

Solar Energy System with Maximum Power Point Tracking

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ABSTRACT: This work develops a most point following (MPPT) algorithm for optimizing solar battery performance that's strong to chop-chop varied climatic conditions. Above all, a novel extremum seeking (ES) controller, that utilizes the electrical converter ripple, is intended and tested on a simulated array with grid-tied electrical converter. The new algorithmic program is benchmarked against the perturb and observe (PO) methodology victimization irradiance information gathered on a upside array experiment in Princeton, NJ. The extremum seeking controller achieves associate potency of ninety nine.7% and transient rise to the MPP of .1 seconds, that is one hundred times faster than perturb and observe

KEYWORDS: Maximum Power Point Tracking, Photovoltaic System, Perturb And Observe Method, Direct Current

I. INTRODUCTION

The potency of a PV plant is affected principally by 3 factors: the potency of the PV panel (in industrial PV panels it's between 8-15% [3]), the potency of the electrical converter (95-98 the troubles [5]) and therefore the potency of the most wall socket chase (MPPT) algorithm (which is over ninety eight [6]). rising the potency of the PV panel and therefore the 2 inverter isn't simple because it depends on the technology offered, it's going to need higher components, which might increase drastically the price of the installation. Instead, improving the chase of the most wall socket (MPP) with new management algorithms is easier, not dear and may be done even in plants that are already in use by updating their management algorithms, which might result in an on the spot increase in PV power generation and consequently a discount in its worth.

MPPT algorithms are necessary as a result of PV arrays have a non linear voltage-current characteristic with a novel purpose wherever the ability created is most [7]. This point depends on the temperature of the panels and on the irradiance conditions. Both conditions amendment throughout the day and are totally different reckoning on the season of the year. what is more, irradiation will amendment apace owing to ever-changing region conditions like clouds. it's vital to trace the MPP accurately underneath all possible conditions in order that the most offered power is usually obtained. In the past years various MPPT algorithms are printed [8]. They take issue in many aspects like complexness, sensors needed, value or potency. However, it is pointless to use a dearer or a lot of difficult methodology if with a less complicated and less expensive one similar results is obtained. This can be the explanation why a number of the proposed techniques don't seem to be used. Measuring the potency of MPPT algorithms has not been standardized till the European common place linear unit 50530 was printed at the top of might, 2010 [9]. It specifies how to take a look at the potency of MPPT strategies each statically and dynamically. In any case, there are not any publications scrutiny the results of the various MPPT algorithm under the conditions projected within the common place.

The work in this paper is divided in two stages. 1) Text- Detection 2) In painting. Text detection is done by applying morphological open-close and close-open filters and combines the images. Thereafter, gradient is applied to detect the edges followed by thresholding and morphological dilation, erosion operation. Then, connected component labelling is performed to label each object separately. Finally, the set of selection criteria is applied to filter out non text regions. After text detection, text in painting is accomplished by using exemplar based Inpainting algorithm.

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II. RELATED WORK

Maximum electric receptacle trailing, often mentioned as MPPT, is associate degree electronic system that operates the electrical phenomenon (PV) modules in an exceedingly manner that permits the modules to supply all the power they're capable of. MPPT isn't a mechanical trailing system that "physically moves" the modules to create them purpose additional directly at the sun. MPPT could be a absolutely electronic system that varies the electrical operational purpose of the modules in order that the modules area unit ready to deliver maximum out there power. extra power harvested from the modules is then created out there as increased battery charge current. MPPT will be employed in conjunction with a mechanical trailing system, however the 2 systems area unit fully totally different.

How do MPPT charge controllers work

The maximum power point tracking (MPPT) is a higher efficient DC-DC converter technology compared to "shunt controller" and "pulse width modulation (PWM)" technologies. Using a non-MPPT charge controller is like connecting the battery directly to the solar module. A traditional charge controller may charge a battery with the voltage that is dictated by battery. By nature, the voltage of a fully-charged battery is higher than that of a discharged-battery. Consequently, the power drawn by an empty battery is usually lower than that of a full battery. The question arises, when we notice that there is a power loss that we are not utilizing when our batteries are empty. Where did my power go? The MPPT utilizes whole module power by dictating the voltage of the battery charging state. The charge controller keeps the voltage and current at an optimized level where the modules deliver the most juice

Let's explain with an example:

Assume that we are using an Evergreen ESA 210 Solar panel, which has the V_{mp} of 18.3 volts and the I_{mp} of 11.48 amperes. ($11.48A \times 18.3V = \sim 210$ watts). An empty 12V battery may generally have 12.2 volts. Therefore the battery would charge by $11.48A \times 12.2V = 140$ Watts. It's significantly less than the maximum available output (210 watts) of the module. What a MPPT charge controller does is that it boosts the voltage and the current of the system, as close as the I-V curve of the module. In this case, the MPPT charge controller charges the battery at almost 18.3 V and 11.48A, while using the most out of the solar panel. A one last note here is that Maximum Power Point Tracking technology has nothing to do with solar tracking. MPPT is only a control feature for a battery charger.

