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REVIEW ON MAXIMUM POWER POINT TRACKER FOR LONG TERM LOGGING USING PV MODULE PERFORMANCE

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ABSTRACT: **We present a system that field test of photovoltaic module. The system is used for to absorb more energy from sun. There are Maximum Power Point (MPP) can be monitoring and extract the maximum energy from sun for producing Electricity. It can use monitor performance and Long-term stability of module under realistic condition. A monitoring system consists a individual MPP tracker attached to each module under test. This system also contains a one data logger which cans Analysis and saving of data. The data logger monitoring the performance of photovoltaic (PV) module under field condition is important for both the testing of individual module and the comparison of energy yield for different types of solar cell module at certain geographic location.**

KEYWORDS: maximum power point tracker, Performance evaluation, Photovoltaic cells, power MOSFET, Microcontroller, Stepper motor.

I.INTRODUCTION

Photovoltaic (PV) sources are used nowadays in many applications such as battery charging, water pumping, satellite power systems, etc…. For the best system utilization, the photovoltaic cells must operate at their maximum power point (MPP).The maximum power point tracking technique (MPPT) is used in photovoltaic (PV) systems to maximize the photovoltaic array output power, irrespective of the temperature and irradiation conditions and of the load electrical characteristics. Generally, if the load is directly coupled with the solar array panel, the operating point does not coincide with the maximum power point. To fulfill the load demand, direct connection of the load to the solar array leads to over sizing the solar panels thus increases the cost of the entire system. To solve the problem, a DC/DC converter with an automatic duty cycle control is usually inserted between the solar panel and the load. The MPPT computing system modifies the duty cycle of the main converter switch and implicitly the input impedance of the converter until the system reaches the maximum power point. The algorithms commonly used to track the MPPT are the P&O method has been widely used because it is easy to implement.

In recent years, research has been done on improving the capabilities of MPPT algorithms, partly driven by the availability of more powerful control circuitry. However, even a quite simple hill-climbing or perturb-and-observe algorithm can give sufficient accuracy and response speed to assess the power output of PV modules to within a few percent of error margin over a wide range of irradiances.

II. CONTROL STRATEGY

Different methods used for MPPT:

The output power of a PV panel is a function of temperature, radiation and the position of panel. It is also the function of product of voltage and current. By varying these parameters the power can be maximize. To maximizing the output power generally MPPT used. There are several MPPT method exists in order to maximizing the output power.

The existing methods are

1) Perturb and observation method.

2) Incremental conductance method.

3) Open Circuit Voltage method.

4) Short Circuit Current method.

Methods are studied and compare in this paper

1) Perturb and Observe Methods:

The P & O algorithm operated by the periodically perturbing (increasing or decreasing) the terminal voltage or current and then compare with the output power by the previous perturbation cycle. If the power increases then one continues increasing the voltage or current in the same direction. If power decreases then continue vary the voltage or current in the reverse direction.

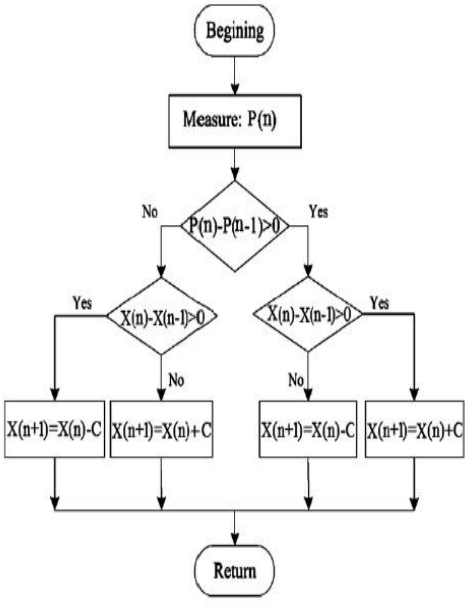

Fig.1. Perturb & Observe algorithm

2) INCREMENTAL CONDUCTANCE METHOD:

As we know those P&O methods have some limitations like it fails under rapidly changing environment condition. To overcome such limitations we use Incremental Conductance method. This method consists of slop of derivative of the current with respect to the voltage to reach the MPP. To obtain this maximum point change in current with respect to change in voltage (di/dv) should be equal to the negative current voltage ratio (-i/v). By applying the variation in the voltage towards the biggest value or smallest value it affect the power value. If power increasing then should continues in the same direction, if power decrease then should reverse the direction.

