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Implementation of Digital Pic on Troller for Dc To Dc Boost Converter Connected To Ev

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ABSTRACT:The recent upsurgein the demandofPVsystemsisduetothefactthattheyproduce electric power without hampering theenvironmentbydirectlyconvertingthesolarradiation into electric power. However the solarradiationnever remains constant. Itkeeps onvaryingthroughouttheday.Theneedofthehour is to deliver a constant voltage to the gridirrespectiveofthevariationintemperatures andsolarinsolation.Wehavedesignedacircuit such that it delivers constant andstepped updc voltage to the load. We have studied theopenloopcharacteristicsofthePVarraywith variation in temperature and irradiationlevels. Then wecoupled the PV array withthe boostconverter in such a way that withvariation in load, the varying input currentandvoltagetotheconverterfollowstheopencircuitcharacteristicofthePVarrayclosely.Atvariousinsolationlevels,theloadis varied and the corresponding variation in theinputvoltageandcurrenttotheboostconverterisnoted.Itisnotedthatthechanging inputvoltageandcurrentfollowstheopencircuitcharacteristicsofthePVarrayclosely.

I. INTRODUCTION:

In the last few decades, there has beentremendousincreaseintheuseofswitchmodpowersupplies(SMPS)duetotheirsuitabilityintheapplicationsofrenewableenergy,automobileetc. Thebasicpower electronicDC-DCconverterarebuck,boostandbuck-boost.DC-DCboosconverter finds enormous applications inindustries,fewofthemareinhybridelectrical vehicle, thermoelectric generator powerconditioningsystems,poweramplifiers,adaptive controlapplications.Ineachofthesecases,theinputside voltageortheloadsidemayundergosuddenvariations. Forahybridelectricvehiclethebatteryvoltagemaychangeattheinput,oriapplicationsuchasinpowerconditioningsystemtheboostconvertermaybeconnectedinseries withtherectifiercircuitwhichmayhavevariationintheinputvoltage,i.e.thesecondharmonicsathesourcevoltage.

Similarly in case of thermos electric generator also theinputvoltageisafunctionofheatenergycomingfromthethermalsystem.Henceboostype DC-DCconverter seems to havenumerous applications,butinmostoftheindustrial applications, these power electronic convertersaresubjectedtoexternaldisturbancessuchaslinevoltageandloadvariationswhileatthesametimeneedstoachievedesiredconstantvoltage at the output. Thus there is a need toapplypropercontrolstrategieswhichwillregulatethe outputvoltageofboostconverter.

To attain this objective in these switching powerconverters,asuitablecontrollerisrequiredandin conventional approaches, linear PID controllerhas been used in many applications. Using thesmall-signalmodelsoftheDC-DCconverters,derivedfromstatespacemodel.linearPIDcontrollersareingeneraldesignedthroughclassical frequency response techniques such asbodeplots,inwhichthedesiredloopgain,crossover frequency, and phasemargin canbeadjusted to guarantee the stability of the overallsystem.

OBJECTIVE

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Project:

- ModellinganddesignaspectsofDCtoDCBoostConverterforEVapplication.
- Todevelopandanalyzethe closedloopPIcontroltechniqueusingMATLAB.
- ToimplementthedigitalPIControllerandassesthe results.

Thisprojectisbeneficialtopowermonitoringanddisplayeddataonserverstoidentifyhowmanpower is used.Inthis circuit, in the night the lampwillbeautomaticallyONbyusingLDRCircuit,N needtooperates lampmanually.
Voltage and current can be easily measured with thehelpofcurrentandvoltagesensor,noneedvoltmeter tomeasurethesesquantitiesandalsopowercanbemeasured.

NeedsofDigitalPI Controller:

- It need to use at least one DC/DC converter to interfaceBattery andDCappliance.
- InirregularvoltagedirectionDC/DCconvertercanbedesignedtotransferpowerinonedirectionfrominput tooutput.
- DC/DCconverterisanelectriccircuitthatconverts sourceofDCfromonevoltageleveltoanother,anreleasingatrequiredvoltage.

