AHASANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

" PEL Lab Project "

Course No : EEE- 4228

Course Name : Power Electronics Lab

Project Name : Surge Protector.

Date of Submission : 6/2/2018

Submitted BY :-

Group : 1

Section : C-2

Year : 4th

Semester : 2nd

Project Name:

Surge Protector.

Objective:

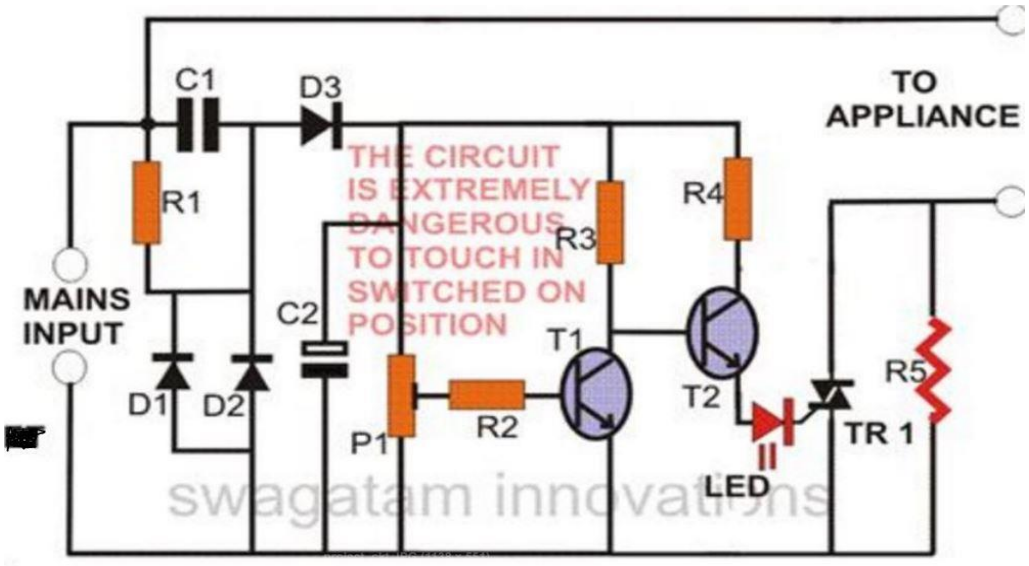
The objective of our project is to-isolate the load from supply or minimize the high voltage for uninterrupted supply in case of any type of surge.

Required Equipments:

1. 220v/12v transformer
2. Diodes
3. Transistors(BC547C)
4. TRIAC
5. Preset and Pot
6. Resistors
7. LED
8. AC and DC supplies
9. Connecting Wires.

Circuit Diagram:

Reference Circuit :



Modified Circuit :

