



# **MPPT Based Improvement of Solar Power Efficiency Using Labview**

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**ABSTRACT:** A maximum power point tracker (or MPPT) is a high efficiency system that extracts the maximum power output from a solar cell or an array of photovoltaic (PV) cells. PV cells have a single operating point where the values of the current (I) and Voltage (V) of the cell result in a maximum power output. Maximum power point trackers utilize various types of control circuit or logic to search for this point and thus allow the converter circuit to extract the maximum power available from a cell. In this project Incremental Conductance algorithm is used for the MPPT.

At night, an off-grid PV power system uses batteries to supply its loads. Charging may begin at a voltage considerably below the array peak power point, and a MPPT can resolve this mismatch. The MPPT must then shift the array operating point away from the peak power point until production exactly matches demand. For the analysis of the results Labview based Virtual instrument will be used to display the change in voltage, current and hence the power output of the PV panel.

**KEYWORDS:** MPPT, Incremental conductance algorithm, Lab view.

## **I.INTRODUCTION**

It is certainly clear that fossil fuels are mangling the climate which is unsustainable. There is now a broad scientific consensus that the world needs to reduce greenhouse gas emissions more than 25 percent by 2020 -- and more than 80 percent by 2050. Solar collectors concentrate the sunlight that falls on them and convert it to energy. Solar power is a feasible way to supplement power in cities. In rural areas, where the cost of running power lines increases. Solar power is a clean renewable resource with zero emission, has got tremendous potential of energy which can be harnessed using a variety of devices.

With recent developments, solar energy systems are easily available for industrial and domestic use with the added advantage of minimum maintenance. Solar energy could be made financially viable with government tax incentives and rebates. An exclusive solar generation system of capacity 250KWh per month would cost around Rs. 20 lakhs, with present pricing and taxes. Most of the developed countries are switching over to solar energy as one of the prime renewable energy source. The major dis-advantage of solar power is its **limited efficiency** compared to other renewable resources.

## **II. EXISTING SYSTEM**

### **IMPLEMENTATION OF MPPT USING MATLAB**

The various I-V and P-V characteristics are obtained for the various values of solar cells is displayed using MATLAB software. The P-V characteristics are obtained for various solar insulating using M-file showing Maximum Power Point and also indicating the voltage  $V_{mp}$ , current  $I_{mp}$  and maximum power  $P_{max}$ .

The entire world is facing a challenge to overcome the hurdle of energy crisis. Rapid population growth and industrialization demands for an increased amount of electrical energy. Solar energy is a renewable, inexhaustible and ultimate source of energy. If it is used in a proper way, it has a capacity to fulfill the energy demands. The earth receives a power of  $1.8 \cdot 10^{11}$  Mw from the sun. It enables more research in the field of solar energy so that we can overcome the demand for the energy crisis. The output power characteristic of the PV module depends on the

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irradiance conditions, the temperature on the cell and the output voltage. The power system tool in Matlab /Simulink package is used in the existing system to obtain the output characteristics.

## EXISTING SYSTEM DISADVANTAGES

1. It is comparatively slower.
2. Slow and complex graphical user interface.
3. Calculations are not well optimized.
4. Simulation execution is delayed in MATLAB.
5. Not an automatic controller.
6. Installation cost is high.

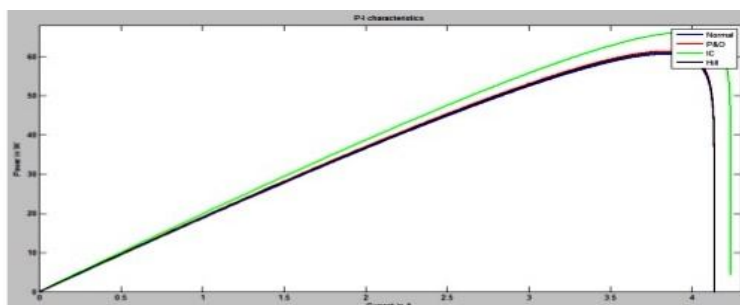


Fig3: P-I Characteristics (P1: Reference conditions)

