Maximum Power Point Tracking (MPPT) For Solar Photo Voltaic (SPV) Panel Companion Inverters

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Abstract

Today sunlight is considered as non-vanishing renewable energy source that is very eco friendly. Now day's electricity is need of hour. Solar energy is better source to fulfill the demand of energy. The solar energy is used for various purposes like industrial work, residential and commercial work. For utilizing energy of sun, solar panel is required that stores the energy and use it further. In this paper the review of various techniques used for power management of solar panel. It further checks the benefits of solar PV panel that maximizes the efficiency and temperature is minimum.

Key Words*: Photovoltaic PV cell , Renewable energy, Solar panel, Photovoltaic cell, Modelling of PV panel, Solar Concrete Collector*

1. INTRODUCTION

These days, because of the diminishing measure of sustainable power source resources, the most recent ten years become increasingly critical for per watt cost of solar energy gadget. (Verma et al. 2018)It is certainly set to wind up practical in the coming years and developing as better innovation as far as both expense and applications. The earth gets daylight above (1366W approx.) everyday. This is a boundless wellspring of energy which is accessible at no expense. The real advantage of solar energy over other ordinary power generators is that the daylight can be legitimately changed over into solar energy with the utilization of littlest photovoltaic (PV) solar cells. (Zhang et al. 2017) . There have been a lot of research exercises to join the Sun's energy procedure by creating solar cells/boards/module with high changing over structure. The most points of interest of solar energy is that it is free reachable to everyday citizens and accessible in huge amounts of supply contrasted with that of the cost of different non-renewable energy sources and oils in the previous ten years. Also, solar energy requires significantly lower labor costs over ordinary energy generation innovation.

(Serban et al. 2018) An expanded need of energy because of requesting by local use, industries and so forth. It couldn't be satisfied by just customary resources. Consequently the interest of then again energy resources is additionally expanded. To satisfy this interest solar energy is vital energy. Most extreme Efficiency of solar panel expanded from thermoelectric cooling system.

- Solar Energy

The energy that is in the form of heat and radiation is known as solar energy. The light that comes from sun contains radiation and heat, and it is wide range of natural energy which is used by solar thermal, power plant and solar heating. Approximate 30% of solar radiations are reflected back to the space while some is observed by clouds, ocean and land.

- Working of solar PV panel

First of all it observe the sunlight that comes from sun after that PV cell convert it into direct current electricity. It also has charge controller that controls the solar panel power. The system also has battery that act as storage of the electricity power that is produced. This is further utilized when sunlight is not available. The inverter is connected with system that converts DC into AC.

- *Solar Cell (Photovoltaic Cell)*

The cells converted solar radiation directly into electricity. It consist various kinds of semiconductor materials. It has two types: positive charge and negative charge shown on fig.1. This cell technology are used to design solar cells with low cost as well as high conversion efficiency. When the cell absorbed photons from sunlight, electrons are knocked free from silicon atoms and are drawn off by a grid of metal conductors, pressure a flow of electric direct current. Solar cell PV made up of many chemicals.

- *Photovoltaic Module*

A PV module consists of solar cell circuits sealed in an environmentally protective laminate and are the fundament building blocks of PV system. Generally sizes from 60W to 170W. Usually a number of PV modules are arranged in series and parallel to meet the energy requirement.

- *Photovoltaic Panel*

It includes one or more PV modules assembled as a pre-wind, field instable unit. In this panel PV cell is series connections. Solar panels are made up of individual PV cells connected together.

- *Photovoltaic Array*

It is contain of several amount of PV cells in series and parallel connections. Series connections are responsible for increasing the voltage of the module whereas the parallel connection is responsible for increasing the current in the array. It generates maximum 180W in full sunshine. Large the total surface area of the area of the array, more solar electricity it will produce.

1.1 MERITS OF SOLAR ENERGY

It is save up to 20% of energy costs. It can use in Remote Locations. Easy Installation (i.e. does not required any wires, cords etc.). Roof top which means no new space is needed & every domestic or commercials user can generate their own electricity. It is widely available of sunlight with free of cost, eco-friendly, renewable resource. It has no moving parts and not required any additional fuel, other than sunlight, to produce power. No need of water and fuel.

1.2 DEMITS OF SOLAR ENERGY

No generation of energy, when the sun is not shining. Initial cost is high. More area needed for large amount power. For alternating Current (AC) application required of inverter and also storage at night. Production PV systems single silicon crystals is technically challenging, energy, time consuming.

2. LITRATURE REVIEW

This section presents comprehensive survey of literature to detect best possible approach out of the available mechanisms for conserving solar energy for electrical appliances.

