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Real Time Monitoring and Control of Substation Parameters using IOT

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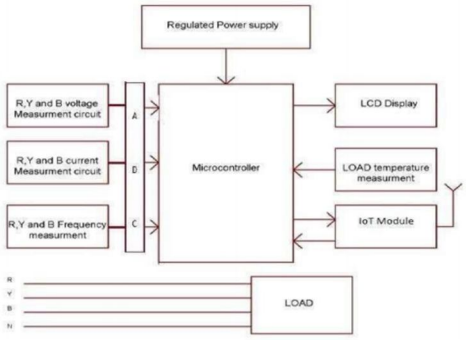
Abstract: ***This paper studies about real time monitoring and control of substation .automation of substation has become a need of companies. So, it is necessary to monitoring system that will be able to automatically sense, monitor, and classify the existing constraints on electrical loads. The main purpose of the project is to acquire the remote electrical parameters like voltage, current, temperature and frequency and send these real time values over network at power station. This project is also designed to protect the electrical equipments by operating relays .This relay gets activated whenever the electrical parameters exceed the predefined values.This system can automatically update the real time electrical parameters periodically. It has sensing capability to sense whether the system is in normal conditions or it exceeded the predefined values .If it exceeds predefined values then it gives buzzer to alert and relays automatically trips the circuit .***

Keywords: Automation, constraints, power station, electrical parameters, predefined values.

I. INTRODUCTION

A power system consists of components such as generators, lines, transformers, loads, switches and compensators. widely dispersed power sources and loads are the general configuration of modern power systems. Today electricity still suffers from poweroutages and blackouts due to the lack of automated analysis and poor visibility of the utility over the grid. A sensor node will decide information or to slightly delay this notification.when a system damages there are many impacts. So frequent monitoring is very important.This system sends alerts whenever parameters like current, voltage and frequency exeeds. This prototype uses micro controller this controller can effictevely communicate with different sensors which are going to be used.the controller is provided with some internal memory to run the code.The controller is programmed using embedded c language. The substation has a crucial role to maintain the reliability and to keep the quality of an electric power transmission system. as this is a prototype of the proposed project, for demonstration purposes we used Arduino Uno . The controller can efficiently communicate with the different sensors being used. Specifications of a substation monitoring system are highly variable, depending on the type of substation, voltage levels, loads grid integration and many other technical parameters. In view of the criticality of their application, a wide range of regulations and standards govern the specification, design, engineering and application of substation monitoring system, both for hardware and software components. Substation monitoring system may be installed in a given substation on a standalone basis, or often integrated as part of a wider substation automation system.enabling quik response is key feature .

II. OPERATION



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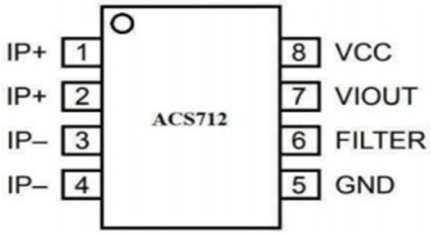
Here in the proposed prototype we have used Arduino Uno as our primary microcontroller. It will work as the heart of the system; all measurement will be interfaced through this. Besides the microcontroller we have used current sensor, voltage sensor, temperature sensor, frequency measurement unit, arduino Uno buzzer and relay, to demonstrate the load we have used a fan and a bulb and 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 . 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 require 5 Volt regulated DC, So12 Volt DC is fed to 7805 Voltage regulator Pin Diagram of ACS712 which makes it to 5 Volt regulated DC. buzzer and relay need high amount of current for operation, we have to For that amplification arrangement in case of relay we have used a relay driver and for buzzer We have used two BC547transistorin Darling ton pair configuration.

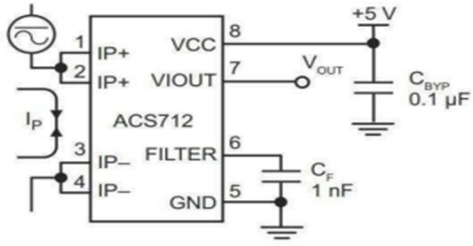
III. SENSORS

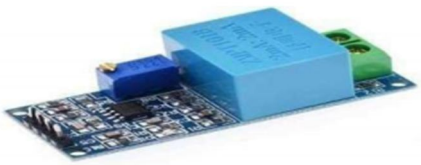
we used ACS712" Current sensor for current measurement in our prototype. The ACS712 Module uses the famous ACS712 IC to measure current using the Hall Effect principle. The ACS712 module has two phoenix terminal connectors with mounting screws. These are terminals through which the wire has to be passed. Other side we have three pins. The Vcc is connected to +5V to power the module and ground is connected to the ground of the µC. the Current Sensor detects the current in a conductor and generates a signal proportional to the detected current either in the form of analog voltage or digital output. current-carrying conductor also gives rise to a magnetic field in its surroundings, the current is measured by calculating this magnetic field by applying either Faraday's law or Ampere law. IP+ Terminals for current being sensed; fused internally IP- Terminals for current being sensed; fused internally. GND Signal ground terminal FILTER Terminal for external ground capacitor that sets bandwidth VIOUT Analog output terminal VCC Device power supply terminal .

