PROJECT ON AC FAN REGULATOR/DIMMER USING 'TRIAC' AND 'DIAC' TO CONTROL THE FAN SPEED AND COMPARE WITH SIMULATION OF FAN DIMMER/REGULATOR.

AIM OF THE PROJECT :-

To study —

(a) The circuit diagram of AC Fan regulator by using Triac, Diac, variable resistor, capacitor.

(b) The control of the speed of fan-motor by varying the voltage supplied across it by controlling the FIRING ANGLE of the TRIAC.

(c) Simulation of the fan dimmer/regulator and compare it with the experimental value.

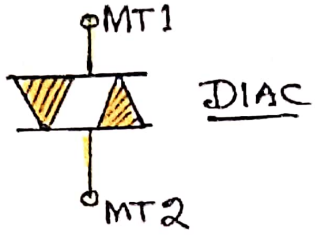
Materials required for AC Fan regulator circuit :

- Resistor $R_1 = 10k\Omega$
- Variable resistance or potentiometer $R_2 = 100k\Omega$
- Capacitor $C_1 = 0.1\mu F$ (For operating range of up to 400V)
- DIAC, $D_1 \Rightarrow$ DB3
- TRIAC, $T1 \Rightarrow$ BT136.
- A single phase ceiling fan or AC motor – 220V, 50Hz (range below 200W)
- A PCB (printed circuit board) Board.
- Connecting wires.

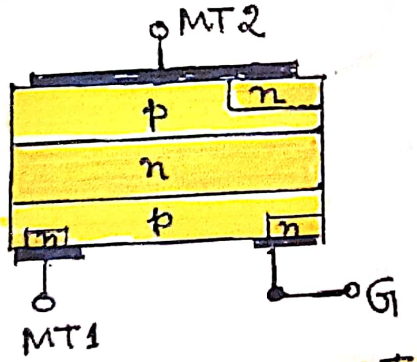
THEORY :- It is an electronic ceiling fan regulator circuit using a TRIAC and a DIAC which is used to control the speed of a ceiling fan. This circuit basically works using phase-control-principle, in which the voltage supplied to the fan motor

is varied by controlling the firing angle of the TRIAC.

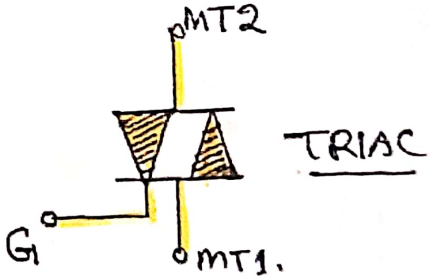
DIAC :- It stands for Diode for Alternating current. A two terminal power semiconductor device made by combining two SCRs (Silicon-controlled-Rectifier) in anti-parallel without the gate terminals and acts as a bidirectional semiconductor uncontrolled switch.



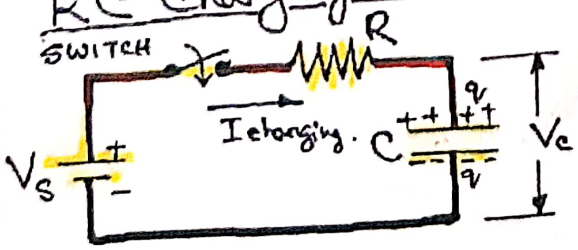
TRIAC : It is a three terminal AC switch which can conduct in both the directions that is whether the applied gate signal is +Ve or -Ve, it will conduct. This is a three terminal, four layer, bi-directional semiconductor device that controls AC Power.

