International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 07 | July - 2021 ISSN: 2582-3930

OVER AND UNDER VOLTAGE PROTECTION OF ELECTRICAL APPLIANCES

1. Chandan B C
Student
Electrical and electronics engg.
Dayananda sagar college of engg
Banglore , India

2. Naveen D
Student
Electrical and electronics engg.
Dayananda sagar college of engg.
Banglore , India

3. Tanuja H
Asst. professor
Electrical and electronics engg.
Dayananda sagar college of engg
Banglore , India

4. Ramesh T P
Student
Electrical and electronics engg.
Dayananda sagar college of engg.
Banglore , India

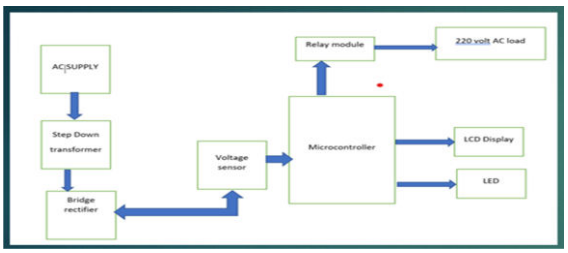
Abstract: Electrical power system is considered as one of the most complicated artificial systems all over the globe, as social and economic development depends on intact, consistent, stable and economic functions. Actually sudden fluctuation in voltage is very big and serious problem in industries and home appliances and it causes losses in electrical circuits. These losses causes low power factor in the supply and by much amount of power is going to be wasted.

I.INTRODUCTION

Actually sudden fluctuation in voltage is very big and serious problem in industries and home appliances and it causes losses in electrical circuits. These losses cause low power factor in the supply and by much amount of power is going to be wasted. These fluctuations may significantly impact the power quality as well as the reliability of other voltage controlling devices. Therefore, due to this fluctuation various costly and precious equipment may get damaged. Electrical Power System protection is required for protectionof both user and the system equipment from fault, hence electrical appliances are not allowed to operate without any protective device installed.

Here an inexpensive auto cut off circuit, which is fabricated using transistors and other components. It can be used to protect loads such as TV, refrigerator and VCR from undesired over and under line voltages, as well as surges caused due to sudden failure/resumption of main switch power supply.

II. BLOCK DIAGRAM AND EXPLANATION

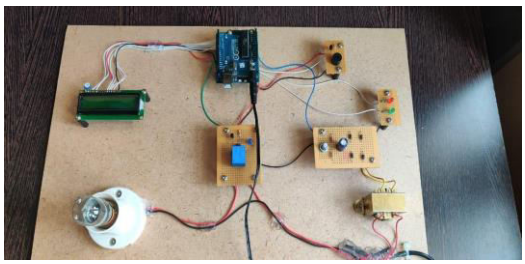


FLOW CHART

Working: Ac supply is given to this protection system then it converts the input voltage into 12 volts by using the stepdown transformer. It can be converted into DC by using the bridge rectifer using the diodes after this process the dc supply is given to voltage sensor. Voltage sensor senses the voltage and the ouput is given to microcontroller then the microcontroller will send the instruction to the realy for its operation. Relay is connected to 220 volts ac load, realy protects that ac load from over and under voltage condition. LCD display and LED lights are used for the indication of over and under voltage conditions. LCD display shows the over and udervoltage condition and LED lights also indictae during the over and under voltage conditions about the condition it's in. So basically, the bridge rectifier is used to convert ac to dc, it

consist of diodeswhich converts AC into DC by arranging them in a particular way. the voltage sensor senses the voltage level and it sends the signals to the micro controller and then micro controller will send the signal to the relay. The relay operates based on the signals, if the voltage level is higher then the normal condition the relay gets deenergized. If the voltage level is below then the normal voltage level then the relay will again be deenergized The LED lights and LCD display are used for the indication purpose if the voltage level is higher, LED lights will blink red and even if it's higher it'll blink red and it also displays the voltage level in LCD display.