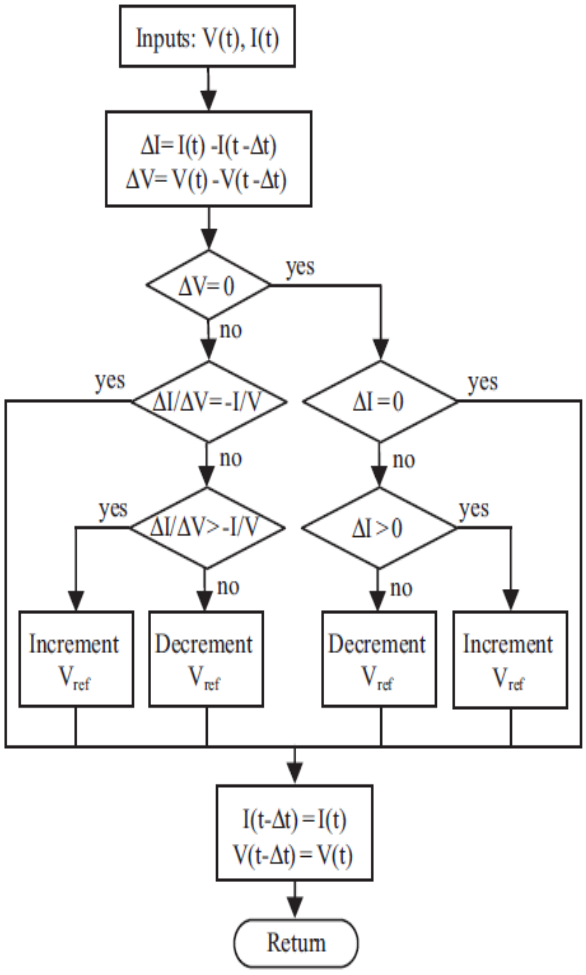

Fig.2. Incremental Conduction algorithm

3) Open Circuit Voltage Method-

This method is one of the simplest off line methods, which uses the approximately linear relationship between the open circuit voltage(V_{OC}) and the maximum power point voltage (V_{MPP}) under different environmental conditions as described by the following equation:

$$V_{MPP} = K\, V_{OC} \quad (1)$$

Where,

K is a constant, which depends on the solar cell characteristics. This constant is empirically derived based on measurement of the V_{OC} and V_{MPP} under different environmental conditions.

4) Short Circuit Current Method:

This method represents another offline approach which is relatively similar to the OCV method. There is also an approximately linear relationship between the short circuit current (I_{SC}) of the solar panel and the MPP current (I_{MPP}), which can be described by the following equation:

$$I_{MPP} \sim K\, I_{SC} \quad (2)$$

Where,

K is a constant between 0.8 and 0.9.

Similar to the OCV method, the load should be shed in order to determine the I_{SC}. While the SCC method Is more accurate and efficient than the OCV method, due to practical issues associated with measuring the ISC, its implementation costs are higher. In, a boost converter is used, where the switch in the converter itself can be used to apply as short circuit to the PV array. An improvement similar to that proposed above for the OCV method can be applied to the SCC method.

5) Fuzzy Logic Control Method:

Fuzzy logic method (FL). Fig.3.shows the flow diagram for fuzzy inference system. This system implements the fuzzy logic control in three stages: fuzzification, decision-making, and defuzzification. During fuzzification, crisp input variables are converted into l in guistic variables based on a membership function as depicted in Fig. 4.