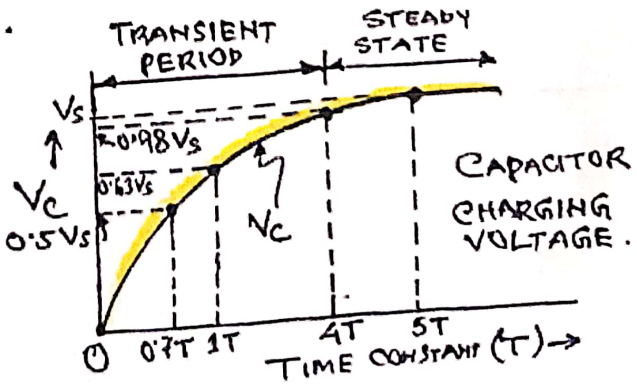


Basic Structure of TRIAC.



RC charging circuit :-





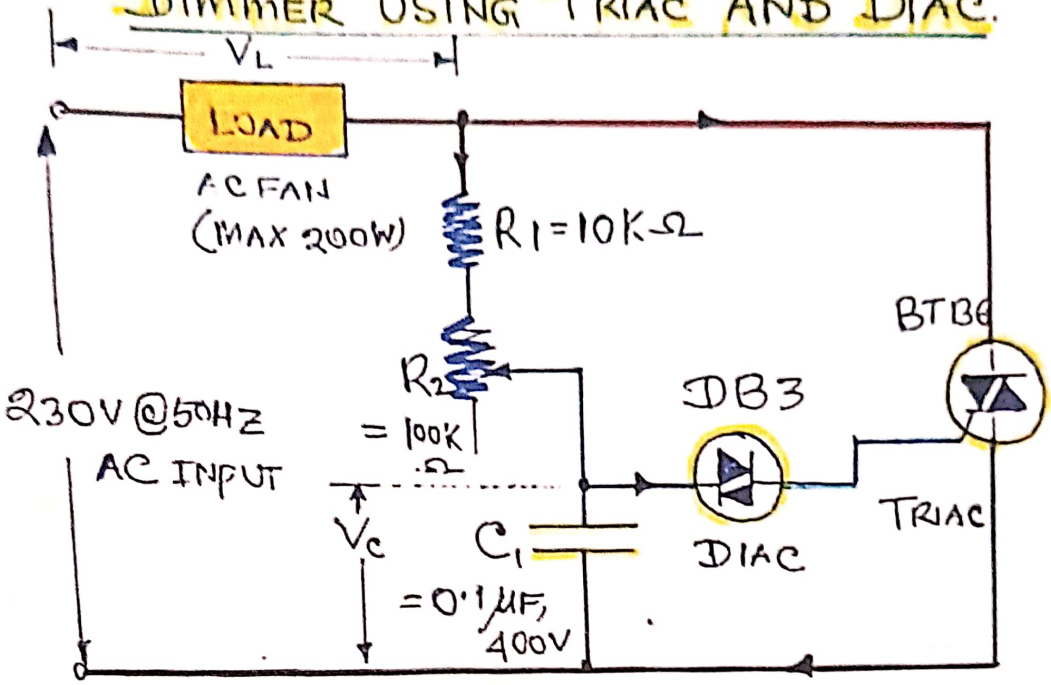
Formulae :-

Time constant, $\tau = R \times C$

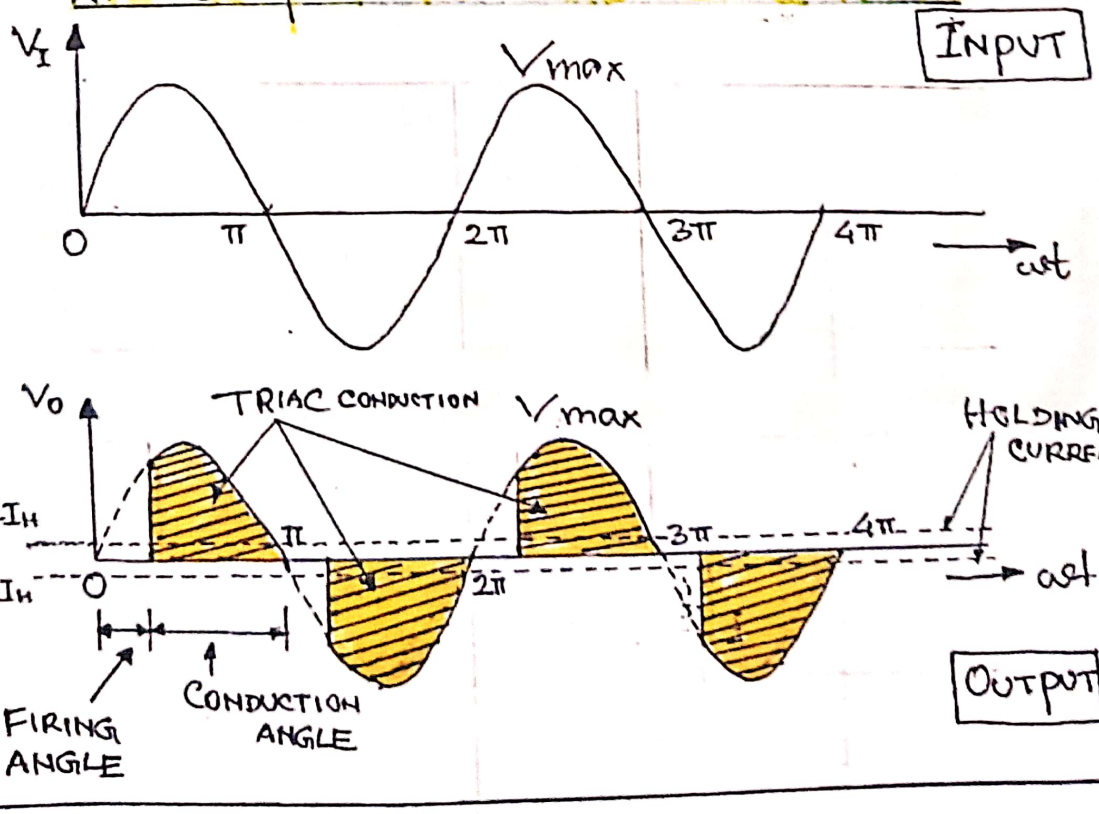
$\therefore$ Voltage across the capacitor, $V_c = V_s\left(1 - e^{-\frac{t}{\tau}}\right)$

V_s = Supply voltage ; V_c = Capacitor voltage, t = elapsed time.

CIRCUIT DIAGRAM OF AC FAN REGULATOR/ DIMMER USING TRIAC AND DIAC.



GRAPHICAL REPRESENTATION OF INPUT AND OUTPUT VOLTAGE USING TRIAC



WORKING PROCEDURE OF THE ELECTRONIC VOLTAGE REGULATOR CIRCUIT

- Before giving the power supply to this fan regulation circuit, keep the variable resistor or potentiometer in maximum resistance position so that no triggering is applied to TRIAC and hence the TRIAC will be in cut-off mode.
- Turn-on the power supply of the circuit and observe whether the fan is in standstill condition or not. Vary the potentiometer position slowly so that the capacitor starts charging at the time constants determined by the values of R_1 and R_2.
- Once the voltage across the capacitor is more than the breakover voltage of the DIAC, it starts conducting. Thus, the capacitor starts discharging towards the gate terminal of TRIAC through DIAC.
- Therefore, TRIAC starts conducting and hence the main current starts flowing into the fan through the closed path formed by TRIAC.
- By varying the potentiometer R_2, the rate at which capacitor is going to be charged get varied. This means that if the resistance is less, the capacitor will charge at a faster rate & earlier will be the conduction of TRIAC.
- As the potentiometer resistance gradually increases, the conduction angle of TRIAC will be reduced. Hence the average power across the load ie fan will be varied.
- Due to the bi-directional control capability of

both TRIAC and DIAC, it is possible to control the firing angle of the TRIAC in both +ve and -ve peaks of the input.