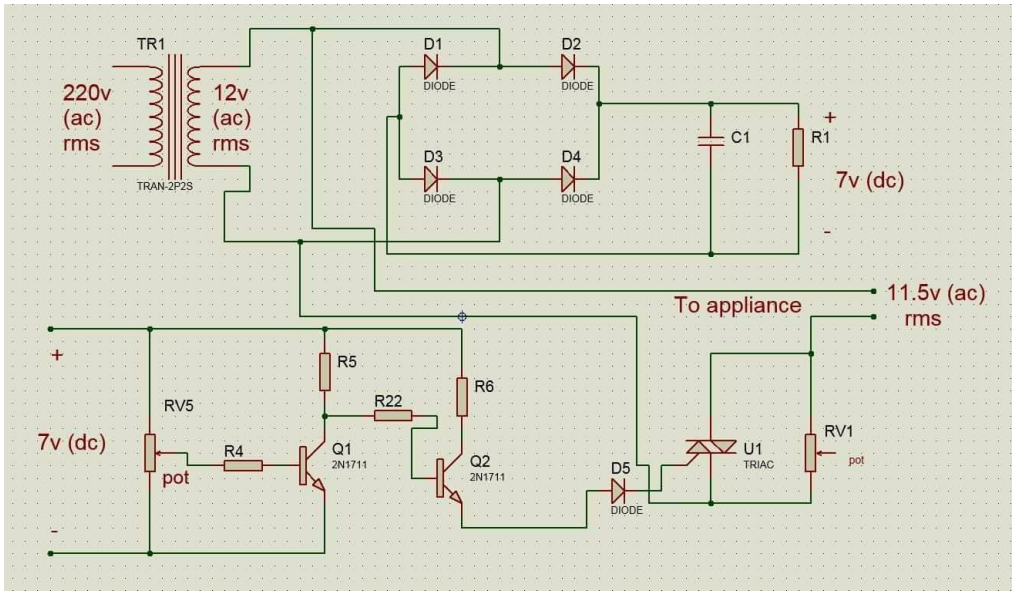


Fig : Normal Operation

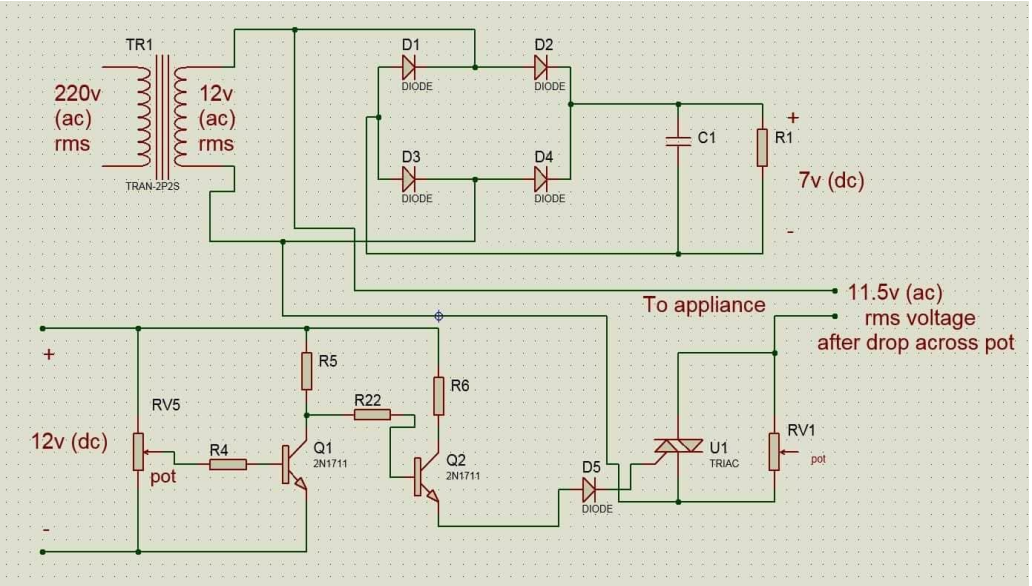


Fig : Abnormal Operation

Working Principle :-

At first we use a - step down Transformer to step down the supply voltage from 220V(rms) to 12V(rms). In normal condition-we want exactly the supplied voltage at the load. During operation, the transistors are needed to be kept on for both positive and negative half cycle. For this purpose- we need positive voltage all the time. So, we designed a single phase full wave bridge rectifier using ac supply,four diodes,a resister and a capacitor. We got the DC output voltage from this circuit as expected.

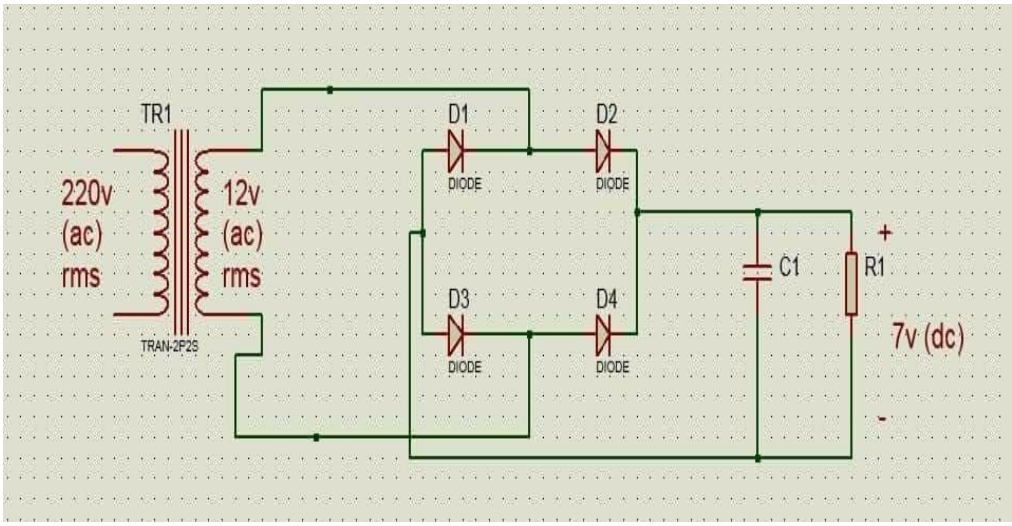


Fig : Single Phase full wave bridge rectifier

This DC voltage is applied across transistors. A Preset is used in parallel with the applied DC voltage. It's middle terminal is connected to the base of first BJT through a resistor. It's collector is connected to positive side of source through a resistor and emitter is connected to the negative side of DC supply. Second Transistor's collector is connected similarly as the first one, base is connected to the collector of first BJT through a resistor and it's emitter is connected to a TRIAC's gate through a LED. A pot is connected in parallel with the TRIAC.