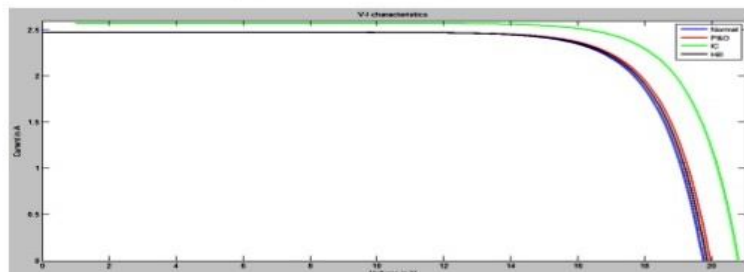


Fig4: V-I Characteristics (P2: Reduced insolation)

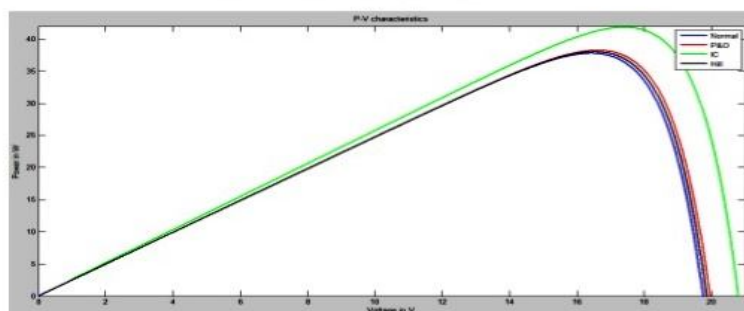


Fig -5: P-V Characteristics (P2: Reduced insolation)

Fig .1 Output Characteristics of MPPT using MATLAB

## III. PROPOSED SYSTEM

### IMPLEMENTATION OF MPPT USING LABVIEW

The proposed system of the project provides the possible solution to the Maximum Power Point problems and obtain the output characteristics in LABVIEW software instead of using MATLAB. To attain the Maximum Power of the solar panel the Incremental Conductance Algorithm is used to implement the Maximum Power Point Tracking Technique. PV cells have a single operating point where the values of the current (I) and Voltage (V) of the cell result in a maximum power output. The MPPT must shift the array operating point away from the peak power point until



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production exactly matches demand. The output characteristics of the MPPT is obtained in the LABVIEW. The various I-V and P-V characteristics are obtained for the various values of solar irradiance or insolation and keeping the temperature of the cell constant in the Maximum Power Point.

## PROPOSED SYSTEM ADVANTAGES

1. The functions of calculation in LABVIEW are very well optimized.
2. It is fast and simple construction of graphical user interface that facilitates the updating parameters and elegant presentation of the results.
3. Installation cost is low.
4. The proposed model is to track the maximum power automatically from the solar panel.
5. Output is very efficient.

## IV. TYPES OF ALGORITHM

Controllers usually follow one of three types of strategies to optimize the power output of an array. Maximum Power Point Tracking can be implemented using different types of algorithms and switch between them based on the operating conditions of the array. They are

1. Current Sweep Method
2. Constant Voltage Method
3. Perturb and observe Method
4. Incremental Conductance Method

### CURRENT SWEEP METHOD

The current sweep method uses a sweep waveform for the PV array current such that the I-V characteristic of the PV array is obtained and updated at fixed time intervals. The maximum power point voltage can then be computed from the characteristic curve at the same intervals.

### CONSTANT VOLTAGE METHOD

The term "constant voltage" in MPP tracking is used to describe different techniques by different authors, one in which the output voltage is regulated to a constant value under all conditions and one in which the output voltage is regulated based on a constant ratio to the measured open circuit voltage ( $V_{OC}$ ). If the output voltage is held constant, there is no attempt to track the maximum power point, so it is not a maximum power point tracking technique in a strict sense, though it does have some advantages in cases when the MPP tracking tends to fail, and thus it is sometimes used to supplement an MPPT method in those cases.

In the "constant voltage" MPPT method (also known as the "open voltage method"), the power delivered to the load is momentarily interrupted and the open-circuit voltage with zero current is measured. The controller then resumes operation with the voltage controlled at a fixed ratio, such as 0.76, of the open-circuit voltage  $V_{OC}$ . This is usually a value which has been determined to be the maximum power point, either empirically or based on modeling, for expected operating conditions. The operating point of the PV array is thus kept near the MPP by regulating the array voltage and matching it to the fixed reference voltage  $V_{ref}=kV_{OC}$ . The value of  $V_{ref}$  may be also chosen to give optimal performance relative to other factors as well as the MPP, but the central idea in this technique is that  $V_{ref}$  is determined as a ratio to  $V_{OC}$ .