ADVANTAGES :-

- Power saving is achieved at all the speeds by minimizing the energy Losses.
- Continuous and step-less control of the fan speed is possible.
- Efficient as compared to resistive type due to lower power consumption.
- Cost-effective.

OBSERVATIONS :-

POTENTIOMETER POSITION	INPUT AC VOLTAGE (VOLT)	VOLTAGE ACROSS CAPACITOR (V_c) (VOLT)	VOLTAG ACROSS LOAD/ FAN (V_L) (VOLT)
1	230	18	78
2	230	18	110
3	230	18	143
4	230	17	183
5	229	15	214
6.	230	4	229

Calculation :-

Time constant, $\tau = R \times C$

$\therefore \tau = 110 \times 10^3 \times 0.1 \times 10^{-6}$ sec

$\doteq 0.011$ sec.

where,

$R = R_1 + R_2$

$= 10k\Omega + 100k\Omega$

$= 110K\Omega.$

$= 110 \times 10^3 \Omega$

C = Capacitance

$= 0.1 \mu F$

$= 0.1 \times 10^{-6} F$

CONCLUSION :- Fo<u>r</u>om the above experiment we verify that the theoritical values we determined are nearby equal to the values obtained from the simulator.

-SUBMITTED By

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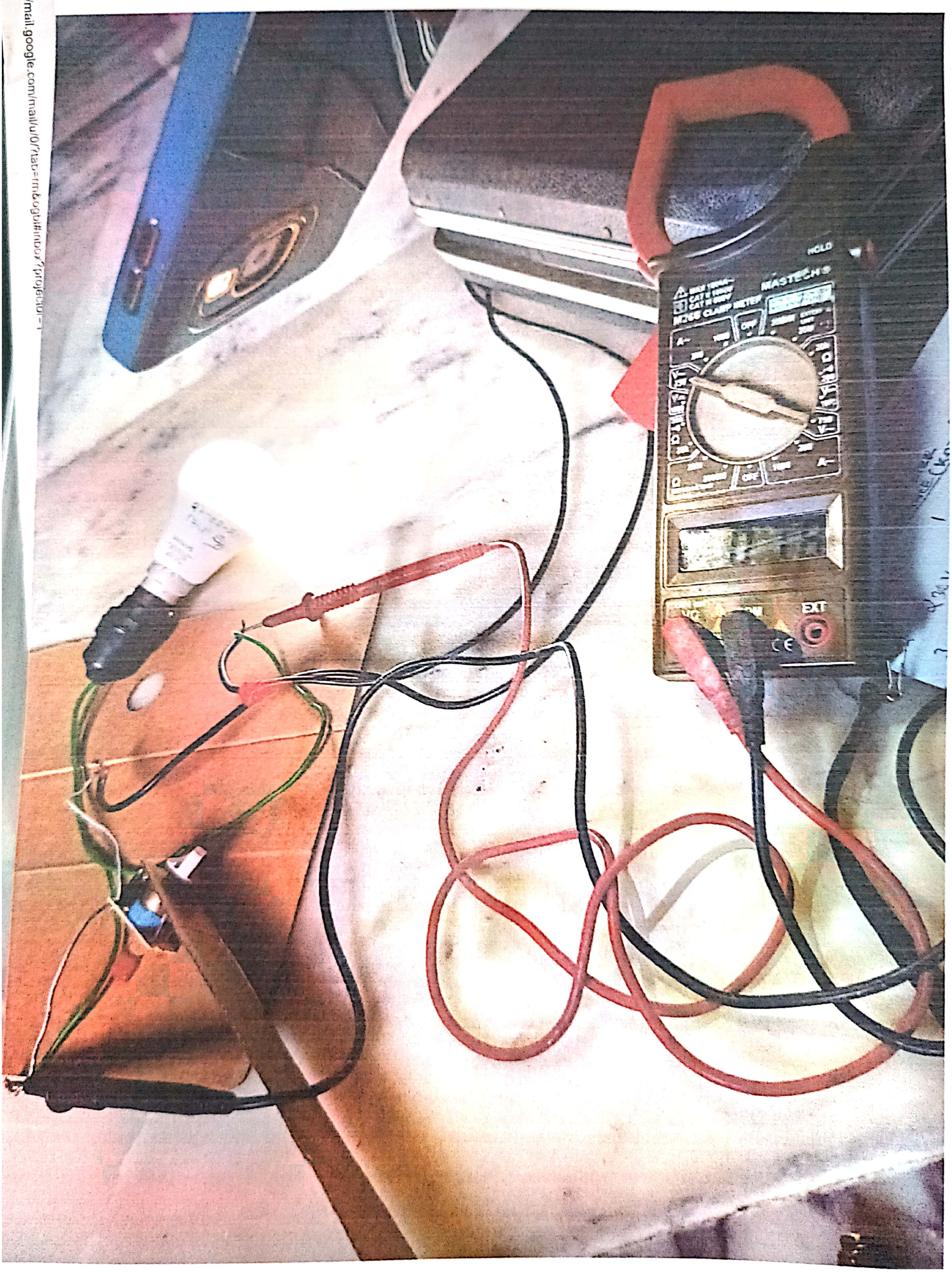

