International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 12, Issue 4 [April. 2023] PP: 193-197

Wifi Enabled "Industrial Process Control "using SCADA based Remote System

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ABSTRACT:
As complexity of distribution network has grown, automation of substation has become a need of every utility company. To improve the quality of power it is necessary to be familiar with what sort of constraint has occurred. Additionally, if there is any inadequacy in the protection, monitoring and control of a power system. Therefore, it necessitates a monitoring system that will be able to automatically detect, monitor, and classify the existing constraints on electrical lines. The purpose of this project is to acquire the remote electrical parameters like voltage, current an frequency and send these real time values over network along with temperature at power station. This project is also designed to protect the electrical circuitry by operating a relay. This relay gets activated whenever the electrical parameter exceeds the predefined values. This system can automatically update the real time electrical parameters periodically (based on time settings). This system can be designed to send alerts whenever the relay trips or whenever the voltage or current exceeds the predefined limits.
Key Words: *microcontroller, SCADA, Arduino.*

Date of Submission: 08-04-2023 Date of acceptance: 21-04-2023

I. INTRODUCTION

Electricity is an extremely handy and useful form of energy. It plays an ever-growing role in our modern industrialized society. The electrical power systems are highly non-linear, extremely huge and complex networks. Such electric power systems are unified for economic benefits, increased reliability and operational advantages. They are one of the most significant elements of both national and global infrastructure, and when these systems collapse it leads to major direct and indirect impacts on the economy and national security. A power system consists of components such as generators, lines, transformers, loads, switches and compensators. However, a widely dispersed power sources and loads are the general configuration of modern power systems. Today electricity still suffers from power outages and blackouts due to the lack of automated analysis and poor visibility of the utility over the grid. WSN will give the utility provide the needed view by collecting information from the different sub-systems of the grid. A sensor node will decide information or to slightly delay this notification (whether to immediately notify the sink about this information.). As complexity of distribution network has grown, automation of substation has become a need of every utility company to increase its efficiency and to improve quality of power being delivered.

The introduction of this project describes the need for automation in substation to improve the quality of power and to monitor and control the power system. It explains that a monitoring system is necessary to detect, monitor, and classify the constrains on electrical lines.

The project aims to acquire remote electrical parameter like voltage, current, and frequency, and send these real-time values over the network along with the temperature at the power station. The system is also designed to protect the electrical parameter exceed predefined values. The project uses a microcontroller, Arduino Uno, to efficiently communicate with the different sensors being used. The introduction also explains how the system works, with sensors sensing the values and comparing them to predefined values, and sensing alerts and activating the relay if any values exceed their limits. Overall the introduction sets the context for the project and explains its purpose and goals.

II. WORKFLOW OF THE PROPOSED APPROACH

The power supply provides power to the entire system, and the sensors sense the electrical parameters (current, voltage, frequency) and temperature of the power station. The microcontroller (Arduino Uno) receives this data from the sensors and processes it.

The microcontroller then compares the real-time values with the predefined values, and if any of the values exceed the predefined values, it sends a fault alert to the relay, buzzer/alarm, and updates it on the display. The relay is then activated, which isolates the loads from the rest of the system to protect the electrical circuitry

If the fault exists for the preset time, the relay remains activated, and if the fault gets cleared, the relay reconnects the loads with the rest of the system. The system can also automatically update the real-time electrical parameters periodically based on time settings.

The system model explains that the system is designed to acquire remote electrical parameters and protect the electrical circuitry by operating a relay whenever the electrical parameter exceeds the predefined values as illustrated in Fig.1.

It also sends alerts whenever the voltage or current exceeds the predefined limits and periodically updates the real-time electrical parameters over the network. In proposed prototype we have used Arduino Uno as our primary microcontroller. It will work as the heart of the system as shown in Fig.2; all other measurement circuitries will be interfaced through this. All the detailed specifications will be discussed in the next chapter, nevertheless let me take you through the basic components for better understanding the rest of the operation.