(Agarwal et al. 2017) proposed a quasi health monitoring mechanism of sensor within solar inverter. Result is verified against the scaled down version of grid connected with solar inverter. The mechanism conserve energy along with reliability by ensuring least amount of power is consumed while transmission of power through solar inverter.

(Arefifar et al. 2017) proposed an optimization technique that processes the different PV modules and generate curves for operating areas. It implements the optimization process for solar plant design and it maximizes total payback time and financial benefits have been increased. It utilizes parameters like sensitivity, average and variance.

(Formica & Khan 2017) describes various challenges that are occurred during handling of solar photovoltaic systems and also gives robust technique that handle these challenges also it focus on ROI. It also analysis the failure data and gives reliability concerns for solar PV inverters. It uses key for handling failures in ROI for solar PV inverter and improves reliability of the system efficiently.

(Inverter et al. 2017) proposed modified SOP modulation technique that is used for implementation of controlling voltage boost of inverter. It utilizes simple conversion methods and gives effective result. It maintained the operating power below 5% and the frequency of switching is 350 Hz. It utilizes conversion method for handling waveform of quasi-sine along with operational constraints.

(Optimizer 2018) describes partial power DC-DC optimizer that is used for controlling voltage of battery. It support PV string voltage and grid connection that can work in various operating conditions. It analysis various power stages of inverter and control the voltage for these stages by applying flexible charging of battery .

(Kumar & Singh 2017) describes technique for handling single stage solar PV generation . The technique use BLDC motor driven water pumping system that describes various stages of 1 pv generation . It provides DC-DC converter that uses current sensing element and gives cost effective drive,. The results shows that it handles the power of water pump and gives cost effective drives.

(Meyer et al. 2017) surveys various techniques used for PV installation on power quality. The analysis shows the many techniques has low installed PV capacity and it also includes PV frequency range more than 2Khz. It configures that the proper use of PV installation is not done and the emission of power is more.

(Systems 2017) proposes a cost effective sensor less power reserve technique that is used for handling power supply in grid connected PV systems. It utilizes MPPT operations that routinely checks the available power and after that estimates have been calculated. It set up a limit for extracting PV power and minimizes the power fluctuation during this process. The results shown that it has high performance and cost effective.

(Schwanz et al. 2016) describes a stochastic method that estimate the contribution of single phase PVI . It includes the uncertainty and calculate the impact of induction motor. The network is allowed to operate in any condition and the risk of single phase size is reduced. It can control the connected power links of the PVI of single phase.

(Serban et al. 2018) proposed mechanism that handle the power loss of PV solar system. It firstly analysis the power loss of 3L-TNPC and then the proposed method is applied on it for handling this loss. The results shows that it normalized the power supply by 5%. It can operate in high modulation index and leads to the accurate power loss estimation.

The comparative analysis of the literature is presented as under

References	Technique	Parameter	Merits	Demerits
Agarwal et al. 2017	Sensor health monitoring	Energy Consumed	The energy consumed decays by the use of proposed mechanism	Energy efficiency is achieved but execution time is high while generating max power
Arefifar et al. 2017	Optimization of PV modules	Maximum solar power	The solar panel with the application of this technique generates good power generation mechanism	Execution time and reliability of the proposed mechanism is poor
Formica and Khan 2017	Discussed challenges of handling solar panels	No parameters are discussed	Discussed techniques and best possible technique can be selected for future enhancement	No new mechanism is suggested through the discussed literature
Inverter et al. 2017	SOP modulation	Compression rate	Modulation of signals is performed and good strength of signals is obtained	Power generation mechanism is excessive in execution time
Optimizer 2018	Partial power DC	Power strength	Power strength is	Power increase is

mechanism	increased considerably	without considering additional overhead of cost

Table 1: Comparison of techniques used for enhancing performance of solar panel based inverters

The result section shows the result obtained from various literatures and shows the best possible approach under challenging environment.

(Aggarwal et. Al) compare the IV characteristics of solar cells. It shows the analysis of papers in terms of voltage and temperature. It shows various I-V characteristics of papers.

Cell	Current	Temperature
Cell 1	53.8	10
Cell 2	50.2	25
Cell 3	48.5	40
Cell 4	42.9	55
Cell 5	30.3	70

Table 2: Comparison of solar cell wise IV characteristics.

The cells of the solar panel with the technique solar panel health monitoring approach are obtained to be best but future modifications may be desirable for improving execution time.