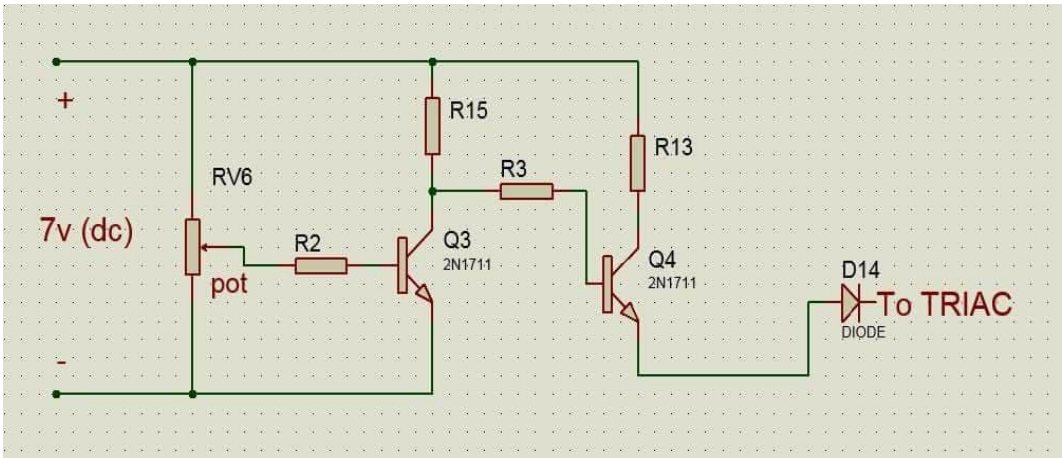


Fig : Connection of two BC547b

Threshold voltage of these two BJT's are 0.4v. We vary the preset in such a way that V_{BE} of first BJT is just below 0.4v. So, first transistor will remain off and will get voltage at it's collector. As second transistor's base is connected to first one's collector , so- it will turn on and so will the LED.

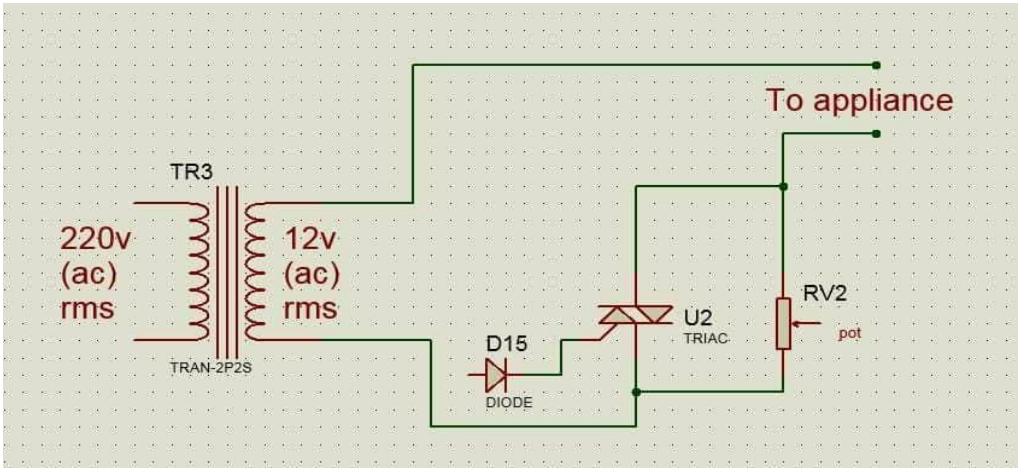


Fig : Connection of TRIAC and POT

LED is connected to the TRIAC's gate. So, TRIAC will be turned on and main circuit will be completed through TRIAC. We will get about 11.5V (rms) for 12V supply.

In Abnormal Condition, V_{BE} of BJT-1 will be greater than 0.4v. So, it will turn on. Second BJT's base will get no current as- no voltage at collector of BJT-1. So, it will be off and LED will be also off. That means no gate voltage of TRIAC and it will also remain off. So, The circuit will be completed through the POT which is short circuited by TRIAC in normal condition. By controlling POT , we can control voltage drop across it and get desired voltage to the appliance.