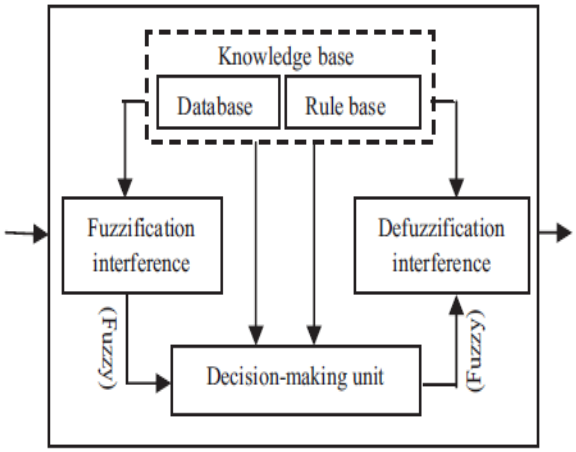

Fig3. Flow diagram of Fuzzy Logic system

In the decision-making stage, the rules which are specified by as f IF–THEN statements define the controller behaviour. The rules describing this stage of operation are expressed as linguistic variables represented by fuzzy sets. In the de fuzzification stage, the fuzzy logic controller output is converted from a

linguistic variable to numerical variables till using a membership function shown in Fig. 4.

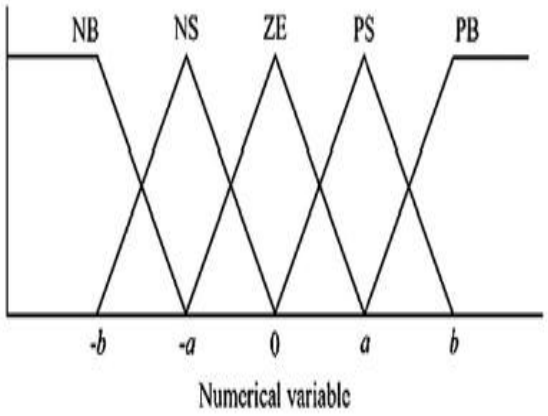

Fig4. Membership function for inputs and output of fuzzy logic controller

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This provides an analog signal that will control the power converter and drive the operating point to the MPP. The fuzzy logic controller inputs are usually an error E and a change in error, E associated with several different variables. In particular, in order to track MPP, the error is computed based on irradiance and temperature or instantaneous values such as power and voltage. The output signal is either the duty cycle itself, or V_{MPP} and I_{MPP} from which the duty cycle can be generated.

Table I: Comparison between different MPPT techniques

MPPT Methods	***Complexity***	***Digital or analog***	***Convergence Speed***	***Prior training***	***Sensed parameter***	***Efficiency***
O.C. Voltage	*Low*	*Both*	*Medium*	*Yes*	*Voltage*	*Low=86%*
S.C Current	*Medium*	*Both*	*Medium*	*Yes*	*Current*	*Low=89%*
Fuzzy Logic	*High*	*Digital*	*Fast*	*Yes*	*Depends*	*High*
Incremental conductance	*Medium*	*Digital*	*Depends*	*No*	*Voltage and current*	*High*
Perturb and Observe	*low*	*Both*	*Fast*	*No*	*Voltage and current*	*High=96%*