III.CIRCUIT DIAGRAM :

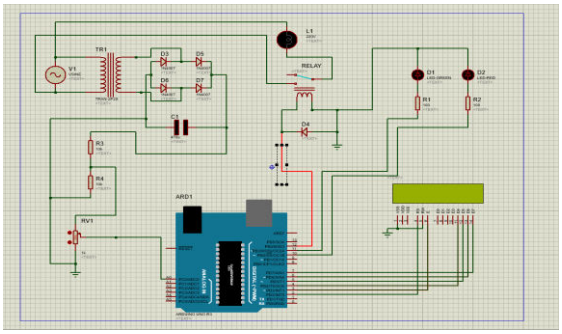


CIRCUIT WORKING :

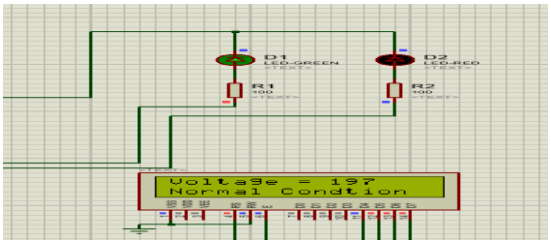
This project is implementing based on Atmega328 Arduino microcontroller. The program uploaded to the Arduino Uno microcontroller board. The voltage sensor is connected with analog pin of microcontroller. Arduino Uno microcontroller board was developed for measuring electrical quantities and protecting overvoltage and under voltage conditions in a main AC power supply. Including the hardware and software to build the system in which an Arduino Uno platform is implemented as a microcontroller to read voltage from a voltage sensor (ZMPT101B). In addition, the Arduino is also used to send all measurement to LCD display for monitoring the measured voltage value. We will use just 6 digital input pins from the Arduino Board. The LCD's registers from D4 to D7 will be connected to Arduino's digital pins from 4 to 7. The Enable pin will be connected to pin number 2 and the RS pin will be connected to pin number 1. The R/W pin will be connected to Ground and the VO pin will be connected OVER AND UNDER VOLTAGE PROTECTION OF ELECTRICAL APPLIANCES 2020-21 DEPARTMENT OF EEE, DSCE 45 to the potentiometer. The voltage measurement is compared with the minimum voltage and the maximum voltage. In case over voltage or under voltage detected, then the microcontroller will trigger off the relay and load will get automatic switch.

IV. RESULT ANALYSIS

Introduction about the simulation software :Proteus software version is 8.10 (designed by Labcenter Electronics Ltd.) is a software tool set, mainly used for creating schematics, simulating Electronics & Embedded Circuits and designing PCB Layouts. Proteus ARES is used for designing PCB Layouts of electronic circuits It's available in four languages i.e. English, Chinese, Spanish & French. Our circuit is working perfectly on Proteus but when we have implemented it on hardware, it's not working." I receive a lot of such questions from engineering students, that's why, I am explaining what's the real purpose of Proteus: Proteus is quite lenient in circuit designing and it works on ideal conditions i.e. if you don't add pull up resistors in Proteus simulation, then it won't give garbage value simulation circuit result analysis Simulated the circuit using proteus software The 220VAC is given to the step down transformer where it's stepped down to 12VAC and given to the bridge rectifier where it's converted into 12V DC but it has ripples so get pure DC a filter is used in our case it's a capacitor and thus pure 12VDC is obtained, this is given to the voltage divider and 7V is given as input to the relay which is the operating voltage of the Arduino and the rest is lost as heat and the Arduino sends a signal to relay, based on the signal sanded by the controller .relay will operate on the basis of voltage level sensed by the controller, relay protect the circuit from over and under voltage conditions .controller can find three fault conditions 1.Normal voltage condition 2.over voltage condition 3.under voltage condition.