MOTIVATION:

The Conventional sources of energy arerapidly depleting. Moreover the cost of energy isrising and therefore photovoltaic system is apromising alternative. They are abundant,pollution free, distributed throughout the earthand recyclable. The hindrance factor is it'shighinstallation costandlowconversionefficiency.
Therefore our aim is to increase the efficiency andpower output of the system. It is also required thatconstant voltage be supplied to the loadirrespective ofthevariationinsolarirradianceandtemperature. PV arrays consist of parallel andseries combination of PV cells that are used togenerate electrical power depending upon theatmospheric conditions (e.g solar irradiation andtemperature). So it is necessary to couple the PVarray with a boost converter. Moreover oursystem is designed in such a way that withvariation in load, the change in input voltage andpower fed into the converter follows the opencircuit characteristics of the PV array. Our systemcan be used to supply constant stepped upvoltagetodcloads

II. PROPOSED SYSTEM:

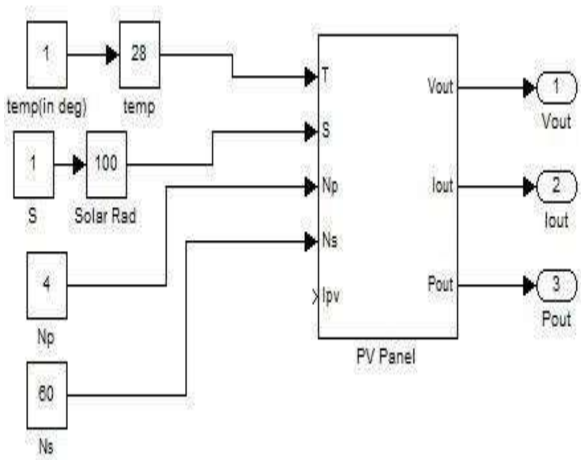

Fig.1blockdiagramofPV Panel

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III. SYSTEM PERFORMANCE

MATERIALSUSEDINPVCELL:
ThematerialsusedinPVcellsare asfollows:

- **Single-crystalsilicon**

Single-crystalsiliconcellsarethemostcommoninthePVindustry.Themaintechniqueforproducingsingle-crystalsiliconistheCzochralsk(CZ) method. High-puritypolycrystalline imeltedinaquartzcrucible.Asingle-crystalsiliconseedisdippedintothismoltenmassopolycrystalline.Astheseedispulledslowlyfromthemelt,asingle-crystalingotisformed.Theingotsarethensawedintothinwafersabout200-400micrometersthick(1micrometer1/1,000,000meter).Thethinwafersarethepolished,doped,coated,interconnectedandassembledintomodulesandarrays.

- **Polycrystallinesilicon**

Consistingofsmallgrainsofsingle-crystalsiliconpolycrystallinePVcellsarelessenergyefficiency. than single-crystalline silicon PV cells. The grainboundaries in polycrystalline silicon hinder theflow of electrons and reduce the power outputofthecell.AcommonapproachtoproducepolycrystallinesiliconPVcellsistoslicethinwafers from blocks of cast polycrystallinesilicon.Anothermoreadvancedapproachisthe"ribbongrowth"methodinwhichsiliconisgrowndirectly asthinribbons orsheets withtheapproachthicknessformakingPVcells.

- **GalliumArsenide(GaAs)**

Acompoundsemiconductormadeoftwoelements: Gallium (Ga) and Arsenic (As). GaAshas a crystal structure similar to that of silicon.An advantage of GaAs is that it has high level oflight absorptivity. To absorb the same amountof sunlight, GaAs requires only a layer of fewmicrometersthickwhilecrystallinesiliconrequires a wafer of about200-300micrometersthick.Also,GaAshasmuchhigherenergyconversionefficiencythancrystalsilicon,reaching about 25 to30%.TheonlydrawbackofGaAsPVcellsisthehighcostofsinglecrystalsubstratethatGaAsisgrownon.

- **CadmiumTelluride(CdTe)**

It is a polycrystalline compound made ofcadmium and telluride with a high light absorbility capacity (i.e.asmallthinlayerofthecompoundcanabsorb90%ofsolairradiation).The main disadvantage of thisbyextraprecaution.

- **CopperIndiumDiselenide($CuInSe_2$)**

Itisapolycrystallinecompoundsemiconductormade of copper, indium and selenium. It delivershighenergyconversionefficiencywithoutsufferingfromoutdoordegradationproblem.Itis CompoundisthattheinstabilityofPVcellormodule performance. As it a toxic substance, themanufacturingprocessshouldbedone Oneofthemostlight-absorbentsemiconductors. As it is a complex materialandtoxicinnaturesothe manufacturingprocessfacesomeproblem.