III. SYSTEM DISCRIPTION:

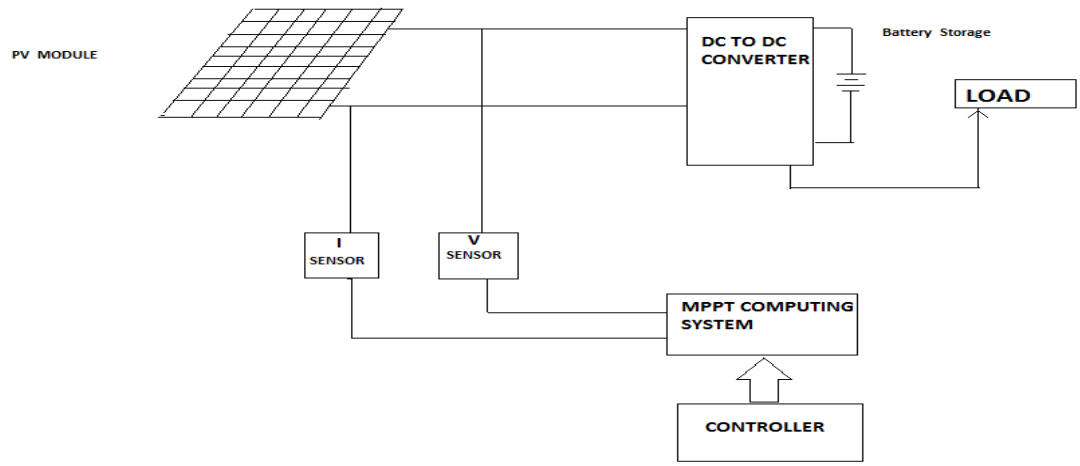

Fig.5. Schematic of diagram MPPT system.

In the proposed method we are using a MPP to detect the inefficient solar panel by the current and voltage characteristics. We are using a voltage sensors it gives the reference voltage for the MPPT to detect the characteristics of the Solar panel. By this method we are collecting information through the remote data logger this information can directly reaches to the controller who do the actions regarding this. Here we are using a Li-ion battery to store the voltage and current coming from the PV system. By all this we can check the condition of that panel and also does the replacing of the panel.

A maximum power point tracking algorithm is absolutely necessary to increase the efficiency of the solar panel as it has been found that only 30-40% of energy incident is converted into electrical energy . Due to the growing demand on electricity, the limited stock and rising prices of conventional sources (such as coal and petroleum, etc.), photovoltaic (PV) energy becomes a promising alternative as it is omnipresent, freely available, environment friendly, and has less operational and maintenance costs. Therefore, the demand of PV generation systems seems to be increased for both standalone and grid-connected modes of PV systems. Therefore, an efficient maximum power point tracking (MPPT) technique is necessary that is expected to track the MPP at all environmental conditions and then force the PV system to operate at that MPP point.MPP refers to PV's unique operating point delivering maximum power giving highest efficiency of array. It varies with solar insolation and temperature & needs to be monitored through tracking techniques. The operating characteristics of a solar cell consist of two regions as represented in Fig 1, the current source region and the voltage source region. In the current source region, the internal impedance of the solar cell is high and this region is located on the left side of the current-voltage curve. The voltage source region, where the internal impedance is low, is located on the right side of the current –voltage curve. As per Maximum Power Transfer Theorem, Maximum Power is delivered to load when source internal impedance matches load impedance.

REFERENCES

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IV. SYSTEM PARAMETERS

To verify the proposed control approach to achieve the multi function of four leg inverter simulation study is carried out using MATLAB/Simulink. The System Parameter is given in Table I shown. The performance of the proposed control approach is validated with the help of MATLAB simulation parameters as given in Table I. The RES is emulated using an auxiliary controlled converter, which injects varying active power at the dc-link of an insulated gate bipolar transistor (IGBT) based 4-leg voltage source inverter connected to grid. A 3-phase 4-wire nonlinear load, composed of 3-phase non-linear balanced load, 1-phase R-L load between phase and neutral and 1-phase non-linear load between phase and neutral, is connected to the grid.

Table I: System Parameter

3 phase supply	**30V,50Hz**
3 phase non-linear load	R=26.6Ω,L=10mH
1 phase linear load	R=36.6Ω,L=10mH
1 phase non-linear load	R=26.6Ω,L=10mH
DC-link Capacitance and Voltage	C=3000µF,90V
Coupling Inductance	2mH

V. CONCLUSION

By above studies we know which method is beneficial for A Maximum power point tracing from sun.