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Over Voltage Protection for Household Equipments

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***Abstract*: This paper identifies the development of an over voltage protection in order to avoid damage in load side. Most of home appliances are expensive also more sensitive. This may get damaged due to the instabilities in ac mains supply. It can also lead to losses in the electrical circuit. These losses lead to low power factors and wastage of so much power. The fluctuations can cause great impact to the power quality and many precious and expensive equipment may be damaged. It is therefore advisable to have a tripping mechanism to protect the load.**
The voltage above the rated values are caused by a sudden decrease in load in a circuit having a poor or damaged voltage regulator. The over voltage may also be caused by a damage in the circuit or loose connections in neutral wire. anything above that will be considered as over voltage. Thus, we can protect the equipment from damage. By doing this, the proposed circuit is able to protect the electrical appliance.
Overvoltage events, caused by lightning strikes, power surges, or electrical faults, pose a significant threat to household electrical equipment, leading to malfunctions, reduced lifespan, or complete failure. This paper discusses various overvoltage protection techniques to safeguard home appliances, including surge protectors, voltage regulators
Keywords: Overvoltage Protection, shunt trip coil for instant tripping , DIAC for giving the triggering pulse to gate terminal of triac . (TRIAC) for AC switching, potentiometer for variation.

I. INTRODUCTION

A High Voltage Protection Project is designed to protect electrical systems and components from damage caused by high-voltage conditions. These conditions can arise from power surges, lightning strikes, system faults, or other disturbances within the power grid. The primary goal of the project is to ensure the safety, reliability, and longevity of electrical equipment by preventing failures that could result from excessive voltage. The project ensures adherence to safety standards and regulations to protect both the infrastructure and personnel . Overall, a High Voltage Protection Project plays a critical role in maintaining the efficiency, safety, and operational longevity of electrical systems. Therefore, problems caused by over voltage, need to be eliminated and are probably detected and protected with the help of this. In this paper, we have established a circuit that can trip to a voltage of more than 260 volts, and in normal voltage condition wich is 220 volts. circuit is in off condition.

II. EASE OF USE

Overvoltage protection for household equipment should be easy to use, reliable, and require minimal maintenance. Here are some user-friendly solutions:

1) Surge Protectors (Plug-and-Play) Ease of Use: Just plug them into the wall socket and connect devices.
2) Best For: TVs, computers, gaming consoles, and kitchen appliances.
3) Voltage Stabilizers Ease of Use: Plug into the power source, then connect appliances. Best For: Refrigerators, air conditioners, and washing machines.

III. METHDOLOGY

It's a RC potential devider with very negligible power loss. If the supply voltage increases above set value then the voltage across capacitor also rises.
If it accedes the 35 volts across capacitor then diac conducts and triggers the triac which subsequently energises the shunt trip coil and trip relay and protects the house hold equipment from damaging by voltage surge. RC value is selected such that if line voltage acceds 250 volts, capacitor voltage acceds 35 volts.

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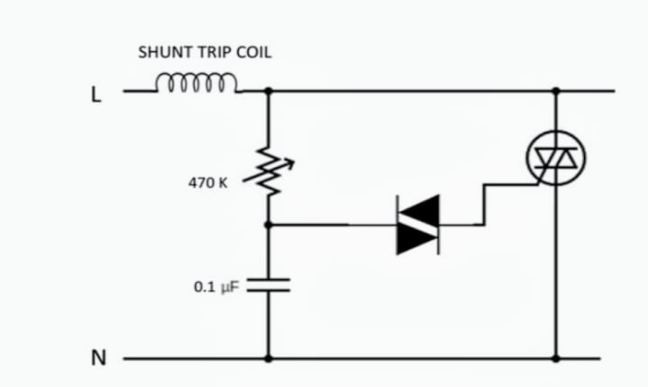


Fig. 1. Power Circuit

Working principle : When the voltage is with in the normal operating condition range, the power circuit delivers current to the load. If an over voltage condition is detected, the control to disconnect the load or the excess voltage to a protective devices.

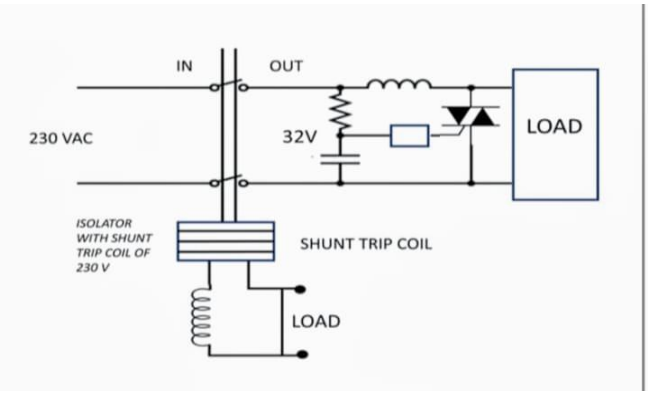


Fig. 2. control circuit

Monitors voltage levels and control the operation of protective devices.

