Project Report

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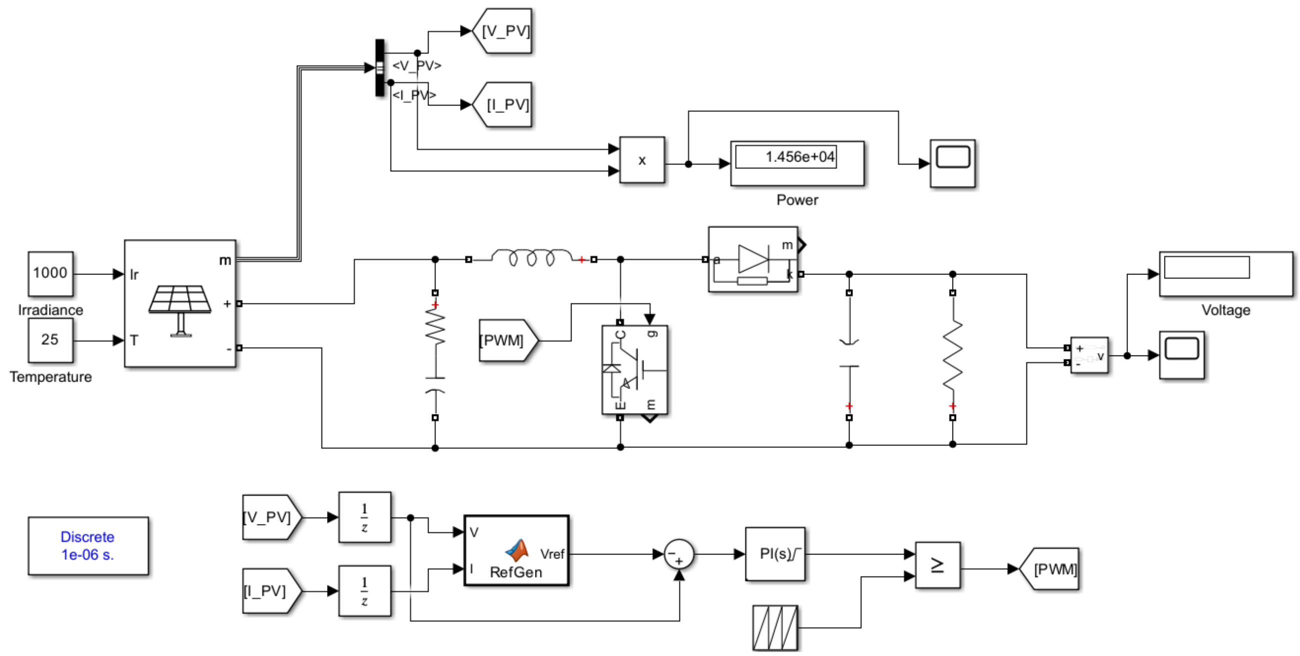
Objective - To Validate the maximum power transfer theorem by implementing a DC/DC boost converter with MPPT and varying load conditions.

Simulink Model -



The MPPT theorem maximizes power production from variable power sources like solar panels. Even with changing sun radiation and temperature MPPT optimizes power transfer by adjusting the source's operating point to match the load impedance.
We will vary the load resistance at the same moment keeping the solar panel and internal resistance constant so that we can observe the Power fluctuations.

MPPT Algorithm implemented in code form -:

Task2 ▸ MATLAB Function

```matlab
function Vref = RefGen(V,I)

Vrefmax = 363;
Vrefmin = 0;
Vrefinit = 300;
deltaVref = 1;
persistent Vold Pold Vrefold;

dataType = 'double';

if isempty(Vold)
    Vold = 0;
    Pold = 0;
    Vrefold = Vrefinit;
end

P = V*I;
dV = V-Vold;
dP = P-Pold;

if dP ~= 0
    if dP<0
        if dV<0
            Vref = Vrefold + deltaVref;
        else
            Vref = Vrefold - deltaVref;
        end
    else
        if dV<0
            Vref = Vrefold - deltaVref;
        else
            Vref = Vrefold + deltaVref;
        end
    end

else Vref = Vrefold;
end

if Vref >= Vrefmax | Vref<=Vrefmin
    Vref = Vrefold;
end

Vrefold = Vref;
Vold = V;
Pold = P;
```

