Over current relays and overvoltage relays have been used for a long period of time and have been electromechanically controlled. In this system, a microcontroller is used to monitor cases of electrical faults and communicate to a switch to isolate the transformer from the system.

2. BLOCK DIAGRAM

Transmitter



Receiver



2.1 HARDWARE DESCRIPTION

1. Sensor:

Sensor are basically use to convert physical quantity in electrical form there are different sensor are Involve for various physical quantity. In our project we control three parameters first is Voltage, Current Temperature, this three parameters we use three different sensors.

2. VOLTAGE SENSOR

A voltage sensor is a device which detects the voltage in a wire, and generates signal proportional to it. The generated signal could be analog voltage or current or even digital output. It can be then utilized to display the measured voltage in a voltmeter or can be stored for further analysis in a data acquisition system or can be utilized for control purpose.

3. CURRENT SENSOR

A current sensor is a device that detects electric current (AC or DC) in a wire, and generates a signal Proportional to it. The generated signal could be analog voltage or current or even digital output. It can be then utilized to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system or can be utilized for control purpose.

4. Temperature Sensor:

Temperature sensor vary from simple ON/OFF thermostatic devices which control a domestic hot water heating system to highly sensitive semiconductor types that can control complex process control furnace plants. We remember from our school science classes that the movement of molecules and atoms produces heat (kinetic energy) and the greater the movement, the more heat that is generated. Temperature Sensors measure the amount of heat energy or even coldness that is generated by an object or system, allowing us to "sense" or detect any physical change to that temperature producing either an analogue or digital output.

There are many different types of Temperature Sensor available and all have different characteristics depending upon their actual application.

6. Micro- controller unit:

Micro controller AVRAtMegha16 is heart of our project. We select this micro controller IC for our project for following no. of advantages. Advanced RISC Architecture Data and Non-Volatile Program Memory on Chip Debug Interface (debug wire) Internal 8 K bytes of electrically erasable programmable read only memory for feeding programmed so that there is no need of external EPROM. Four 8 bit inputs, output port p0, p1, p2, p3 out of which we use two port to read ADC and other port is use to connect 16x2 alphanumeric display for written current & temperature purpose. Operating voltage of 3.5 to 6vd.c. This is easily available by using voltage regulator IC. Internal 128 byte RAM to store temporally storage of data. In which we can feed took up table to turn ON/OFF relay. Three 8-bit time/counter are present for timing and counting purpose. Four external and two internal interrupt are available. Micro controller can read the data (for the Corresponding channel) available at output of ADC and convert in equivalent alphanumeric code & Display on 16x2 dot matrix liquid crystal display.

7. RF Module:

RF module (radio frequency) is electronic devices that transmit and receive RF signal from one device to other device. It is a Transmitter module through which data can be transmitted and received by receiver simultaneously.

8. Voltage regulator:

7805 is a voltage regulator integrated circuit. Fixed output voltage is not obtain due to fluctuation of the voltage source in the circuit .Constant value of output voltage maintain by voltage regulator IC. 7805 provides +5V regulated power supply.

9. 16 X 2 Dot matrix liquid crystal display:

The display used is 16x2 LCD (Liquid Crystal Display); which means 16 appeals per line by 2 lines. The standard is referred as HD44780U, which refers to the controller chip which receives data from an external source (Here Atmega16) and transfers directly with the LCD. Here 8-bit mode of LCD is used, i.e., using 8-bit data bus. i.e., using 8-bit data bus. The LCD's used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility.

10. Relay and Buzzer:

When any one-parameter crosses its level then micro-controller turns on relay and buzzer and through Relay and cutoff main 230 volt supply so that system is trapped.

11. Power Supply

For our all IC we require 5 v D.C Supply, which can be generated by step down transformer, full wave bridge rectifier, and filter condenser and voltage regulator IC 7805.

2.2 Software DESCRIPTION

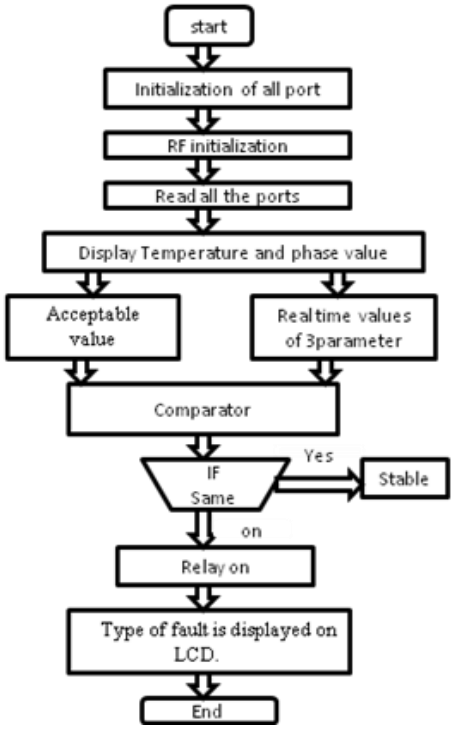
1. AVR STUDIO

AVR studio is software used where machine language code is written and compiled. After compilation machine source code is converted to hex code to be burnt into the microcontroller. The program is written in C language code.

2. Proteus

It is used for circuit designing.

3. FLOWCHART



Algorithm

[1] Start.

[2] Initialize of all ports.

[3] Acceptable value & real time value of 3 parameters are compared.

[4] If both the values are same then it is in stable condition.

[5] If not, then relay is switch off.

[6] Hence switching off the Transformer.

[7] Type of fault is displayed on LCD.

[8] End.

4. CONCLUSIONS

With the knowledge of new technology in 'Electronics' we are able to make our life easier and comfortable. The main objective in this project is to design and implement a system that uses a microcontroller to protect the power transformer. Furthermore, our research motivates the possibility to carry out an extensive research in the area of making the system much cheaper and utilizing the different advanced networking and communication technologies for monitoring the distribution system; and this could play an important role in improving the reliability and efficiency of the distribution power system and making the grid smarter of developing countries in the context of utilizing their power source effectively.

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