IV. RESULT

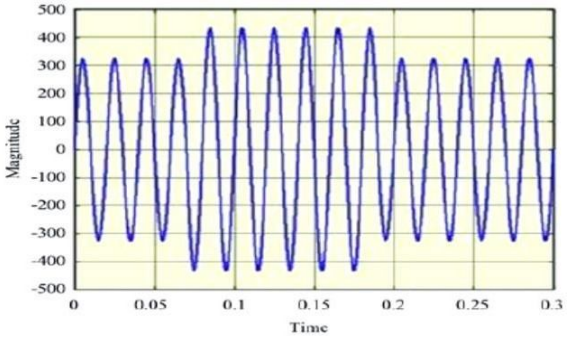


Fig. a) 1. Over voltage waveforms with is shown with magnitude and time.

Overvoltage is a common electrical phenomenoun that can have adverse effects on electronic devices, electrical systems, and overall power supply stability. These voltage fluctuations, occurring either above or below the standard voltage levels, can result in significant damage, malfunctions, and safety hazards. Therefore, implementing effective overvoltage protection mechanisms is essential to safeguarding equipment, ensuring uninterrupted operation, and preventing potential risks . Over voltage can occur due to insulation failure, overcompensation in power systems, and lightning strikes. Overvoltage causes spikes and surges in the electrical power system.

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Overvoltage can cause various problems like distortion of electrical signals, burnout of sensitive equipment, fire hazards, and permanent damage to the electrical equipment. On the other hand. Voltage fluctuation which is defined as a variation in the voltage magnitude, it may occur due to natural events like strong winds, lightning or instances where trees or animals accidentally come and contact with power lines. These fluctuations reduce life as well as efficiency of the equipment and may also lead to damage to equipments.

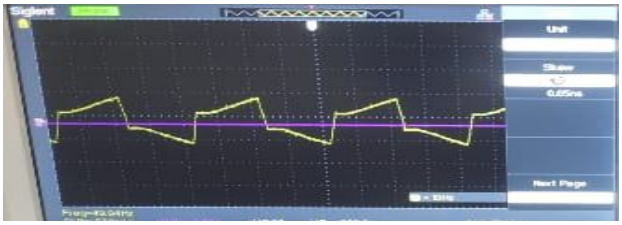


Fig. a) 2. Diac waveforms during gives the triggering pulse to triac.

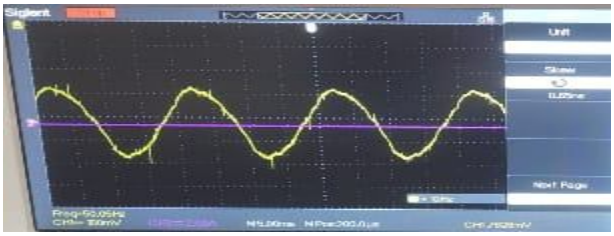


Fig. a) 3. Waveforms at normal voltage condition.

V. HARDWARE IMPLIMENTATION

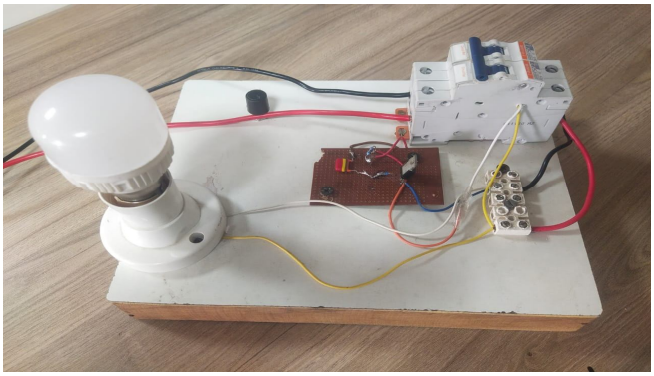


Fig. b) 1. The circuit in this setup has components assembled on a PCB board, connected via a connector, With a shunt trip coil installed.

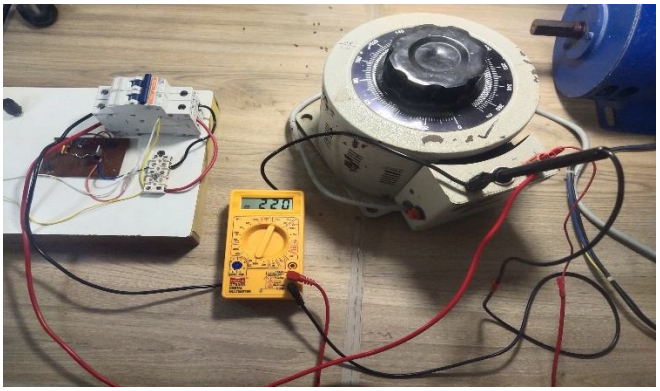


Fig.b) 2. Proposed system when there is no over voltage in AC Supply main.