For R = 0.1 Ω the Solar power is 14560 W and Voltage is 37.52, so I = P/V = 388.05 A

For R = 0.2 Ω the Solar power is 28360 W and Voltage is 74.79, so I = P/V = 379.19 A

For R = 0.4 Ω the Solar power is 55080 W and Voltage is 147.9, so I = P/V = 372.41 A

For R = 0.8 Ω the Solar power is 101600 W and Voltage is 284.6, so I = P/V = 357 A

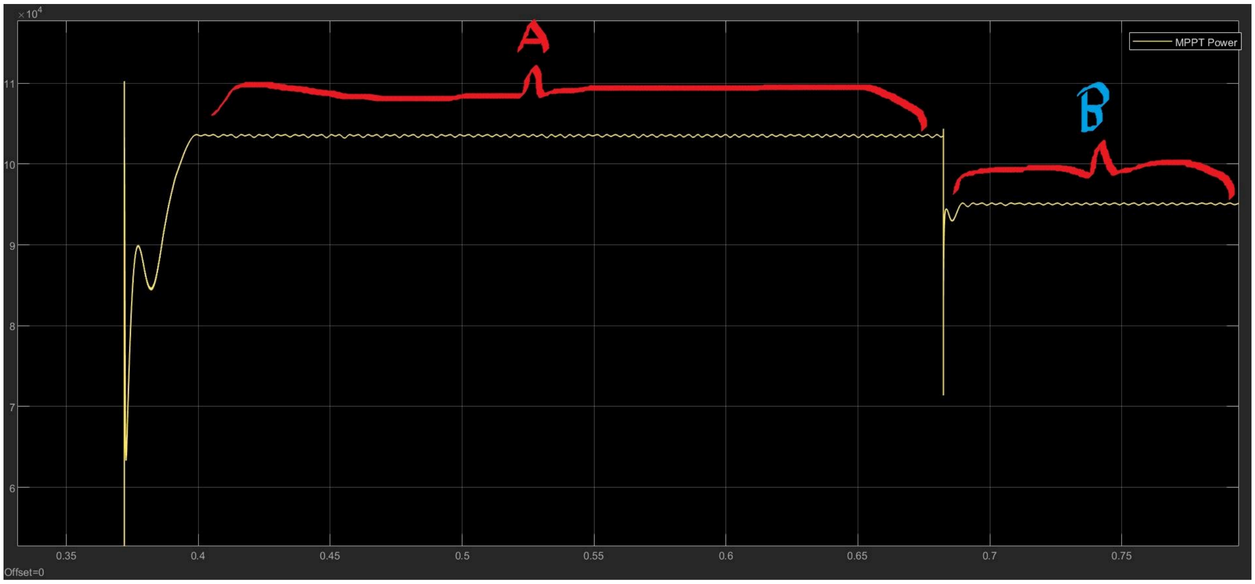
For R = 1.6 Ω the Solar power is 103500 W and Voltage is 407.3, so I = P/V = 254.11 A

For R = 3.2 Ω the Solar power is 67600 W and Voltage is 415.7, so I = P/V = 162.6 A

