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REVIEW ON MICROCONTROLLER BASED SUBSTATION MONITORING AND CONTROLLING USING GSM MODULE

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ABSTRACT

The purpose of this review paper is to manipulate the innovative design of a system based on Substation Monitoring by Micro-Controller using a GSM module that is used to acquire the remote electrical parameter like the voltage, current, frequency and temperature of a distribution transformer in a substation and to protect the system from the rise in parameters and send these real-time values using GSM modem. Defense the distribution transformer can be completed successful by shutdown the entire unit with Radiofrequency Communication and relay support. This relay gets triggered every time the electrical parameters exceed the provided limit values.

The ultimate objective of this paper analyzes the need for this design, which is to continuously monitor the electrical parameters and guard against the burning of distribution transformer or power transformer due to constraints such as overload, over-temperature and input high voltage.

Keywords*: Electricity, GSM Module, Intelligent Electronic Devices, Microcontroller, Real-Time Monitoring, Remote Sensing.*

1. INTRODUCTION

The introduction of this paper should explain the nature of the problem, previous work, purpose, and the contribution of this paper. The contents of each section may be provided to understand easily and softly about the paper.

In our life electricity is essential for all of us because electricity usage and need are high as well as low for different requirement conditions. The distance between the generators and load may be in terms of hundreds of miles hence the amount of maximum power exchange over huge distances has turned out to be a result of the lack of excellence in the electric power. During the earlier development stages, the issues on the quality of power were not frequently reported. Demanding the quality of power being delivered on the user side has raised the alarm due to the increase in demand for electricity on the customer side. A huge amount of power is lost during the transportation of the general power which leads to a reduction in the quality of power received at the substation. To improve the quality of power with the suffering solution it is necessary to be familiar with what sort of constraint has occurred. Moreover, if there is any scantiness in the protection, monitoring and control of a power system. Therefore, is it necessary for a monitoring system that can automatically detect, monitor, and classify the existing constraints on electrical lines?[1]

The development of intelligent electronic devices (IEDs) brings a leap in the development of substations. The large-scale development of IEDs creates a huge amount of data recorded continuously or captured when IEDs are triggered by an event such as a fault or disturbance. Standards for the new developing system: cost, reliability, cyber security, scalability and maintainability and minimal co-dependencies.[2]

The purpose is to manipulate the innovative design of a system based on Substation Monitoring by Micro-Controller by means of a GSM modem that is will obtain the separate electrical parameters of a distribution transformer in a substation and protector of the system from the increase in parameters and direct to these real-time values using GSM device. Protecting the distribution transformer can be accomplished by shutting down the entire unit with the aid of Radiofrequency Communication and relay. This relay gets triggered when the electrical parameters surpass the predefined values. Moreover, the system displays the same on a PC at the main station which is at a distant place. Furthermore, it is capable of recognizing the breakdowns caused due to overload, high temperature and overvoltage. The design usually consists of two units, one in the substation unit, called as transmitter and display unit, and one more in the Main station called as controlling unit

This paper is an eyeopener for reviewing this major issue of Monitoring and Controlling Substation with microcontroller and GSM module. Section 2 presents a brief review of several approaches that are available in the literature for monitoring power in distribution systems.

2. RELATED WORK

The purpose of rebuilding the field of the electricity industry results in an essential for innovative techniques for on behalf of a huge quantity of system data.

Prof. Kunal V. Ranvir and Mayuri A. Solanke [2] have clarified the summary of the Substation Monitoring System that might be obliging for data illustration. Techniques such as 1) guarding 2) overloading and 3) Monitoring must prove to be quite useful. Here yet, the important challenges remain. The major challenges are 1) lack of automation 2) the risk of blackouts 3) brownouts and fires are rapidly increasing.