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Fig .b) 3. Proposed system when there is an over voltage AC supply main.

VI. CONCLUSION

A new system for protecting residential loads from AC power over voltages has been proposed. The system has been designed, manufactured, and tested under overvoltage conditions. It demonstrated excellent performance when tested with a lamp load. Therefore, the system is considered effective for safeguarding home applications against supply overvoltage. The protection circuit can shield expensive electrical appliances from abnormal conditions such as voltage sags, swells, and over voltages, thereby preventing potential damage.

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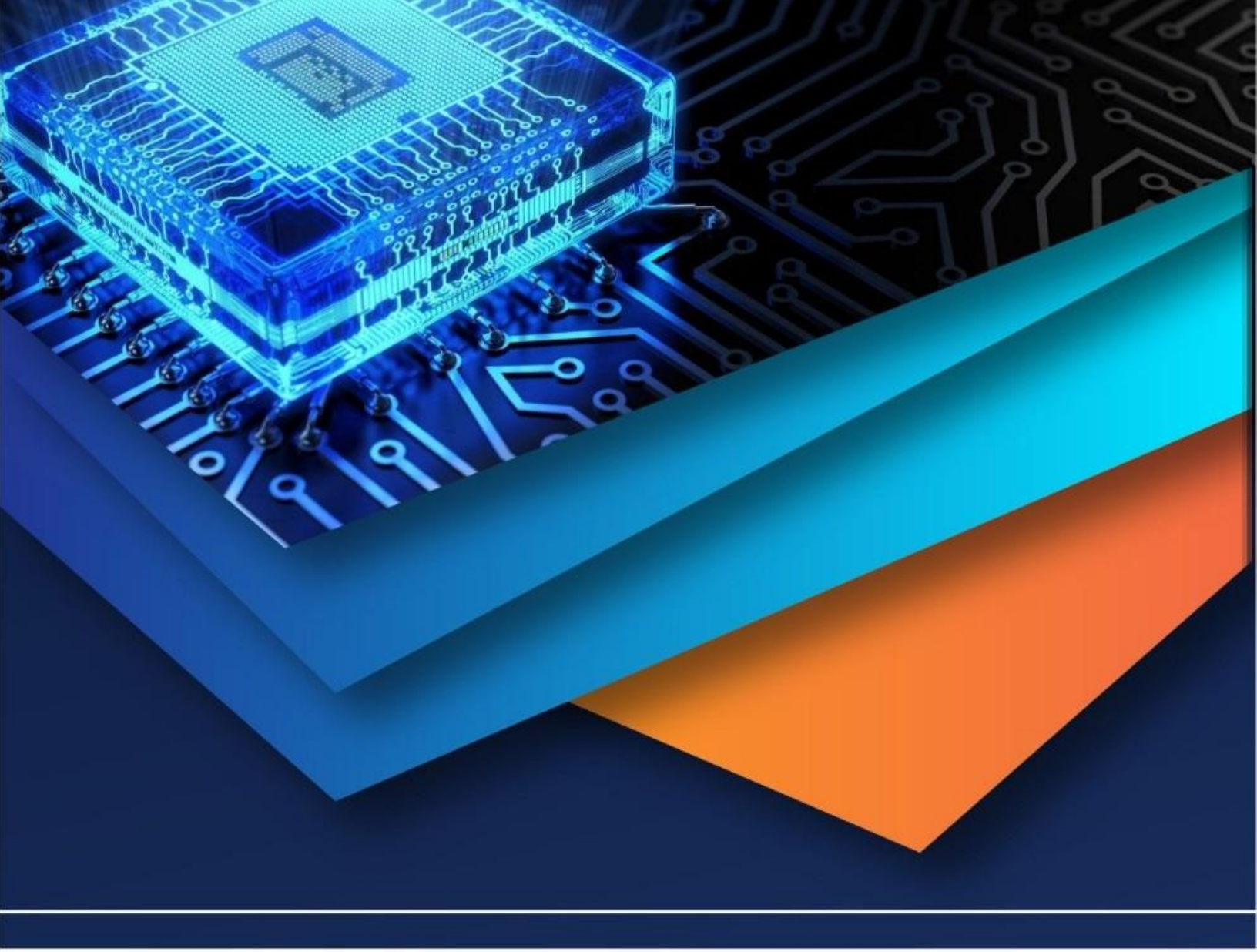
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Table

Sr No	Conditions	Voltage Ranges
1.	Normal Condition	230V
2.	Overvoltage Condition	250V-260V



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