<u>Observations</u> -

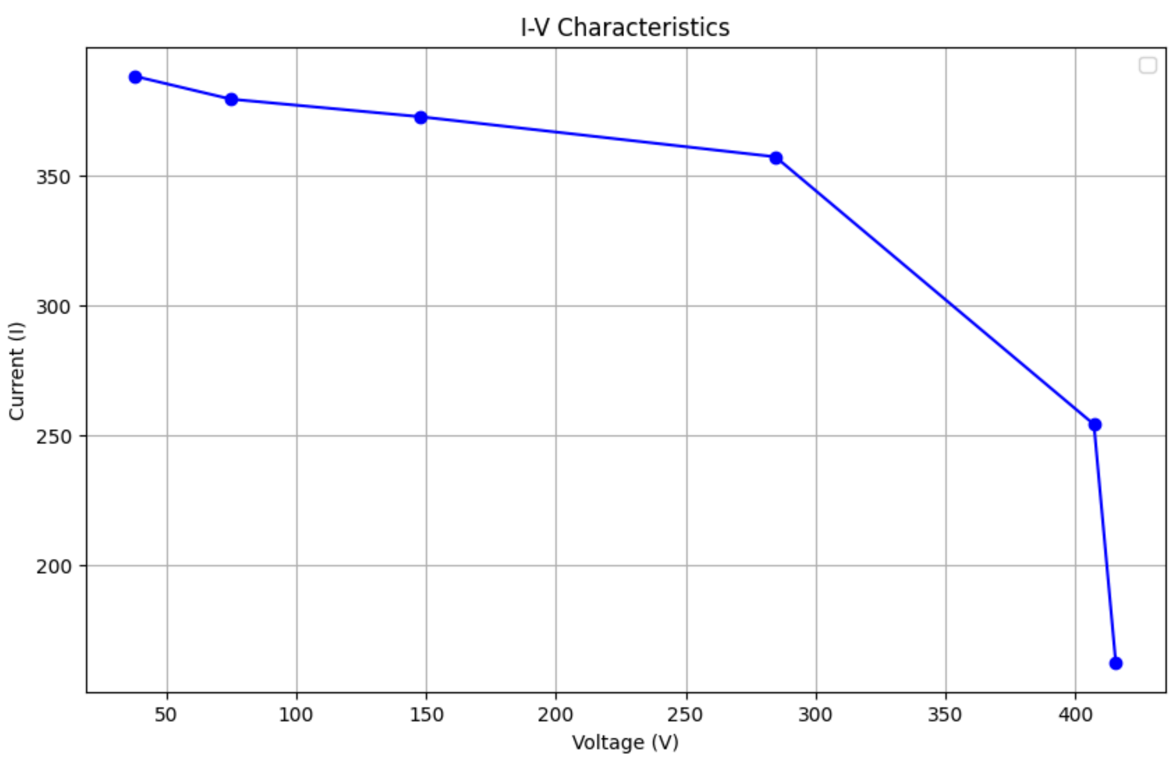
Resistance (Ω)	Voltage (V)	Current (A)	Power (W)
0.1	37.62	388.05	14560
0.2	74.79	379.19	28360
0.4	147.9	372.41	55080
0.8	284.6	357	101600
1.6	407.3	254.11	103500
3.2	415.7	162.6	67600