III. STANDALONE PHOTOVOLTAIC SYSTEM COMPONENTS

A. ELECTRIC CELL

A electric cell or detector may be a conductor that converts light-weight to electrical energy by electrical phenomenon impact. If the energy of gauge boson of sunshine is larger than the band gap then the negatron is emitted and also the flow of electrons creates current. However a electric cell is totally different from a photodiode. in an exceedingly photodiode light-weight falls on nchannel of the semiconductor junction and gets born-again into current or voltage signal however a photovoltaic cell is usually forward biased.

B. PV MODULE

Usually variety of PV modules area unit organized asynchronous and parallel to fulfill the energy requirements. PV modules of various sizes area unit commercially on the market (generally sized from 60W to 170W). for instance, a typical tiny scale chemical action plant needs some thousand watts of power.

C. PV MODELING

A PV array consists of the many physical phenomenon cells asynchronous and parallel connections. Series associations unit responsible for increasing the voltage of the module whereas the parallel connection is responsible for increasing this among the array. usually a electric cell ar usually sculptured by a current offer Associate in Nursingingd associate degree inverted diode connected in parallel thereto. it's its own series and parallel resistance. Series resistance is due to hindrance within the path of flow of electrons from n to p junction and parallel resistance is due to the outflow current.

IV. DIFFERENT MPPT TECHNIQUES

There are different techniques used to track the maximum power point. Few of the most popular techniques are: 1) Perturb and Observe (hill climbing method) 2) Incremental Conductance method 3) Fractional short circuit current 4) Fractional open circuit voltage 5) Neural networks 6) Fuzzy logic

Perturb & Observe

Perturb & Observe (P&O) is the simplest method. In this we use only one sensor, that is the voltage sensor, to sense the PV array voltage and so the cost of implementation is less and hence easy to implement. The time complexity of this algorithm is very less but on reaching very close to the MPP it doesn't stop at the MPP and keeps on perturbing on both the directions. When this happens the algorithm has reached very close to the MPP and we can set an appropriate error limit or can use a wait function which ends up increasing the time complexity of the algorithm. However the method does not take account of the rapid change of irradiation level (due to which MPPT changes) and considers it as a change in MPP due to perturbation and ends up calculating the wrong MPP. To avoid this problem we can use incremental conductance method.

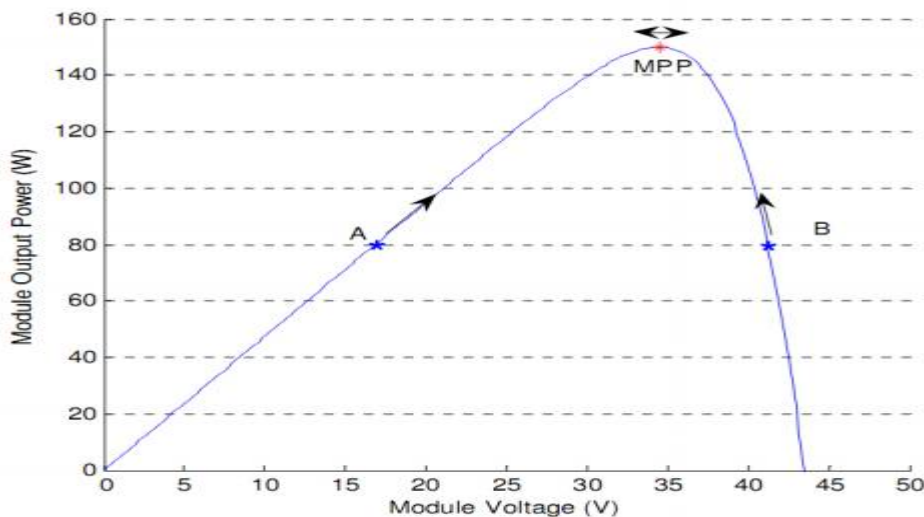


Fig 1 Solar panel characteristics showing MPP and operating points A and B

The Perturb & Observe algorithmic rule states that once the operational voltage of the PV panel is rattled by a little increment, if the ensuing modification in power P is positive, then we have a tendency to square measure getting in the direction of MPP and that we carry on disturbing within the same direction. If P is negative, we have a tendency to square measure leaving from the direction of MPP and also the sign of perturbation equipped must be modified.

Figure two shows the plot of module output power versus module voltage for a electrical device at a given irradiation. the purpose marked as MPP is that the most electrical outlet, the theoretical most output available from the PV panel. take into account A and B as 2 operative points. As shown within the figure higher than, the purpose A is on the left facet of the MPP.