The "Microcontroller Based Substation Monitoring System and Control System by Gsm Modem" of Amit Sachan This project is pointed to acquire the remote electrical parameters like Voltage, Current and Frequency and send these real-time values through the GSM network using a GSM Modem/phone end to end with the temperature at the power station. This Relay gets triggered whenever the electrical parameters beat the predefined values. The Electromagnetic Relay can be used to handle a Circuit Breaker to switch off the main electrical supply. [3]" A 16X2 LCD is also associated with viewing the system's status. This project uses a 5V, 500mA operated power supply. The AC output of the secondary 230/12V step-down transformer is rectified by the bridge-style full-wave rectifier".[3] Yet, again important challenges remain. The major challenge is to observe the temperature of the transformer

In "Substation Monitoring and Control" 1Loganathan N, 2Prasanth J, 3Shankara Saravanan R, 4Jayasuriya V, 5Karthikeyan S Managed to explain the complexity of the distribution centre has grownup, substation automation has become an obligation for any limited helpfulness, increasing its dependability and enhances the effectiveness of electricity provided. The proposed project manages the substation with the assistance of the required components to ensure that it can be remotely controlled and supervised to provide the intensity of intrusion is decreased. The microcontroller can combine and undertake a role as dictated by the sensors implemented at the substation. Electrical parameters include current and voltage only.[4]1Anurudh Kumar, 2Ashish raj, 3Abhishek Kumar, 4Sikandar prasad & 5Balwant Kumar featured Distribution transformers are one of the most important pieces of the shipment in the power network. Because of, the large number of transformers distributed over a wide area in power electric systems, data acquisition and condition monitoring are important issues. This project presents the design and implementation of a mobile embedded system to monitor and diagnose the condition of transform recordings and record key indicators of a distribution transformer like load currents, transformer oil, ambient temperatures and voltages. Data of operation condition of transformer receives in form of SMS Using the suggested online monitoring system will help utility operators to keep transformers in service for longer of time.[5]

3. PROJECTED MICROCONTROLLER BASED SYSTEM FOR SUBSTATION MONITORING

In this paper, we close by the framework engineering for a Wireless Sensor Network which helps in cutting edge circulation transformer load observing and controlling by utilizing GSM Module. Transformers are among the most fundamental and costly bit of utensils of the transmission and dispersion framework. Standard checking wellbeing circumstance of transformer not exclusively is affordable additionally adds to expanded dependability. The GSM based checking of conveyance transformer is helpful when contrasted with manual observing and it is predictable as it is beyond the realm of imagination to expect to screen consistently the temperature rise, load current, voltage, and burglary happen physically. The transformer is experiencing an issue with the message sent to versatile. We can recuperate the framework in less time. Amidst regularly updated innovation it is conceivable to screen countless parameters of the dispersed transformers at a moderately significant expense. To get an important transformer plotting framework to a controlled cost, it is important to focus on a relatively few key parameters. It is the formation of Wireless revolution. We structure this framework to shield the dissemination transformer from overheating and over-burdening. Arduino regulates the agreed information regards and it gives the fundamental yield as modified in it. The modified yield is shown through the neighbourhood show LCD screen. Information will be spared and could be utilized for further investigation. The GSM modem is utilized as a short message service (SMS) gadget that transmits parameters as an SMS 9. Distributed transformers are prone to damage due to the rise in oil temperature when there is an over current streams through the internal winding of the transformer. When the oil temperature rises, it increases the probability of getting damaged in the transformers. The transformers are to be observed very cautiously during these circumstances. The proposed system consists of a monitoring unit that is connected with the distribution transformer to monitor the same. Hence, we familiarize a simulation model which details the operation of the system to remedy the mentioned problem. The monitoring system is constituted of three major units, namely, 1. Data dispensation and transmitter unit 2. Load and Measurement of Systems 3. Receiver and PC display unit We have designed a system based on a microcontroller (AVR) that monitors and controls the voltage, current and oil temperature of a distribution transformer present in a substation. The supervised output will be shown on a PC at the main station that is at a remote place, through RF communication. The parameters checked at the distribution transformer are compared with the rated values of the transformer. The software in the PC compares the get values with the rated measurements of the distribution transformer and shutdown the transformer so that it can be prevented from mutilation and performances can be enhanced to quite a remarkable level. The controller contains a sensing unit that collects the essential parameters such as current, voltage and the oil temperature within the distribution transformer. The digital display connected to the processing unit displays equivalent parameter values at the substation for any technical operations. The controller also senses the overload and high current flow conditions in the internal windings that may lead to the breakdown of the corresponding unit. The microcontroller is programmed in such a manner to continuously scan the transformer and update the parameters at a particular time interval. The parameter values sensed by the microcontroller are transmitted through the RF transmitter connected to the microcontroller unit. The transferred signals are received at the main station using the RF receiver. The received signals are then conceded to the PC. The software loaded on the PC is used to monitor the changes in the parameters that are measured from the distribution transformer. When a remarkable change is noticed in the measured values it controls the unit by ending it from any serious damage.