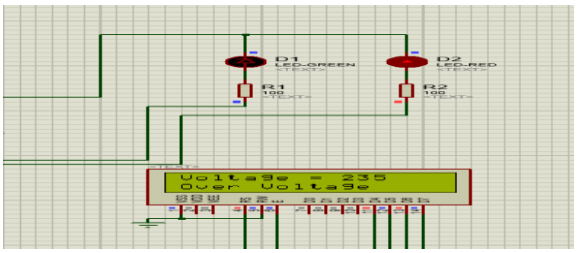
SIMULATED CIRCUIT DIAGRAM



Condition 1:

In normal voltage condition, voltage level is between 180 to 220 volt and the Arduino sends a signal to relay to be in NC and the load is thus connected, it also sends a signal to green LED to start blinking which shows it's safe to operate and the load is switched on in our case the bulb glows and the LCD shows the voltage level and the condition of the circuit.

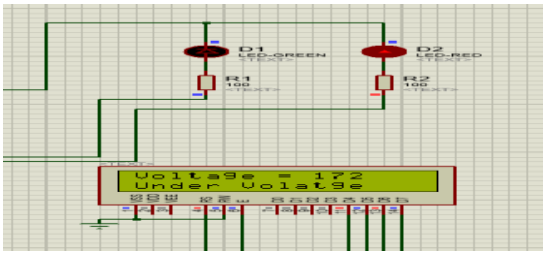
Condition 2 :



Over voltage condition

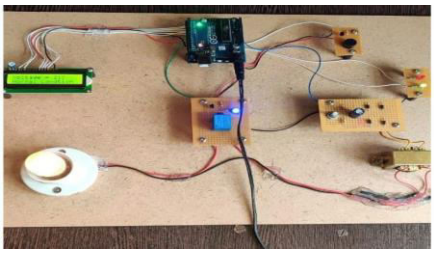
When the input is above the desired level of 220V, it's in Over voltage condition and the Arduino sends a signal to relay to be in NO condition and the load is disconnected, we create the fault using potentiometer. Arduino also sends a signal to the red LED showing that its's not safe to operate and the LCD shows the voltage level. When the fault is fixed, reset the Arduino to accept the new voltage level by clicking the reset button.

Condition 3 :

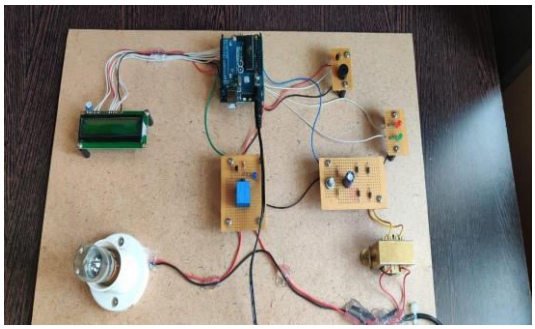


Under voltage condition

when the voltage level is below 180V it's in under voltage condition and the Arduino sends a signal to the relay to be in open condition again so that the load is cut off and the red LED blinks red showing that the load is disconnected and the bulb doesn't glow and it's unsafe to operate the LCD shows.

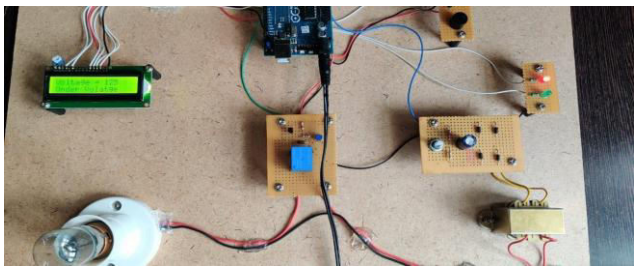


Practical circuit result analysis:



Practical circuit figure

The 220VAC is given to the step down transformer where it's stepped down to 12VAC and given to the bridge rectifier where it's converted into 12V DC but it has ripples so get pure DC a filter is used in our case it's a capacitor and thus pure 12VDC is obtained, this is given to the



voltage divider and 7V is given as input to the relay which is the operating voltage of the Arduino and the rest is lost as heat and the Arduino sends a signal to relay, LED, LCD based on the fault we create using the potentiometer.