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DESIGNOFTHEBOOSTCONVERTER:

(1) CURRENTRIPPLEFACTOR(CRF):

AccordingtoIECharmonicsstandard,CRPshouldbeboundedwithin30%.

i.e. $\frac{\Delta 1}{1}$ =30% (4.5)

(2) VOLTAGERIPPLEFACTOR(VRF):

i.e. $\frac{\Delta 0}{0}$ =5% (4.6)

(3) SWITCHINGFREQUENCY(f_s):

F_s=100KHz (4.7)

GIVENDATA:

- Inputvoltage,V_g=25V
- Outputvoltage,V_O=300V
- Outputloadcurrent,I_O=1A

Step1:CalculationofDutycycle(D):

$$\frac{0}{} = \frac{1}{1-}$$

$$\square \frac{1}{1-} = \frac{300}{25}$$

D=11/12=.9166 (4.8)

Step2:CalculationofRippleCurrent(Δ):

I_L=1A

Δ=(0.3*1)A=0.3A (4.9)

Step3:CalculationofInductorvalue(L):

$$L=\left(\frac{V_g * D}{f*\Delta}\right)=(25*.9166)/(0.3*10^5)=7.63*10^{-4}H. \quad (4.10)$$

Step4:Calculationofcapacitorvalue(C):

Wehave, $\frac{\Delta 0}{0}=T\frac{}{0}$ (4.11)

$R_0=\frac{0}{0}$=300/1=300. (4.12)

$C=D/f*R_0*(\Delta V_0/V)=(.9166)/(10^5)*(300)*(.05)=.611\mu F.$ (4.13)

Thetransferfunctionoftheboostconverterusedforthemodelingis givenby:

G(s)= 1− * (1−)2* C2 (1−) 2 + (1−)2 +1 (4.14)

PuttingthevaluesofR,L,C,D,$V_g$intheaboveequation,thetransferequationthatresultsisgivenby:

G(s)= 25*(300−(100.716*10^−3))((.139*10^−6)*S^2)+0.763*(10^−3)*S+2.08 (4.15)

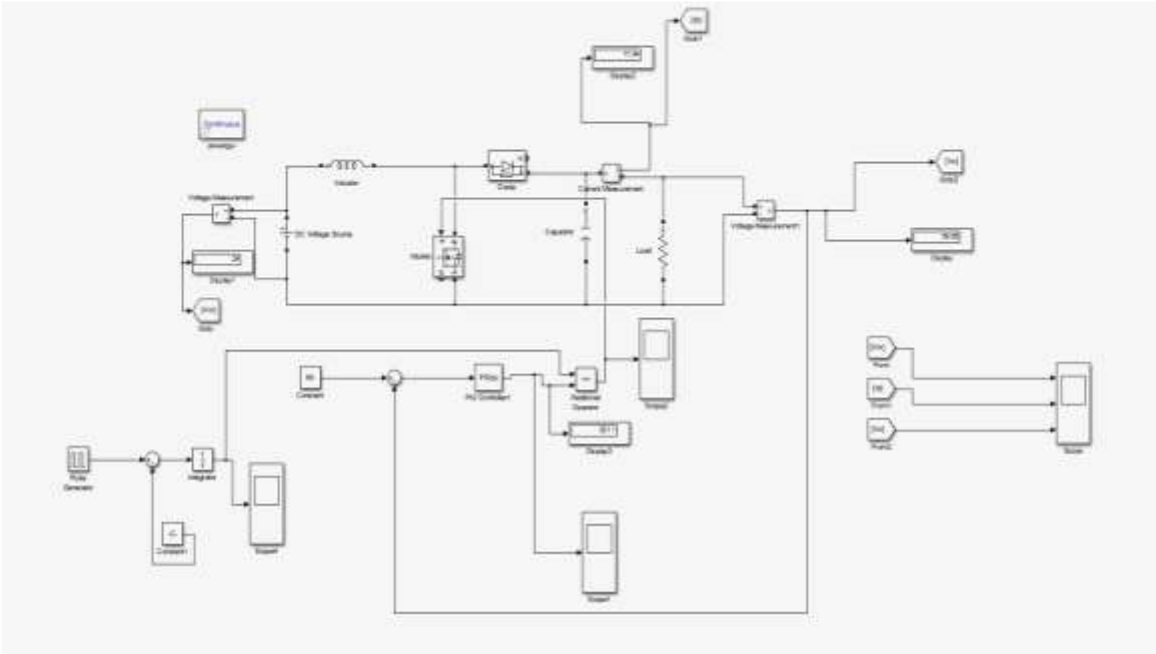
Bytrialand error,wegetthevalue of$K_P$whichgives desiredresultsas.