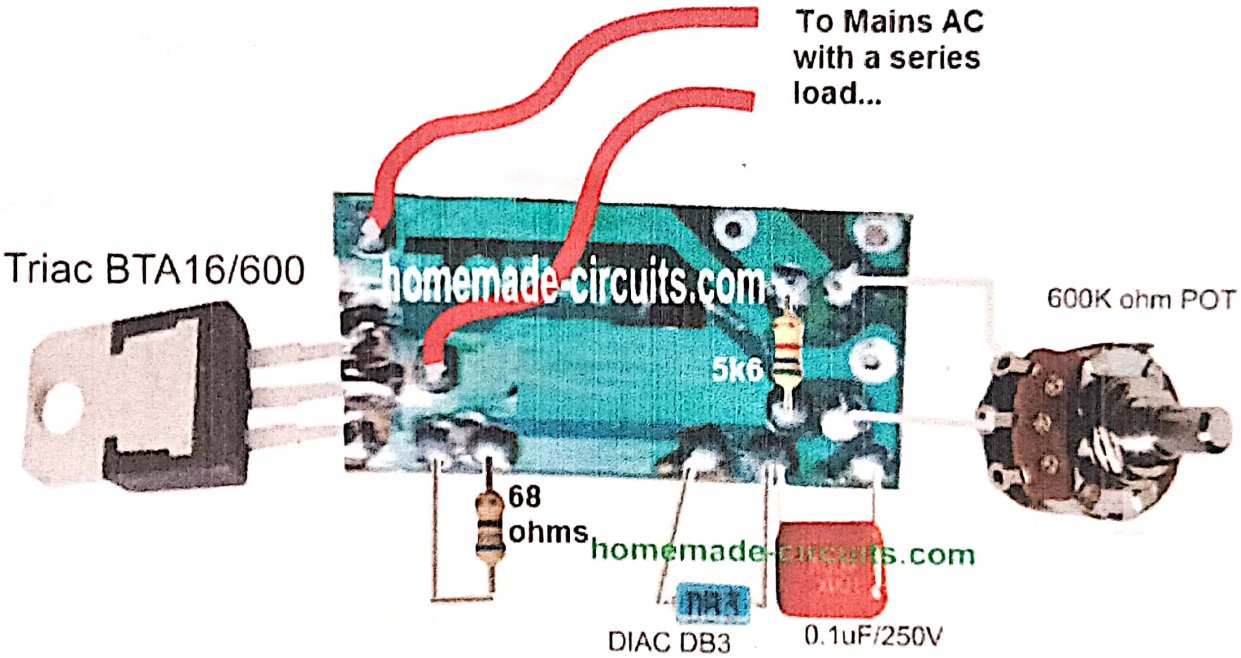

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