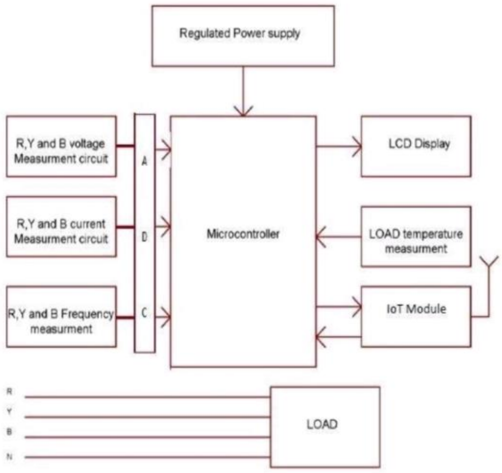


Fig.1.Block diagram

Besides the microcontroller we have used current sensor, voltage sensor, temperature sensor, frequency measurement unit, buzzer and relay; and to demonstrate the load we have used a fan and a bulb. Alongside we also have used a supply unit, consisting of a transformer, which converts 230 Volt AC to 12 Volt AC then it is passed through bridge rectifier unit which converts this 12 Volt AC to 12 Volt DC which is pulsating in nature which is then fed to the capacitor which work as a filter, makes the pulsating DC to smooth DC. As a lot of our components like Arduino Uno and some of the sensors as well require 5 Volt regulated DC, that is why this 12 Volt DC is fed to 7805 Voltage regulator which makes it to 5 Volt regulated DC.

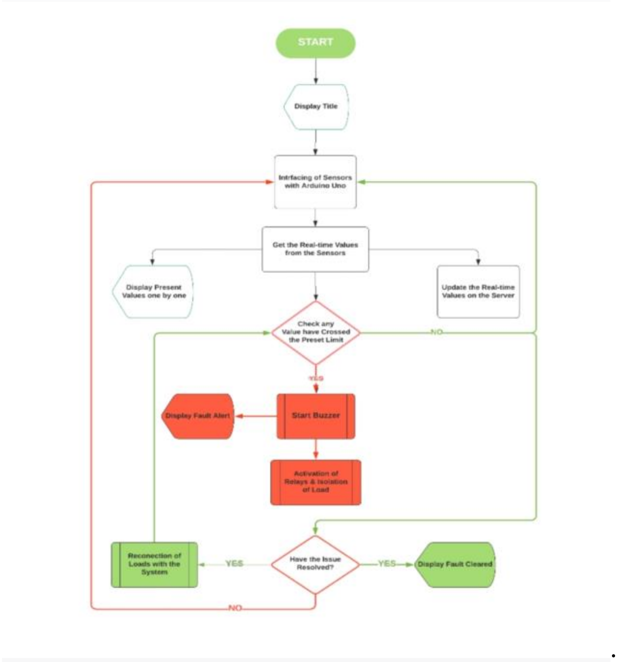


Fig.2.Flow Chart of the Prototype.

III.HARDWARE DESCRIPTION:

In Proposed prototype we have used Arduino Uno as our primary microcontroller as shown in Fig.3. It will work as the heart of the system; all other measurement circuitries will be interfaced through this. Besides the microcontroller we have used ACS712 current sensor, ZMPT101B voltage sensor, LM 35 temperature sensor, frequency measurement unit, a piezo buzzer and a two-channel relay module; and to demonstrate the load we have used a fan and a bulb