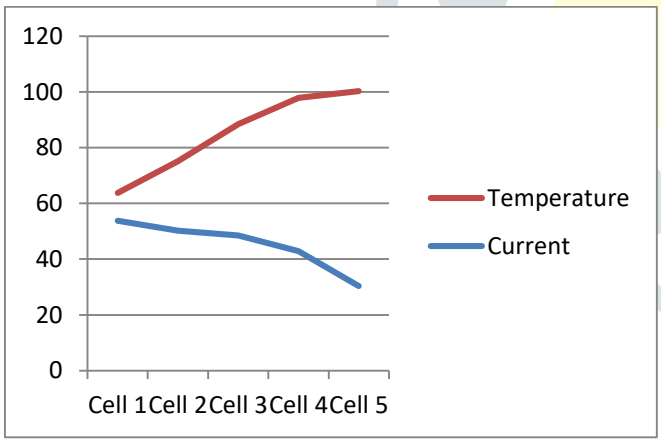


Figure 1: IV comparison of solar cells.

The IV characteristics of solar panel are optimized by the use of technique proposed by Arefifar et al. The voltage and current characteristics considerably improved by the use of this mechanism. The result in terms of this characteristics is given as under

Cell	Current	Temperature
Cell 1	58.8	10
Cell 2	56.2	25
Cell 3	52.5	40
Cell 4	50.9	55
Cell 5	45.3	70

Table 3: IV characteristics through Optimized mechanism proposed by Arefifar

The plot from the table 3 is given through figure 2.

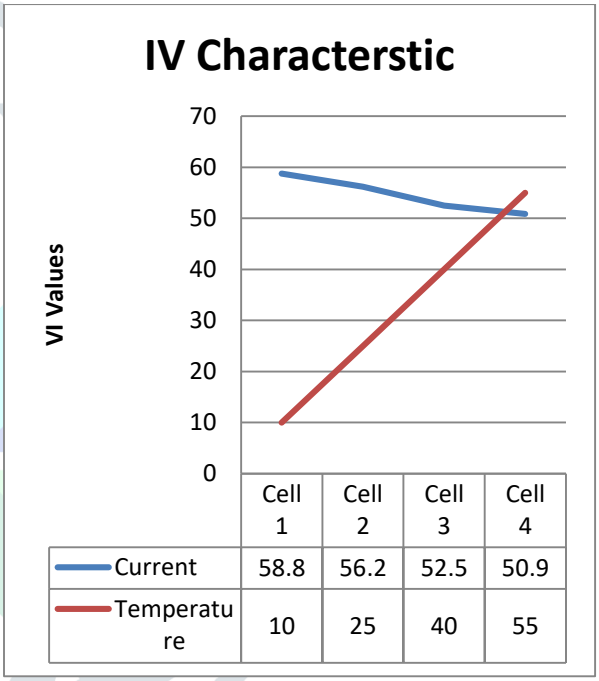
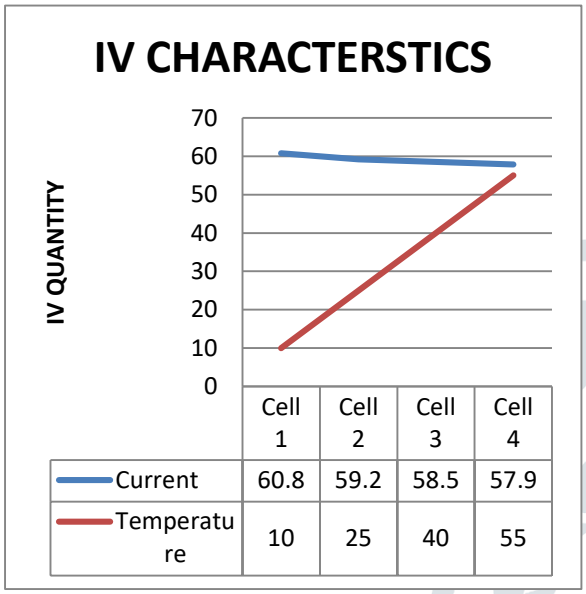


Figure 2: Comparison of IV values obtained through Arefifar

The third literature considered for comparison is of Formica and Khan 2017. This literature considered the evaluation of solar power source and considered criticallity of signal that is being evaluated and apply compression to soften the signals. The table 4 shows reading obtained through he literature.

Cell	Current	Temperature
Cell 1	60.8	10
Cell 2	59.2	25
Cell 3	58.5	40
Cell 4	57.9	55
Cell 5	55.3	70

Table 3: Systematic IV characteristics obtained through technique suggested through Formica and Khan 2017



The figure 3 gives the plots for the table 3 showing the IV charcaterstics. The result is systemetic and uniform.

