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IOT BASED THREE PHASE VOLTAGE AND CURRENT MONITORING AND PROTECTION SYSTEM

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Abstract : This system demonstrates the use of an IOT-based three-phase voltage and current monitoring system for load protection with automatic ON and OFF control via a relay. The goal of this system is to track three phase connections in real time and trip the relay in response to changes in three phase supply voltage and current in order to protect three phase devices. The voltage and current at each phase are monitored by the system using different phase sensors. The voltage and current measured by each phase are supplied into the Arduino's analogue to digital converter. The monitoring and controlling will be done through the Arduino board.

The tripping of the relay will be determined by the Arduino board's output. Any abnormalities in the input voltage and current at each phase will be detected by the phase sensors. High voltage, low voltage, and current faults are all detected using voltage and current sensors. As soon as any abnormal condition occurs, this system instantly cuts off power to the load.

The output of each phase sensor is kept on the cloud surface for remote access and is also displayed on the LCD at any given time. This system can also automatically turn off the mains supply in an abnormal or malfunctioning condition and then turn it back on when the situation is safe.

IndexTerms **– IOT, Voltage sensor, Current sensor, Arduino, Over voltage, Under voltage, Over current.**

I. INTRODUCTION

Voltage irregularity is a major concern in today's industry and home, and it is frequently responsible for the destruction of valuable electrical equipment. Electric system safety tools are essential for the protection of both the user and the machine gadget from malfunction; as a result, A safeguarding tool has been established. A defect in an energy machine is defined as an unfavorable event that occurs within the machine. Short circuits, current leakage, ground shock, overcurrent, and other undesirable circumstances can occur when using an electrical device. under voltage, overvoltage, and so forth.

Here, we'll look at the importance of electricity and the consequences of having too much or too little. Electric current has a significant impact on electrical load, and its detection and measurement are critical in a variety of applications, including commercial, domestic, and automotive. Although, in many electronics and embedded structures, measuring or controlling current flow is a must.

In our system the major concern is to guard the load connected to three phase system. When there is a rapid fluctuation in voltage or current at any one of the three phases, which can cause dangerous damage to three phase machines or motors, this system will immediately cut off the supply to all three phases automatically and then switches back on in a safe condition.

If any unwanted variation in the mains supply occurs, then Arduino controller will safeguard the load from switching surges. When the mains supply goes outside the predefined limitations (over/under voltage) or crosses the over current value, the relay immediately shuts down the motor or load.

II. METHODOLOGY

In this project, voltage sensing circuit and current sensing circuit are used to monitor the supply voltage and input current at three different phases. It will monitor each phase individually. The threshold values of over voltage and under voltage are set at the time of coding. In our project the under-voltage threshold of 200V and over voltage threshold of 250V is used for testing. LCD display is used to display the status of voltage and current at each phase.

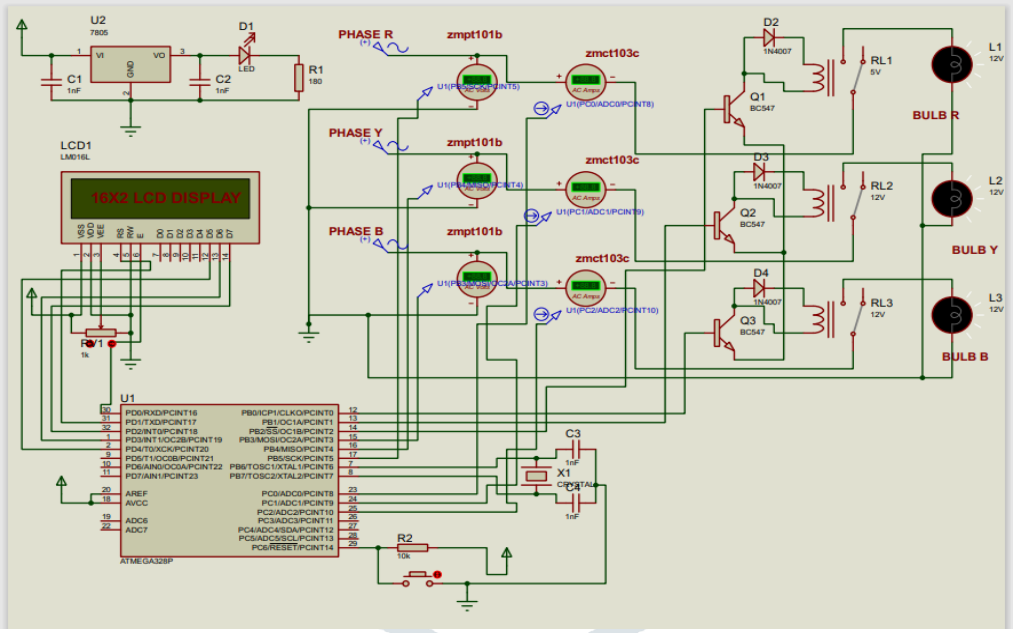
Three voltage sensors and three current sensors are connected to each R, Y, B phase as shown in fig(1). These sensors will monitor the input supply voltage and current at R, Y, and B phase. The output of these sensors is passed to controller for further processing and then the data is displayed on the LCD.