Full Circuit:- (At different condition)

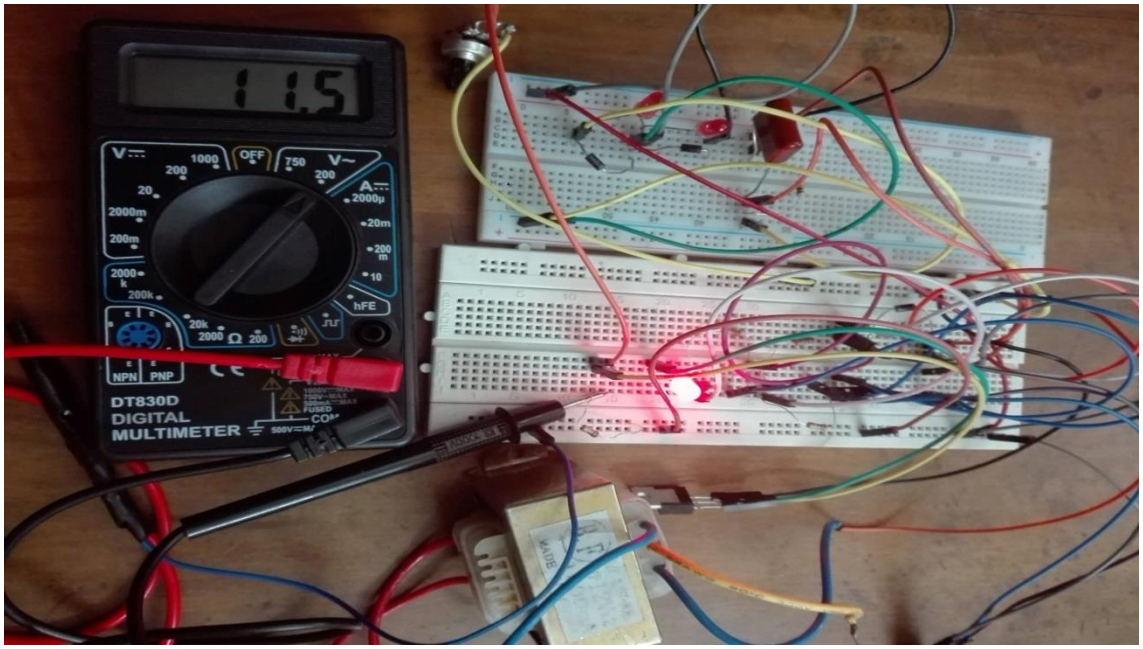


Fig : Normal Operation for 12V(rms) supply

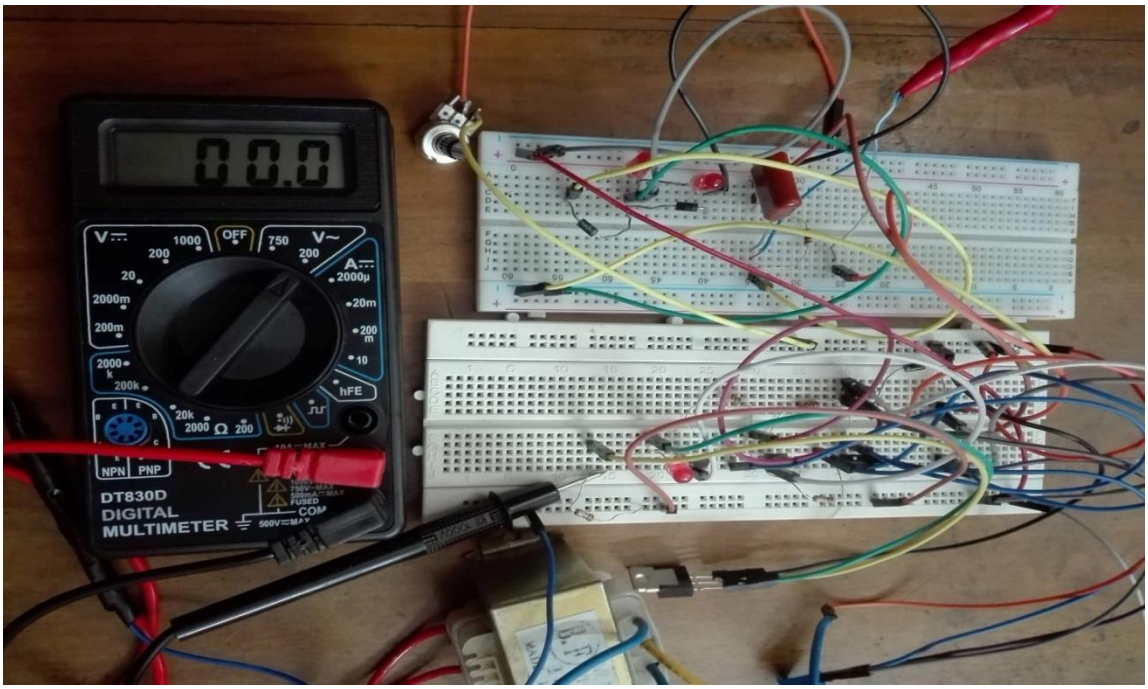


Fig : Abnormal Condition (Without POT)

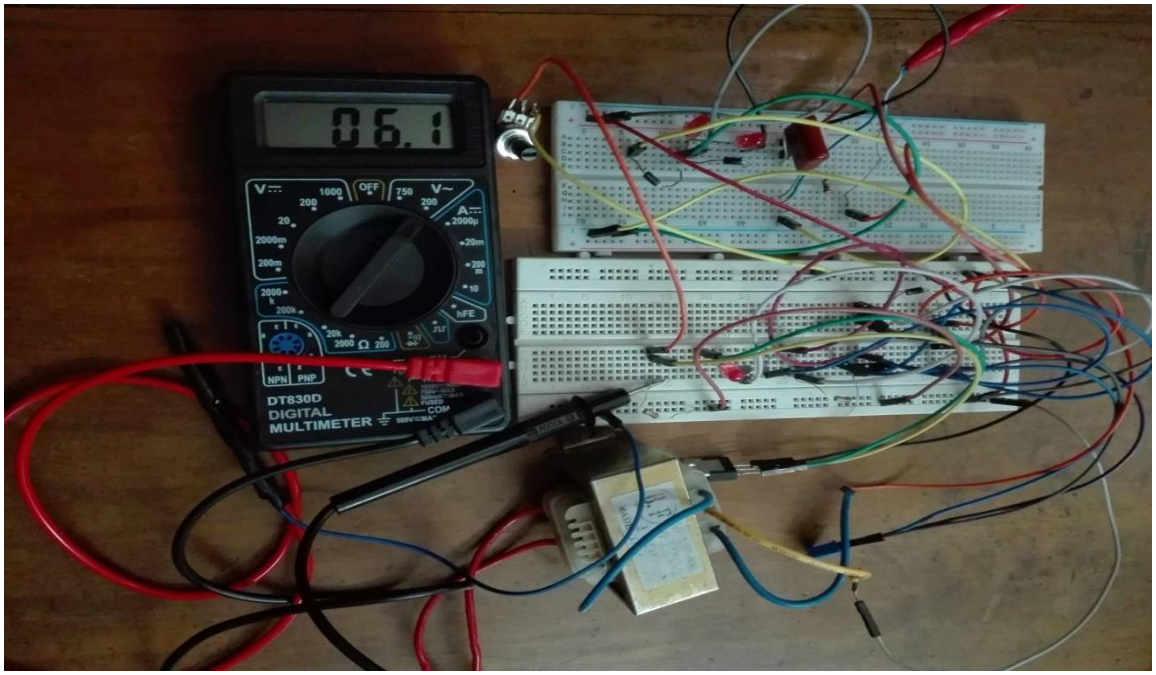


Fig : Abnormal Condition (With POT)

Limitations and Solutions :-

External control of voltage Drop by pot rather than automatic control. This could be done by IRON Core instead of POT. Which increases it's resistance proportionally with voltage Drop and allow only supplied voltage at it's output.

Discussion:

In this project,we designed a surge protector for supply r.m.s voltage about 15v.

Here,if input voltage is about 15v(r.m.s),then the circuit will be completed through TRIAC.Otherwise for any type of surge or high voltage is added with the input,then circuit will be completed through a pot and supply voltage will be available at the appliance.If we do not use pot,then circuit will be isolated.

In reference circuit,circuit is designed for about 200-300v r.m.s value and for very high voltage,the circuit there is completed through an iron core.This core changes it's resistance in such a way that only supplied voltage is available at the appliance.AC to DC conversion process for biasing transistors are also different there.

We got desired outputs from each section.It would be more practical if we could use something that changes it’s resistance itself other than being changed from outside.That’s how we completed this project.