Under voltage condition :

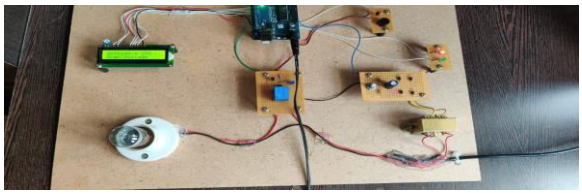
When the input is above the desired level of 220V, it's in Over voltage condition and the Arduino sends a signal to relay to be in NO[normally open] condition and the load is disconnected,we create the fault using potentiometer. Arduino also sends a signal to the red LED showing that its's not safe to operate and the LCD shows the voltage level.

When the fault is fixed, reset the Arduino to accept the new voltage level by clicking the reset button.

Normal voltage condition:

The relay sends a signal to the relay to be in NC and the load is thus connected with the supply, it also sends a signal to green LED to start blinking which shows it's safe to operate and the load is switched on in our case the bulb glows and the LCD shows the voltage level and the condition of the circuit.

Over voltage condition :



When the input is above the desired level of 220V, it's in Over voltage condition and the Arduino sends a signal to relay to be in NO[normally open] condition and the load is disconnected,we create the fault using potentiometer. Arduino also sends a signal to the red LED showing that its's not safe to operate and the LCD shows the voltage level.

When the fault is fixed, reset the Arduino to accept the new voltage level by clicking the reset button.

ADVANTAGES AND APPLICATION Advantages:

• Over voltage protection.

• Under voltage protection.

• High reliability.

• High performance.

• Low cost.

Applications:

• To design the circuit which protect the electrical appliances from over and under voltage surges.

• To protect the circuit from over voltage.

• To protect the circuit from under voltage

Conclusion :

The protection circuit can be used to protect the costly electrical appliances from abnormal conditions like sag, swell, under voltage and overvoltage and avoid appliances being effected from harmful effects We can conclude from the prototype we've built that protection of load from over and under voltages have not been up to date and this prototype shows that there's a better way of protecting the loads and that it's of a great necessity because of the increasing costs of the equipment's. It's also important to note that the circuit disconnects itself when there's a slight increase or decrease in voltage from the desired level which can be used in other applications like if there's a three phase and one of the phases isn't working at the optimal level then the circuit is safe from the fluctuations and after the fault is cleared we can reset and make use of all the equipment's without having to fabricate a new equipment.

Reference :

[1] *Manish Paul, Antara Chaudhury, Snigdha Saikia (2015), "Hardware Implementation of Overvoltage and Under voltage Protection",IJIREEICE Vol. 3, Issue 6, June 2015, ISSN (Online) 2321-2004.*

[2] *Silicon institute of technology, "Power quality problem identification and protection scheme for low voltage system", Orissa, November 2010.*

[3] *G. Yaleinkaya, M. H. J. Boles and P.A. Crossley (1999), "Characterization of voltage sags in industrial distribution systems", IEEE transactions on industry applications, vol.34, no. 4, pp. 682- 688, July/August.*

[4] *C. H. Vithalani, "Over-Under Voltage Protection of Electrical Appliances", August 2003, Electronics for You.*

[5] *EPRI Project Manager R. Schainker, System Compatibility Research Project, "Effects of Temporary Overvoltage on Residential Products", 1008540 Final Report,*

March 2005

[6] *Hopkinson, R. H., "Ferroresonant Overvoltage Control Based on TNA Tests on ThreePhase Delta-Wye Transformer Banks," IEEE Transactions on Power Apparatus and Systems, vol. 86, pp. 1258–65, October 1967.*

[7] *I. N. da Silva et al., "Intelligent systems for the detection of internal faults in power transmission transformers," in Advances in Expert Systems*