A voltage sensor used is ZMPT101B which senses the input supply voltage. It is nothing but a Transformer with high precision voltage. This module makes it easy to monitor AC mains voltage up to 1000 volts. The output of this voltage sensing circuit is dc voltage which is proportional to the input voltage and the attenuator is used to adjust the output as per the requirement of Arduino board.

The current sensor used is ZMCT103C which senses the input current. It is used to check whether the input current is below the over current value or not. ZMCT103C current sensor operates on the principle of variation of magnetic field change between two coils. It generates highly accurate, low noise output voltage signal which are proportional to the applied ac current. It will continuously sense the input current and send the sensed data to Arduino board.

Three different relays are used at three different phases to cut off the supply when there is drastic change in the voltage levels. The relay circuits prevent the load from any kind of electronic damage. The system cuts off the supply to all the phases when any one of the phases crosses the threshold value.

The ESP8266 module is connected with the Arduino. When we have voltage and current data available, we send data over the server using ESP8266. We are making use of ThingSpeak as our logging server. We have created 6 different fields which hold data for 3 different voltage phases and current. The standard refresh rate is of 10 seconds between any two intervals. Depending upon the network speed this may vary.



Fig(1): Circuit diagram of proposed system

III. WORKING

The load is connected to all the three phases of input power supply. As soon as the power supply is switched ON, the voltage and current status of R, Y, B phase is displayed on the LCD. In our project the Over Voltage threshold of 250V and Under Voltage threshold of 200V is used for testing.

The Arduino controller will compare the sensed input phase voltage with desired threshold values. If the input voltage at any of the phase exceeds the over voltage value, then relay circuit will cut off the supply to all the three phases so that load will be turned off and the LCD will display the message as OVER VOLTAGE and also displays the voltage and current status at that time as shown in figure (2). Also, the voltage and current status will be stored on cloud as shown in Fig (3).