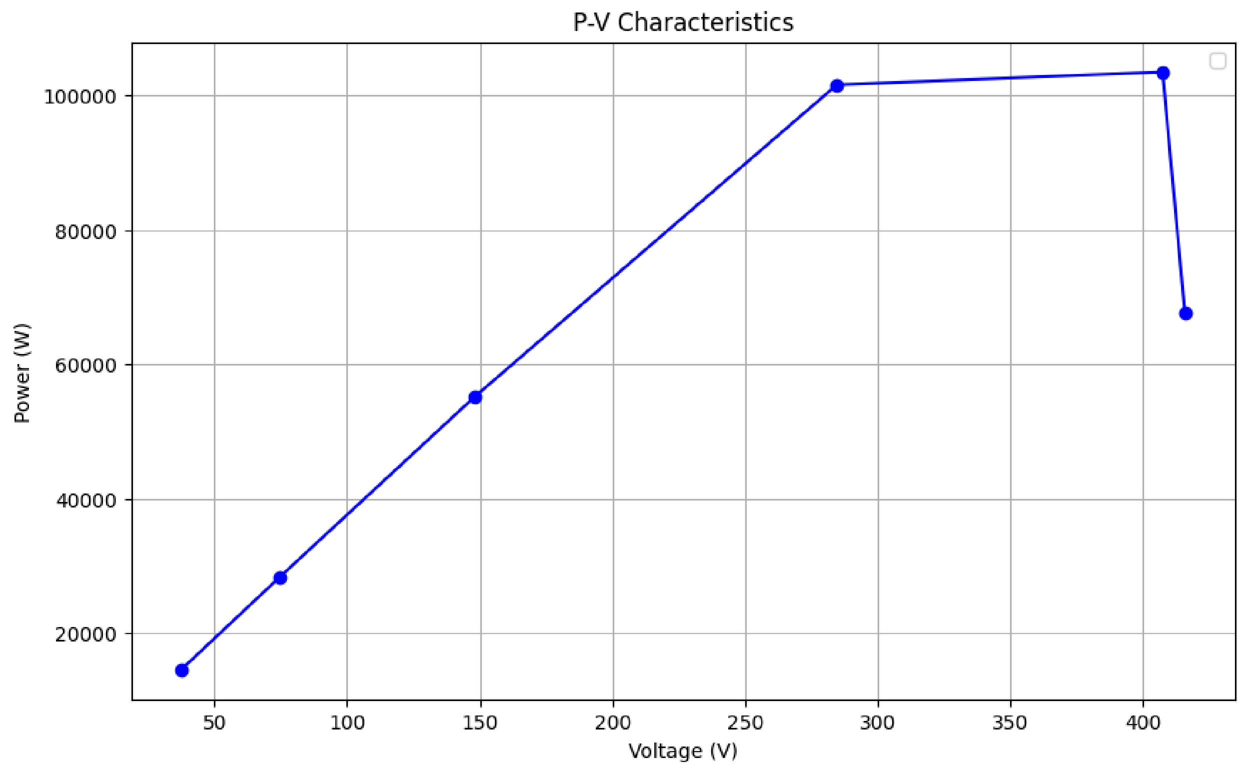
Results -



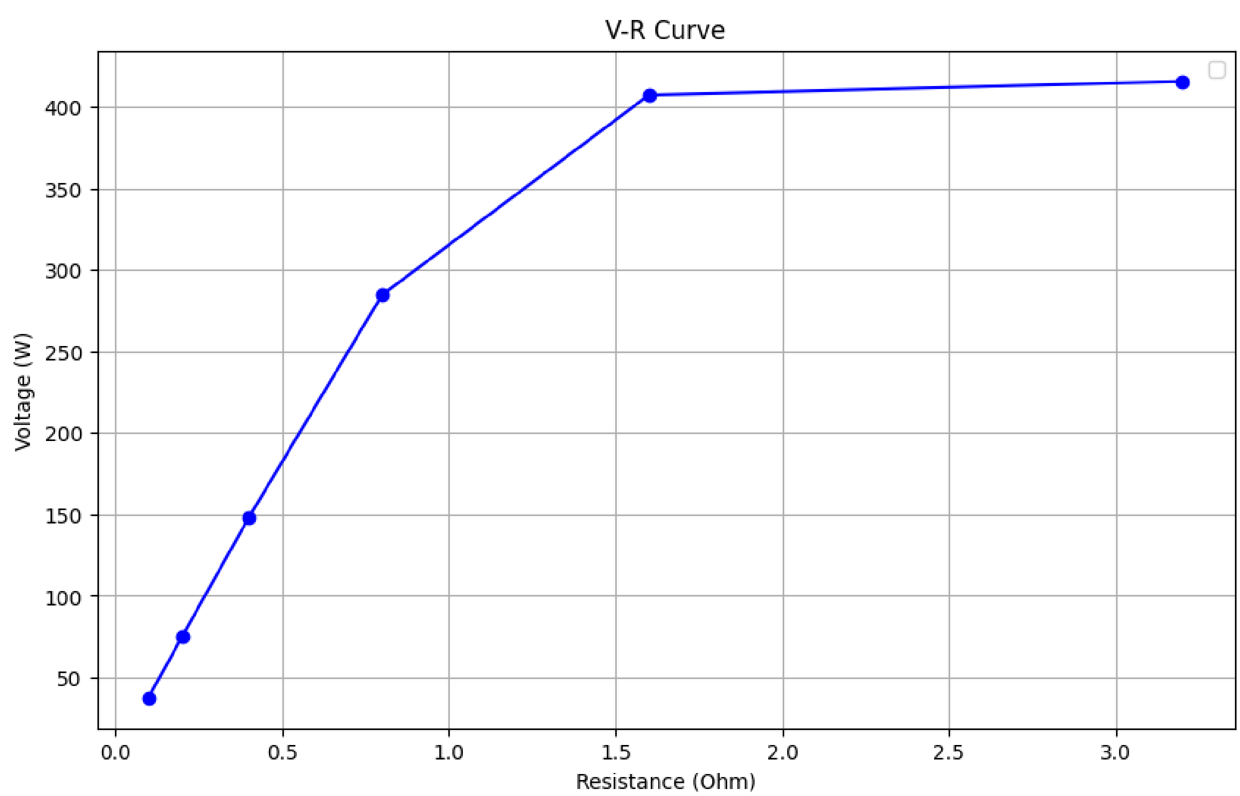
From the above plot we can observe that our implemented MPPT works well, as in starting the irradiance was 1000 W/m^2 and temperature was 25^0 celsius it reached the maximum power (region A) but when the irradiance was changed to 900 we can see the power also changes (region B) and our implemented MPPT tries to reach the maximum power level at that irradiance.