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V. SOLAR TRACKING BLOCK DIAGRAM

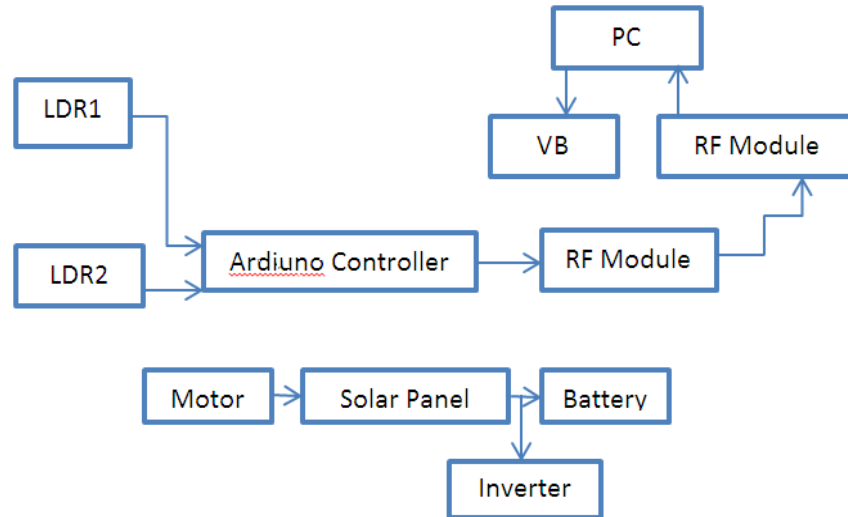


Fig 2 solar tracking with wi-fi automation control diagram

We are using arduino controller and raspberry pi processor in this project to meet our requirements. 2 LDR are provided to track the maximum power point of solar power. The LDR which detects maximum light intensity will pass the signal to arduino controller in the result the solar panel will turn towards the maximum power point of light i.e towards LDR. In next step the battery begins to charge whose current and voltage status will be sent to PC via RF module. PC is connected to the raspberry pi module which is connected to WiFi. The PC will be connected to the home network. After getting the data through RF it will be analysed on MATLAB software.

VI. EXPERIMENTAL RESULT

1) When Light Drop on LDR

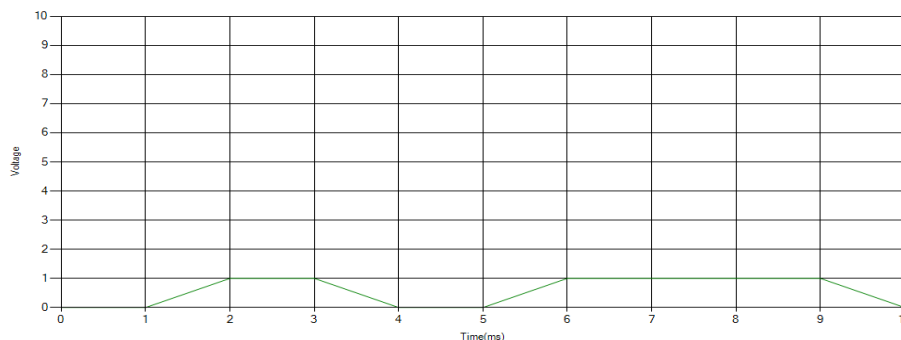


Fig 3 Graph of voltage when Light falls on LDR

2) Without Light Drop on LDR

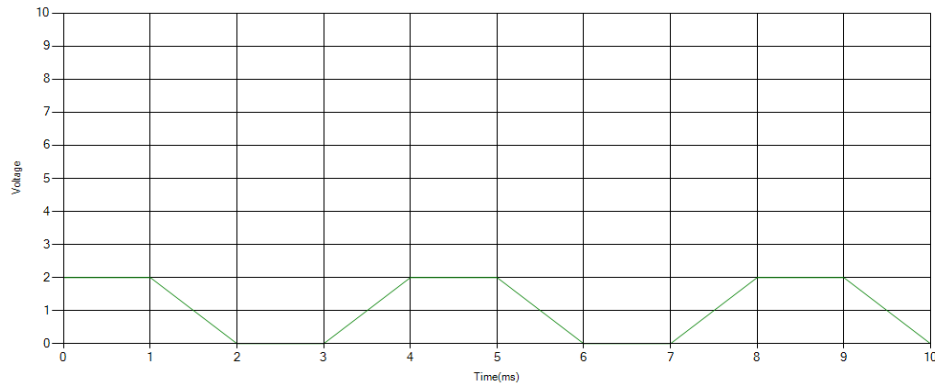


Fig 4 Graph of voltage when without Light falls on LDR

VII. CONCLUSION

Based on the obtained results we can conclude that the proposed solution for a solar tracking system offers several advantages concerning the movement command of the PV panel:

- An optimum cost/performance ratio, which is achieved via the simplicity of the adopted mechanical solution and the flexibility of the intelligent command strategy;
- A minimum of energy consumption, due to the fact that the panel movement is carried out only in justified cases, eliminating unnecessary consumption of energy, and due to the cutting of the power circuits supply between the movement periods of the PV panel;
- A maximization of output energy produced by the PV panel, through an optimal positioning executed only for sufficient values of light signal intensity

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