One of the inherent approximations to the "constant voltage" ratio method is that the ratio of the MPP voltage to  $V_{OC}$  is only approximately constant, so it leaves room for further possible optimization.

### PERTURB AND OBSERVE METHOD

In this method the controller adjusts the voltage by a small amount from the array and measures power; if the power increases, further adjustments in that direction are tried until power no longer increases. This is called the perturb and observe method and is most common, although this method can result in oscillations of power output. It is referred to as a *hill climbing* method, because it depends on the rise of the curve of power against voltage below the maximum power point, and the fall above that point. Perturb and observe is the most commonly used MPPT method

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due to its ease of implementation. Perturb and observe method may result in top-level efficiency, provided that a proper predictive and adaptive hill climbing strategy is adopted.

MPPT method	Advantage
CVT	1. Simple control and implementation. 2. Good stability because there are no big oscillations of solar panel voltage.
P&O	1. Simple feedback structure. 2. Easy to implement in hardware and software.
IncCond	1. Fast response speed to track the MPP. 2. Independent of solar panel characteristics. 3. No power loss due to oscillations.

## V. INCREMENTAL CONDUCTANCE ALGORITHM

### INCREMENTAL CONDUCTANCE

In the incremental conductance method, the controller measures incremental changes in PV array current and voltage to predict the effect of a voltage change. This method requires more computation in the controller, but can track changing conditions more rapidly than the perturb and observe method (P&O). Like the P&O algorithm, it can produce oscillations in power output. This method utilizes the incremental conductance ( $dI/dV$ ) of the photovoltaic array to compute the sign of the change in power with respect to voltage ( $dP/dV$ ).

The incremental conductance method computes the maximum power point by comparison of the incremental conductance ( $I\Delta / V\Delta$ ) to the array conductance ( $I / V$ ). When these two are the same ( $I / V = I\Delta / V\Delta$ ), the output voltage is the MPP voltage. The controller maintains this voltage until the irradiation changes and the process is repeated.

### FLOW CHART

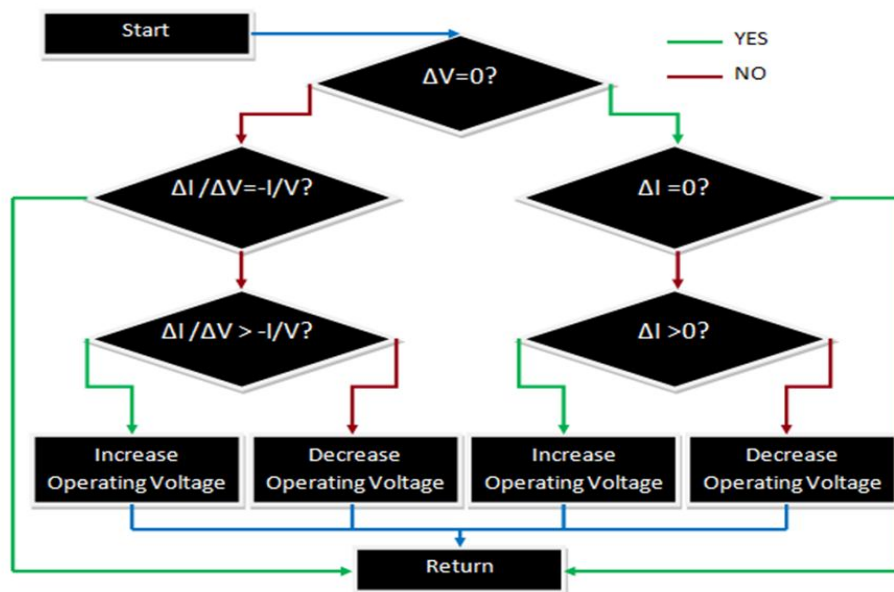


Fig .2 Flow chart

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## VI. RESULT AND DISCUSSION

In future, this approach can be applied for tracking the Maximum Power Point without using any type of controller. Hence, reducing the cost and increasing the efficiency of the system.

The basic advantage of using incremental conductance method is that it can offer a very high efficiency if it is properly optimized, which is highly competitive against other Maximum Power Point Tracking Algorithms.