3.1 MONITORING AND CONTROLLING BY THE PROPOSED SYSTEM

The values of voltage, current and temperature of the transformer are directly applied to Port A (one of the input ports of the AVR microcontroller). Along with this, a display is connected to Port B (another input port of the microcontroller). The RF transmitting section and the load variation control are connected to Port C (one of the output ports in the microcontroller). The observational PC is connected to the main station. The microcontroller at the substation monitors and captures the current, voltage and temperature values for a particular period interval. The received values are stored in the data register and displayed using the LCD. On the receiver side of the proposed system, the receiver antenna converts the RF signal into an electrical signal and acquires the information which has been transmitted by the transmitter. Based on the received information, the controlling operation is performed. If the receiver receives the transformer parameters which is larger than the fixed threshold level, then instantly the unit is shut down to protect the System.

3.2 DESIGN PROCEDURES

The design procedures for the proposed microcontroller-based system are described as follows

- Define the interfacing parameters for LCD and Data Registers.
- Allocate a value for the circuit elements such as Relay, LED, Buffer and Fan.
- Preset the input and output ports of the 01e458-7microcontroller.The functions defined for taking the current, voltage and temperature values are called and performed.
- The displaying functions are called and the parameter values are displayed.
- The apprehended values are transmitted by calling the RF transmitter function.

The controller program is based on a rip-up and retries mechanism for scanning the parameters continuously and displays the current status in the display unit. The procedures stated below are performed and the parameter values are captured to check whether the transformer is operating under safe conditions. The microcontroller is attached to the LCD and RF transmission devices through their respective interfacing ICs. The apt operation of the interfaces is maintained and carried out with the help of the data processing unit. Parameters which are interfacing these parameters are defined to starts the communication between the microcontroller and the peripheral systems. In the main program, an infinite loop is executed and the values for registers of Ports C and D are set as "1" i.e.; the ports are said to be as output ports. Then the capturing functions are executed and the values of the required parameters are captured and stored in the microcontrollers data register. Register values are initialized and assigned whether to perform the READ or WRITE function. The transmitter values are set to zero before transmitting the values to avoid from the buffer. Once the values are transmitted the buffer values are cleared to store the next captured values. The LCD function is initialized to display the parameter values. The 3 major functions to be performed while starting the LCD are: READ, WRITE and ENABLE. The following hex values are would perform the LCD operations 0x01= clear the display screen 0x0C =display on, cursor off 0X38 =2 lines and 0X06=addition cursor (shift cursor to right) and 0x80= force cursor to initializing of 1st line. The LCD uses a 5*7 matrix to display the characters and string values.

4. CONCLUSION

In this paper, we have presented a design of a system based on a microcontroller that is used to monitor and control the voltage, current, frequency and temperature of a Substation System. The proposed system which has been structured to observe the transformer's necessary parameters during its operation. If the microcontroller recognizes an increase in the level of voltage, current, frequency or temperature values the unit has been made shutdown to prevent it from supplementary damages. The structured design not only controls the distribution transformer in the substation by shutting it down but also shows the values throughout the process for the user's preference. This privileges that the proposed design of the system makes the distribution transformer more robust against some key power quality issues which makes the voltage, current or temperature to the peak. That's why, the distribution is made much secure, reliable and well-organized using the proposed system. This system is very accommodating for the electricity board. We are able to for a structure or design and implement the single-phase distribution transformer as a mini prototype model. The large size capacity of 3 phase distribution transformer can be implemented in the future the model. Every distribution transformer data will collect through this system then the fault can be identified and rectify it.

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