The comparison of all the literatures considered for evaluation is given as under

Figure 3: Plots of literature suggested by Formica and Khan 2017.

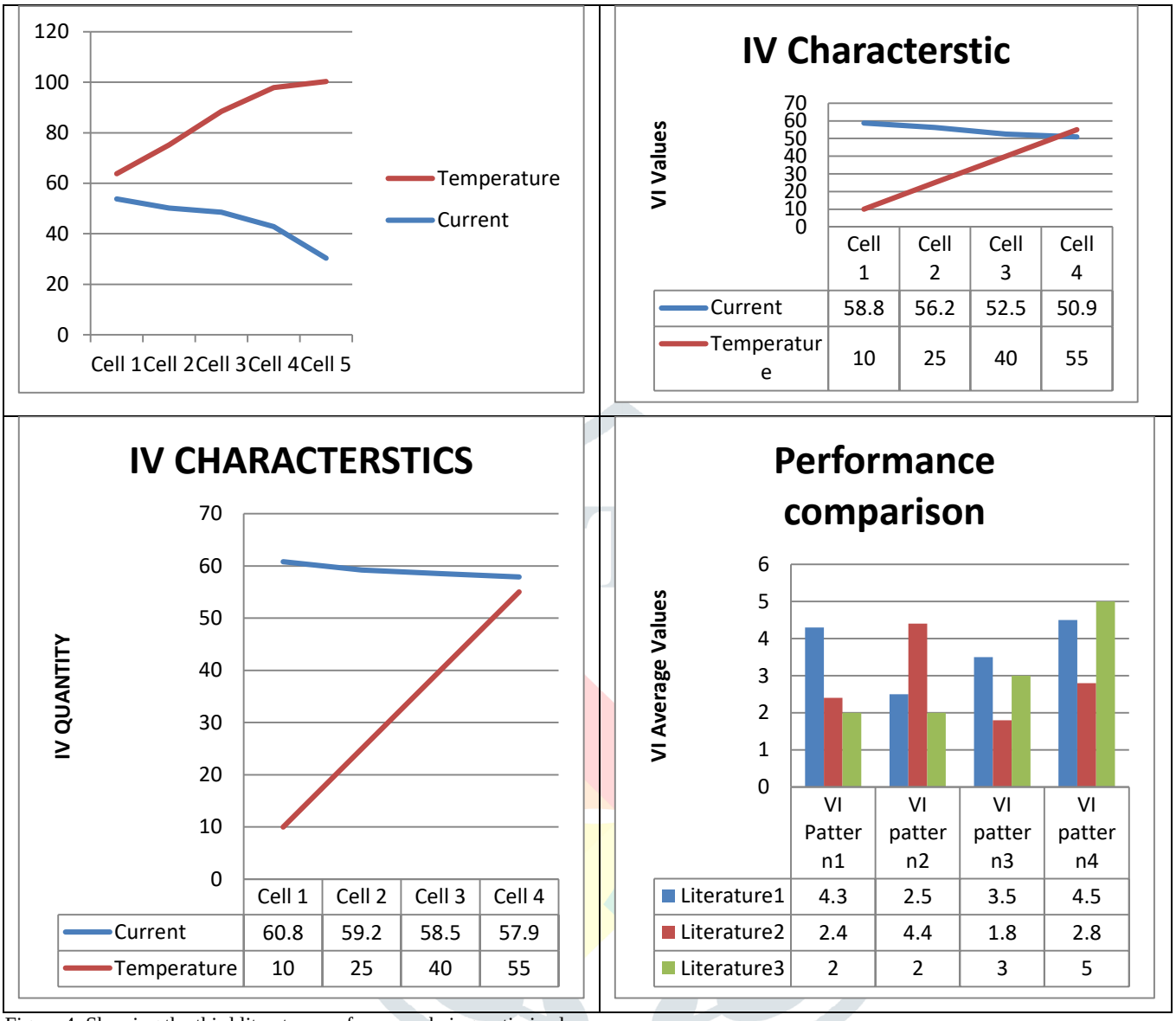


Figure 4: Showing the third literature performance being optimized.

Form the result comparison it is concluded that the performance of third literature is being best and can be used for future enhancement.

3. CONCLUSIONS

From various papers we concluded that the various aspects are governing the efficiency of solar panel in which temperature of PV panel is one the important aspect. To increase the efficiency of PV cell the PV panel temperature should be maintained at particular level. It is the standard temperature at which photovoltaic cells are designed, and it is different for different PV technologies used.

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