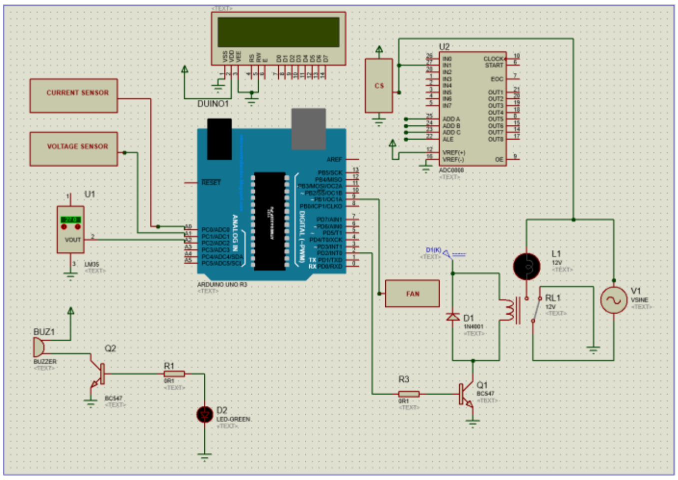


Fig.3.Circuit Diagram

IV.RESULTS AND DISCUSSION

The window display is developed using Graphical User Interface (GUI). The devices and their parameters such as frequency, voltage, load impedance, reluctance, oil level, temperature, cooling condition and power can be monitored integratedly in a displayer. This method helps the operator monitoring in real time the condition of each device easily. Furthermore, in the case of any failure, the operator will be acknowledged immediately that a specific device is experiencing some difficulty or failure. The blackout condition can be prevented and continuity power supply will be guaranteed.

It may be noted that the primary CTs and VTs for protection purposes may not be accurate enough for normal current measurement for revenue metering. The normal metering functions include measuring the voltage and current root mean square (RMS) values and the real and reactive power.

• In addition to these basic functions, metering also includes the values for commissioning and testing, and this feature reduces the commission and testing times on the site. The metered values are the positive, negative, and zero sequence components of voltage and current phase shifts and the normal RMS values. The phase mismatch, differential, and restraint values can be computed easily to hasten the commissioning process as illustrated in Fig.4.

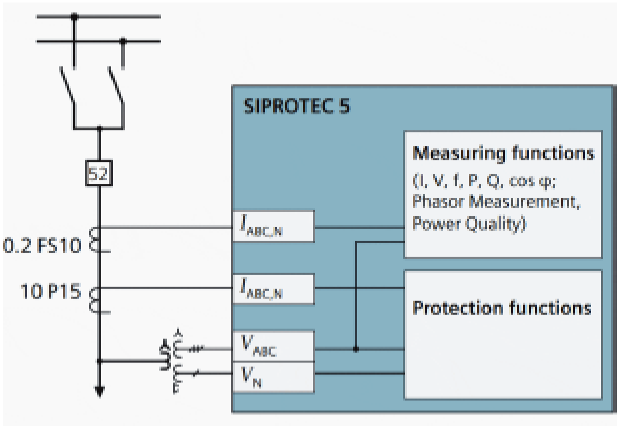
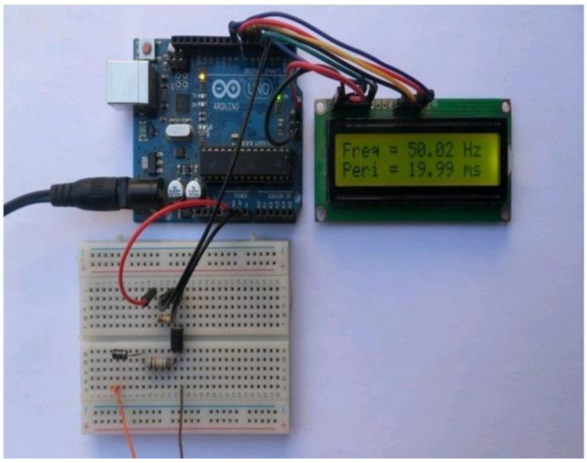


Fig.4 Connection to a protection-class and instrument current transformer for a feeder

TEMERATURE SENSOR

GAS SENSOR

FREQUENCY READING



V.CONCLUSION

Monitoring means acquiring significant parameters from the assets of interest. The acquired data is feasible to be used for analyses and diagnose the condition of the assets which is of great use for maintenance scheduling, failure management and controlling system and this method minimizes time contact between human and high voltage device. As it is known, most substation devices have high voltage and generate electromagnetic that can harm human health. This proposed system is specially designed for monitoring the condition of substation transformers which are deployed at dispersed locations There are many parameters to be quantified and monitored periodically It is quite costly and difficult to monitor the parameters by appointing a person at all locations and furthermore the data would also be error prone if the monitoring is manual. The greatest issue is to have all the transformers data at a single sink when the data is collected manually. Through our proposed system all the problems discussed above can be reduced to some great extent.

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