IV. SOFTWARE DETAILS:

SIMULINKMODEL:

The Figure below shows the block diagram of the complete circuit. This includes the PVmodule, boost converter and control circuit. The modeling and simulation of the whole systemhasbeendoneinMATLAB-SIMULINKenvironment.

Figure.ThecompletesimulationmodelofthePVenergyconversionsystem.



GENERATIONOFTHEPWMSIGNAL:
ThesimulinkmodelforthegenerationofthePWMsignalisshownbelow:

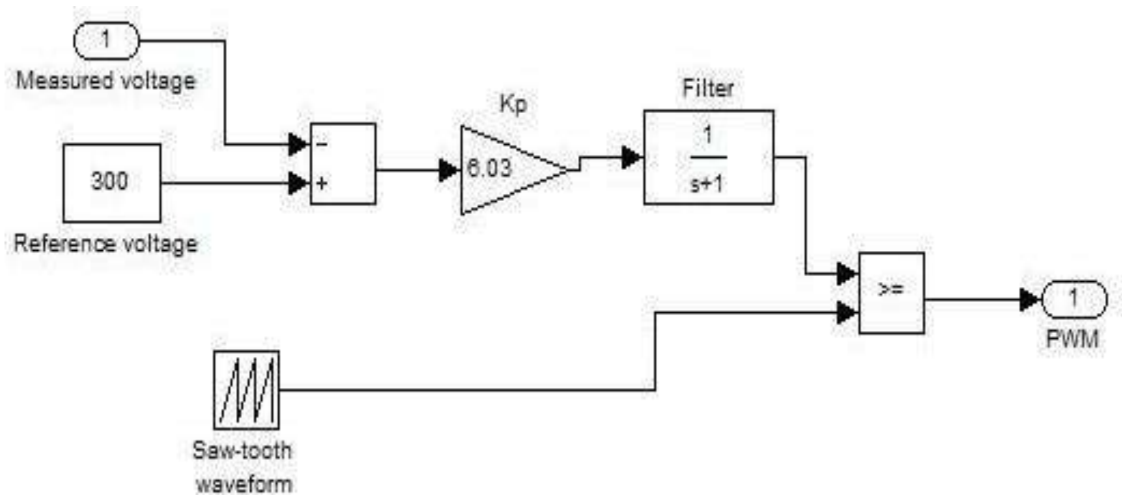


Figure5.4.1CircuitdiagramforPWMsignalgeneration

The output of the filter which is the control signal is compared with the saw-tooth waveformhaving a peak voltage of 25V to generate the PWM signal which is fed as gate signal to theMOSFET. The simulation diagram showing the comparison of the saw-tooth waveform with thecontrolsignalisshownbelow:

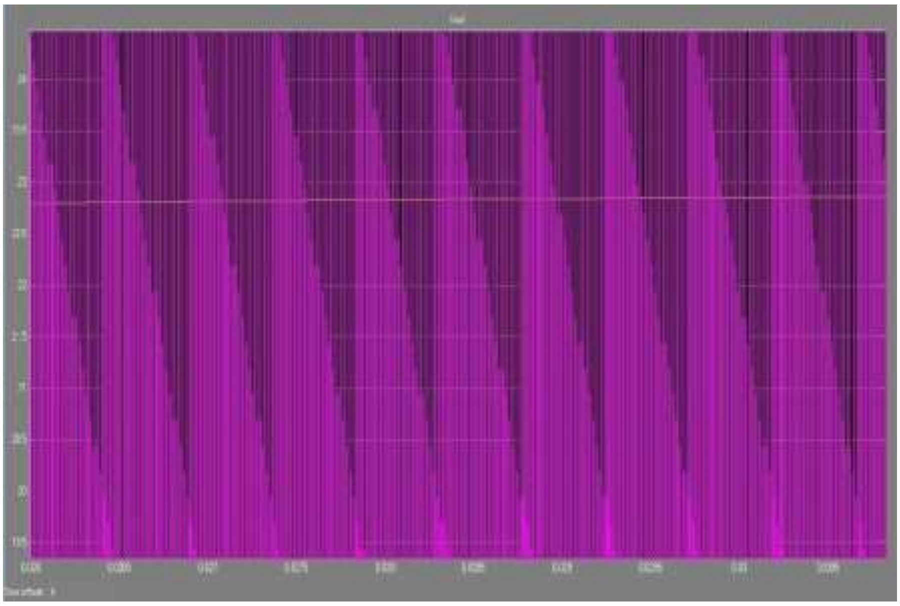


Figure5.4.2SimulationdiagramshowingthegenerationofthePWMsignal

TherequiredPWMsignalusedasthegatepulsefortheMOSFETisshownbelowinthefigure:

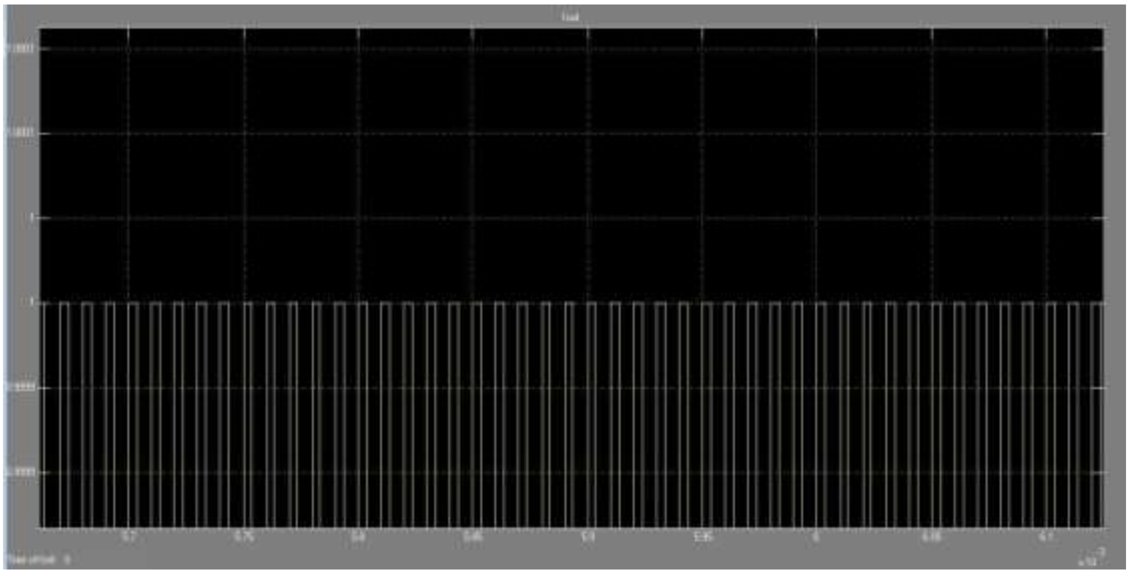


Figure5.4.3PWMsignalgenerated

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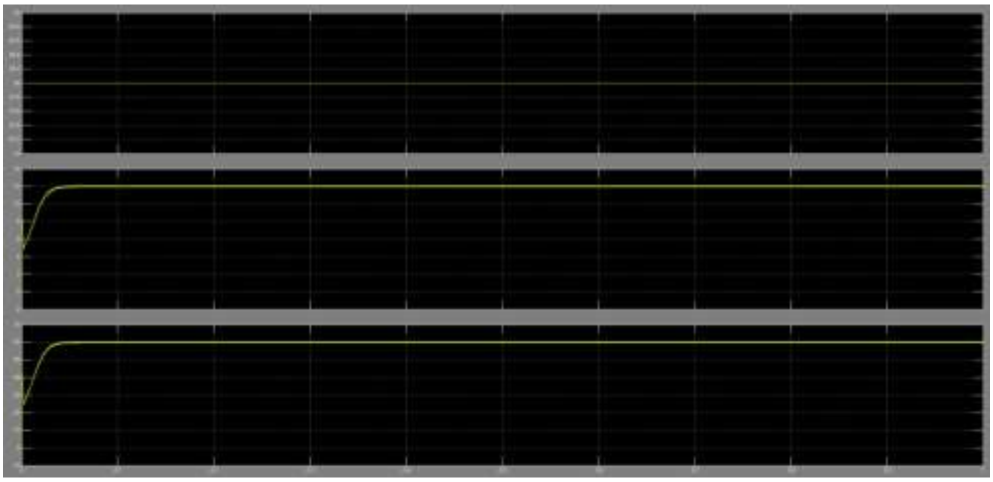
ResultAnalysis:
TheoutputI$_{out}$andV$_{out}$curvesobtainedacrosstheloadresistanceoftheboostconverterofthesimulinkmodelas showninaboveFigure(5.5)is drawnbelow.