Single-phase AC active output voltage mutual inductance module equipped with ZMPT101B series of a high-precision voltage transformer and high-precision amp current, easy to 250v within the AC power signal .ZMPT101B voltage sensor module is a voltage sensor made from the ZMPT101B voltage transformer. It has high accuracy, good consistency for voltage and power measurement and it can measure up to 250V AC. It is simple to use and comes with a multi turn trim potentiometer for adjusting ADC output.

A. Pin Diagram of ACS712







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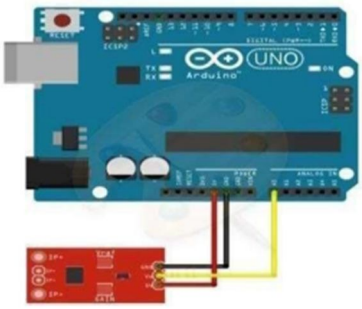
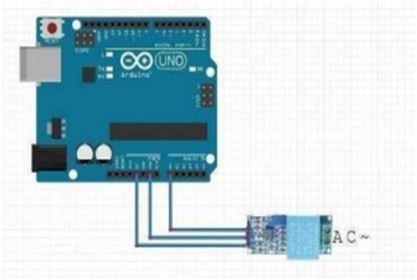
IV. INTERFACING WITH ARDUINO



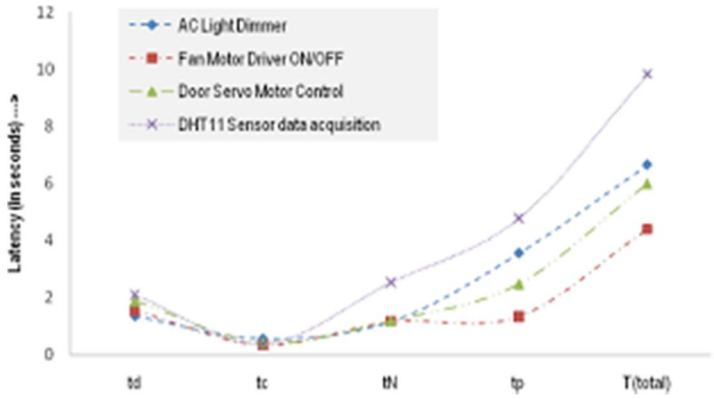
Current sensor interfacing with arduino



Voltage sensor interfacing with Arduino

To measure AV voltage, we will need to have a ZMPT101B" module. All we have to do is connect Vcc of the module to 5v of the Arduino GND to ground of the Arduino and Vout to analog the Arduino .Once all the connections remade, we just need to upload the code to the Arduino and open the serial monitor and the voltage will be displayed. We can measure up to 300v . Frequency is number of cycles (complete turns) per 1 second. Its main unit of measurement is (Hz). Period is time required to complete 1 cycle (turn), its main unit is second. Frequency = 1/Period. Home alternating current (AC) frequency is 50. For frequency of 50Hz the period is 20(ms). The AC input is connected to the circuit as shown where diode 1N4007 eliminate negative half cycles because the PC817opto coupler maximumr everse voltageis6V optocoupler is connected to AC main through 120k ohm resistor (and also the 1N4007 diode) which limits the current that passes through the optocoupler LED (IF). With the 120k ohm resistor and with source of 220V, the peak forward current is equal to (neglecting diode voltages): 220x√2/120k = 2.59 mA and the RMS current (half wave) = 2.59/2 = 1.3 mA.