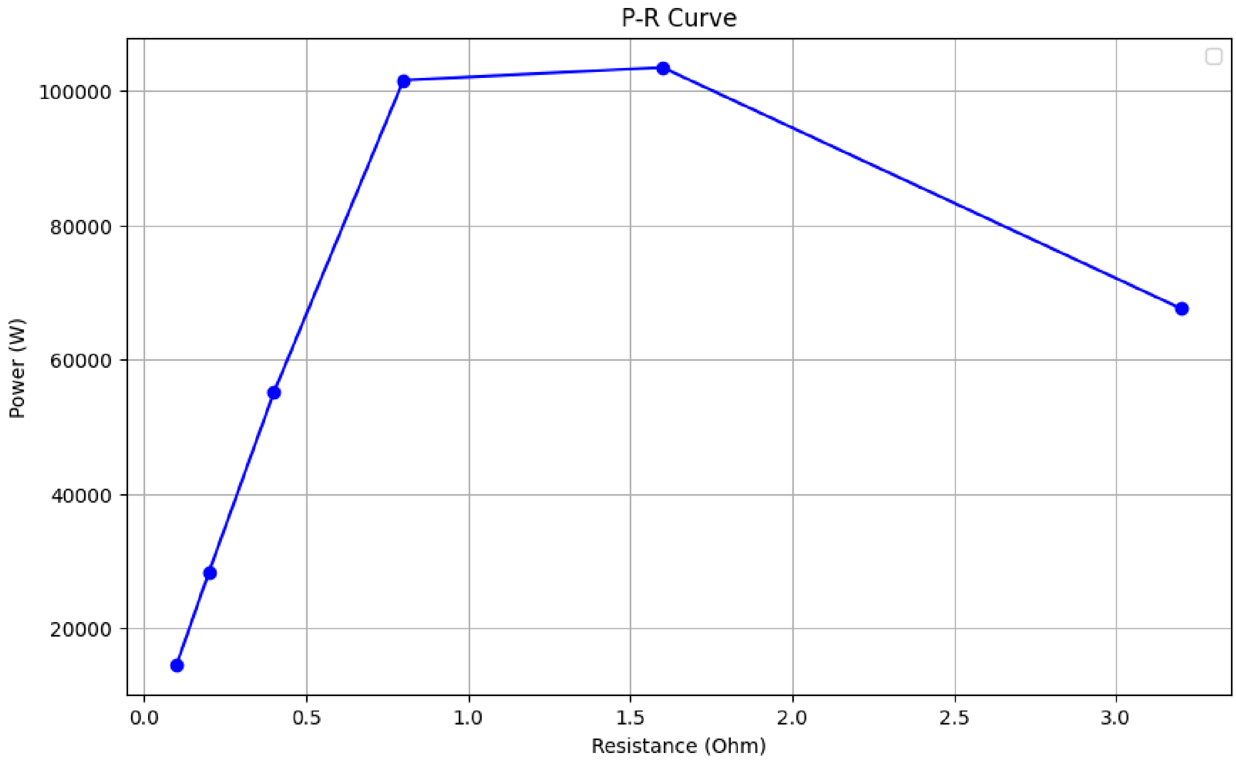
Below are the I-V and P-V characteristics for various loads -:





Below are the V-R and P-R curves -:




P-R Curve
Power (W)
100000
80000
60000
40000
20000
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Resistance (Ohm)