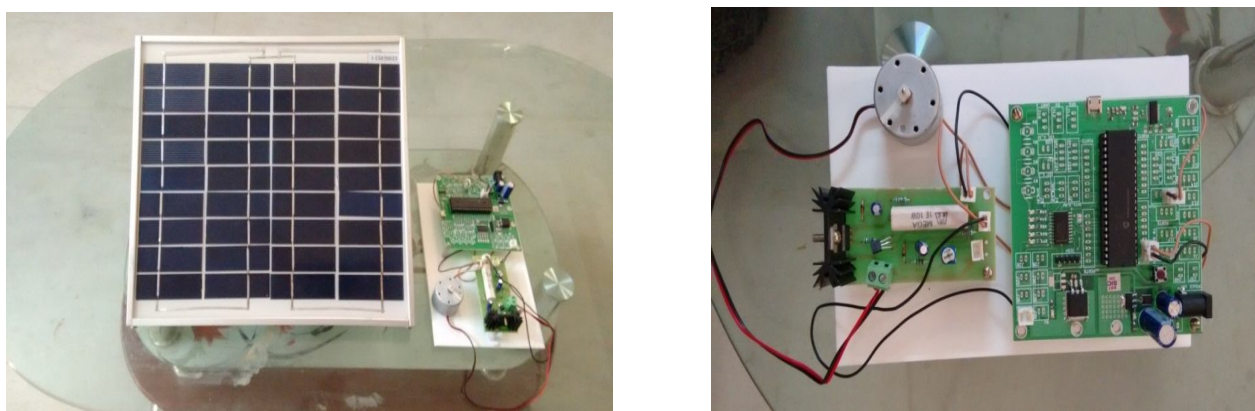


Fig .3 Hardware setup With PV Panel

In the fig 3, it shows the experimental setup of PV panel with controllers.

One benefit of LabVIEW over other development environments is the extensive support for accessing instrumentation hardware. Even people with limited coding experience can write programs and deploy test solutions in a reduced time frame when compared to more conventional or competing systems.

The LabVIEW Professional Development System allows creating stand-alone executables and the resultant executable can be distributed an unlimited number of times. The run-time engine and its libraries can be provided freely along with the executable.

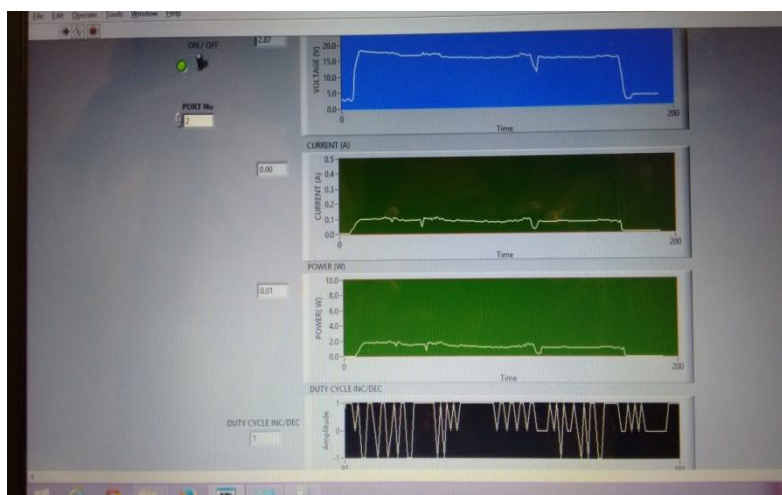


Fig .4 Output Characteristics of MPPT using LABVIEW



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In the fig 4, it shows the graph of voltage and current characteristics of MPPT at the output side of solar PV panel. The efficiency of the solar panel is improved by using the **maximum power point tracking technique** in which the maximum power availability of the solar panel is tracked and maintain it in the Maximum Power Point. **LabView** (Laboratory Virtual Instrumentation Engineering Workbench) software is used to display the simulated output which will provide the variation of current voltage characteristics before and after using the MPPT.

## VII.CONCLUSION

A renewable energy system, like the one implemented here, is suitable for residential and/or industrial applications. Such a system would typically provide a regulated AC output voltage that may also track the input mains utility voltage in phase and amplitude at hundreds to thousands of watts. Thus a system such as this can be deployed easily with little concern about adapting a home or business's electrical wiring to take advantage of solar energy. Many areas allow surplus energy generated by systems such as this to be sold to the utility grid in a policy known as "net metering." But for this project, these features were out of scope.

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