V. RESULT



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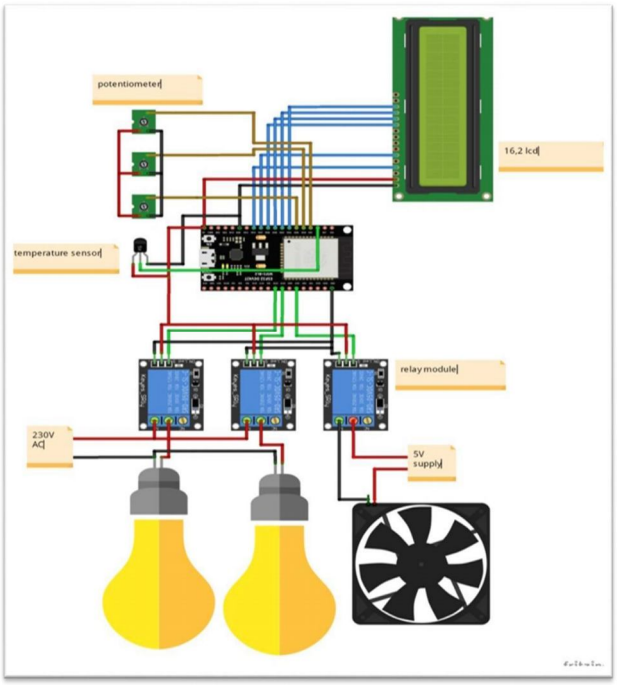

VI. CONCLUSION

The acquired data is feasible to be used for analysis 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. In 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 great extent.

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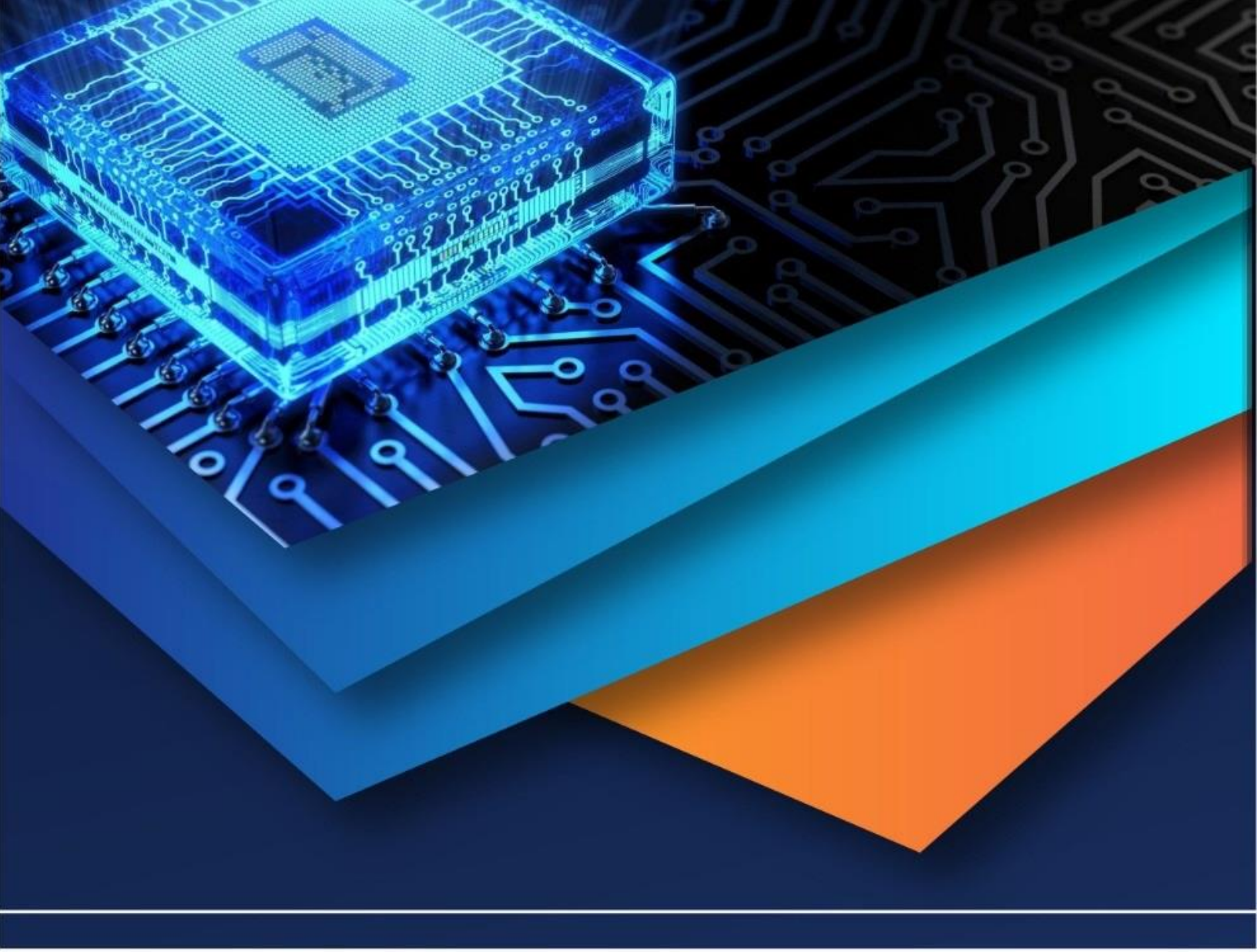

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