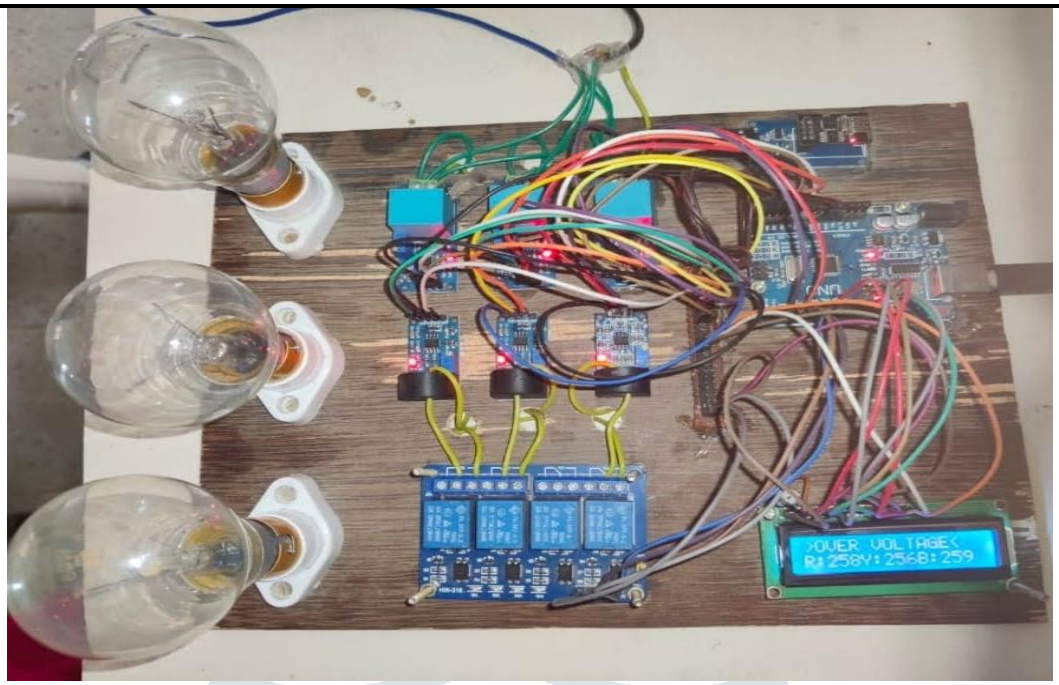


Fig (2): Output result of supplied voltage above the 250V

Fig (3): Sensed value of voltage at R, Y, B phase is above 250V stored on cloud

If the input voltage at any of the phase drops below the under-voltage value, then relay circuit will cut off the supply to all the three phases so that load will be turned off and the LCD will display the message as UNDER VOLTAGE and displays the voltage and current status at that point of time. The sensed voltage and current values will be stored on cloud shown in Fig (4).

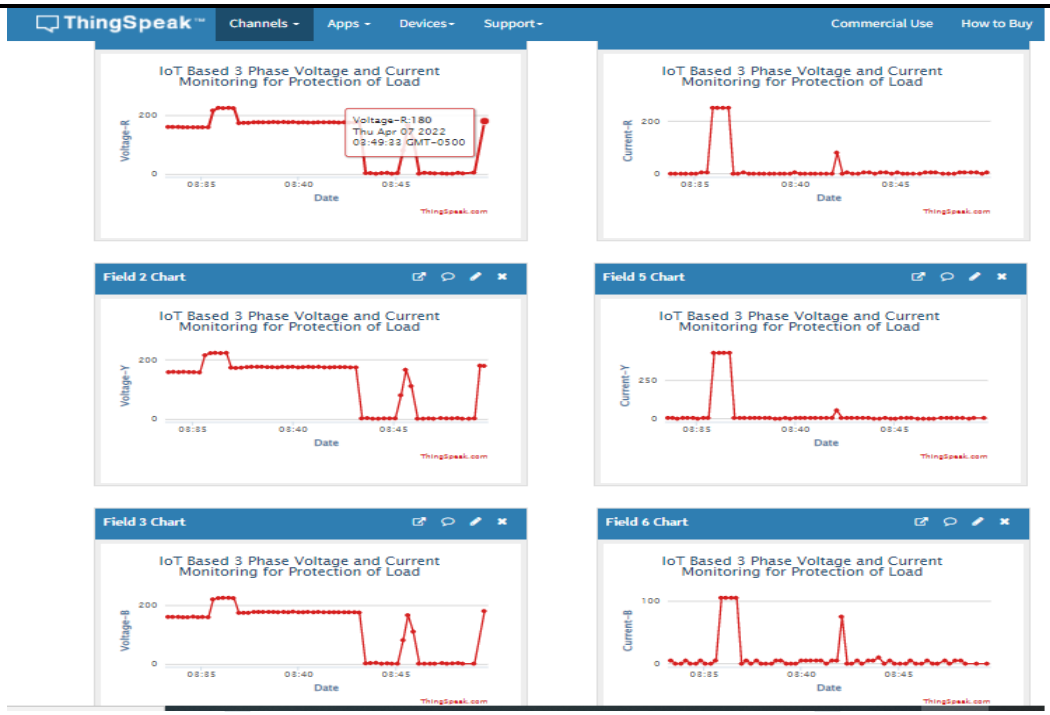


Fig (4): Sensed value of voltage at R, Y, B phase is below 200V stored on cloud

Similarly, If the input current exceeds the over current value, then relay circuit will cut off the supply to the load and it will be will be turned off and the LCD will display the message as OVER CURRENT and displays the voltage and current status at that point of time. The sensed voltage and current values will be stored on cloud shown in Fig (5).

Fig (5): Sensed value of current above over current value is stored on cloud

IV. RESULTS

If the input voltage and current at each phase is within the threshold value then relay circuit will turn ON and the power is supplied to all the three phases hence load will turn ON and the LCD will display the status of voltage and current of all three phases. The sensed voltage and current values will be stored on cloud as shown in Fig (6).

Fig (6): Sensed value of voltage and current within threshold values stored on cloud

When the limits of the maximum allowable under voltage and over voltage are exceeded, the controller generates a trip signal, which in turn switches off the relay leading to turning off the load and display message as under voltage or over voltage at respective phases and hence load is protected from heavy over and under voltage condition. Similarly, over current faults are monitored and load is protected from those faults.

V. CONCLUSION

The Implementation of IOT based three phase voltage and current monitoring system has been done. The model is developed and tested on lamp loads with rated current of 5A and the test results are satisfying the design criteria. The voltage and current data are sent over the server using ESP8266. The load is protected against fault current, under voltage and over voltage.

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