Figure5.5Thevoltageoutputandcurrentacrosstheloadresistanceoftheboostconverter



RESULTSCONFIRMINGPROPERCOUPLIN GOFPVARRAYWITHBOOSTCONVERTER:

The load resistance of the closeloop boost converter is varied and the values of theinput voltage and current fed to the converter are noted for various levels of insolation. Thevalues of the current and voltage obtained are plotted in the open circuit I-V curve of the PVarray. The values obtained follow the curve closely thereby fulfilling our requirements. Thetabulationandthecurves whichverifyoursuccessfulsimulationmodelis givenbelow:

Table2:Valueofinputvoltageandcurrentforvariationinloadresistanceforanirradiance Level(100mW/m^2)

INSOLATION(mW/m^2)	LOAD RESISTANCE(□)	INPUT VOLTAGE(Volt)	INPUT CURRENT(Amp)
100	300	28.9 2	11.42
100	285	27.2	12.86
100	450	31.6 2	6.898

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Table3:Valueofinputvoltageandcurrentforvariationinloadresistance foranirradiancelevel(80mW/m^2)

INSOLATION(mW/m^2)	LOAD RESISTANCE(□)	INPUTVOLTAGE(Volt)	INPUTCURRENT(Amp)
80	400	28.75	8.58
80	450	29.75	7.382
80	680	31.26	4.726

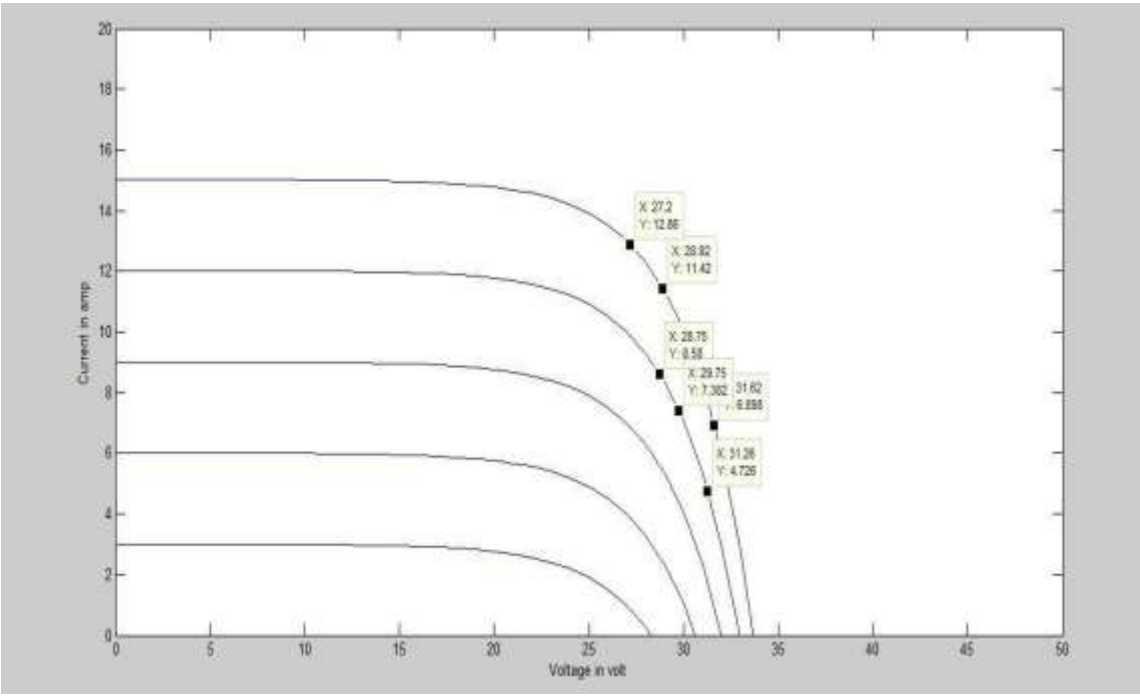

Figure5.6InterfacingofPVarraysimulationresultwithopenloopI-Vcharacteristic

V. CONCLUSION:-

We can operate night lamps automatically by using LDR circuit. Lamps will be glow only whendarkness is present. It's economic one, and electricity will be saved.In the present system, energyload consumption is accessed using Wi-Fi and it will help consumers to avoid unwanted use ofelectricity We can make a system which can send SMS to the concerned meter reading man of thatarea when theft isdetected at consumer end. Also using cloud analytics we can predict futureenergyconsumptions.

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