Maximum Power Tracking Techniques for PV Array: A Review

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Abstract: As solar photovoltaic system are the most emerging technology now days so to increase the energy efficiency of these system there are many different maximum power tracking algorithms have been developed which are working efficiently. The difference comes in these algorithms is in these implementations whether they are analog or digital or on the basis of their design and the hardware requirements or their total cost. Thus this become more important to choose the correct algorithm for the system because they effect the electrical efficiency of the system and also reduce the total cost because the number of solar panels required are decreased which minimize the cost. On the basis of literature survey we here present a total of 62 different techniques for tracking the maximum power tracking point. The main aim of maximum power point tracking system is to manage the power interfaces by which the operational characteristics of load and PV array will match the maximum power points. The present survey is based on the current developments in MPPT techniques.

Key Words:- Maximum power point tracking system, System efficiency, digital control, Photovoltaic power systems, control systems

I. Introduction
As due to the lack of non-renewable resources photovoltaic power generation becomes the most popular method now days to complete the power needs and from the recent year there is sudden growth in this technology. The latest technology i.e. maximum power point tracking is an self control algorithm by which we can manage the power interfaces and also get the maximum possible power harvest and also cover the point to point changes in power, its temperature and PV module characteristics. Thus this becomes the most emerging tool for evaluation of design performance of photovoltaic power component.

In recent studies there are various ways area being introduced for tracking of maximum power point. In 2006, there has been a comparative study has been carried out in which various techniques have been summarized and a comparison between them is presented in this study [1-2]. Thus in continue with the previous advancements, in this paper we gives an overview about the implementation topology and the current MPPT technologies and also discuss about them in brief and the results thus presented are very useful for the future works.

As form past decade the renewable energy resources are being promoted worldwide thus it focuses towards generating clean energy application. And photovoltaic energy is most widely used technology among all these renewable energy techniques. In this technology we convert the heat energy we get from sun into electrical energy by using photovoltaic cells which are being used with the MPPT technology to increase the output power. The main aim of using MPP in PV system is to maintain the original performing voltage of PV panels to the voltage of MPP, by managing the output power provided by inverter.

As by studying the current voltage characteristic this has been observed that the maximum power is obtained at that point where the product of current and voltage is maximum. That point where the value of power is maximum is called MPP. Thus the main of MPPT module is to take the correct decision for the operation of PV module at its MPP, by taking he maximum power available. If the condition of the system is good then the system will generate the maximum power efficiency with an effective MPPT algorithm which has been used in the system.

In literature, there are plentiful MPPT methods as in Kamarza man and Tan ; Liu et al. ; Lyden and Haque. used four categories to review MPPT algorithms as follows: hill-climbing ripple correlation current Liu et al. provides the behavior of MPPT techniques for the partial shaded situations.. Lyden et al. divided the tracking techniques to three types: conventional MPPT techniques, global MPPT techniques, and power electronics-based approaches. The complete research paper is described in five sections. The introduction is described in Section I, Section II describes literature review, Section III describes problem formulation, Performance parameter describe in section IV, Finally, Section V describes the conclusion of paper.

II. Literature Survey
This section will provide the brief description and highlights the contribution, remarks and factors of the work done by the researchers. The comparison table is given by Table 1.

<table>
<thead>
<tr>
<th>MPPT technique</th>
<th>Photovoltaic Array Depen dency</th>
<th>Sensing Device</th>
<th>Tuning of circuit</th>
<th>Circuit Design</th>
<th>Implementation complexi ty</th>
<th>Actual MPP T</th>
<th>Speed of Convergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1] Incremental conductance</td>
<td>No</td>
<td>V &amp; I</td>
<td>No</td>
<td>Digital</td>
<td>Medium</td>
<td>Yes</td>
<td>Vary</td>
</tr>
</tbody>
</table>

Table 1: Literature Review Table

Table 2 Comparison between different MPPT algorithms
PMPP voltage and the power at the maximum point, open circuit voltage VOC, short circuit current ISC, and the cell have also been displayed on the screen. By these characteristics we can display the parameters which show the operation of PV cell like open circuit voltage VOC, short circuit current ISC, and the cell voltage and the power at the maximum point, VMPP, IMPP, and PMPP, respectively.

Thus the fill factor FF and the overall efficiency η have also been consider. By FF we can manage the quality of PV array. FF is the ratio between original MPP to the product of VOC and ISC. The efficiency of an solar cell is define as the ration between output electric power to the imput solar radiation power.

### III. Problem Formulation

For the moderate and large PV system sun tracking and MPPT has been an effective method for gaining the maximum power. Among available PV systems the MPPT systems have been most widely used and famous system. We use the MPPT system to get the maximum power conditions automatically. This is because that the PV system will work to provide the maximum efficiency. The energy which is gain by the PV system is generally relied on various types of characteristics like the level of irradiance, temperature, and the partial shading. Thus these MPPT algorithms mainly based on these factors they alter these factor to get the maximum power. As the I-V and power voltage characteristics have been displayed on the screen. By these characteristics we

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Statement</th>
</tr>
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<tr>
<td>1.</td>
<td>Photovoltaic Array Dependency</td>
<td>Without or with knowledge of parameter value &amp; configuration PV array methods can be applied.</td>
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<td>2.</td>
<td>Actual Maximum</td>
<td>It means if output</td>
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### IV. Performance Parameter

A lot of parameters in the proposed technique that effect on the performance. The performance analysis is given by Table 2.
<table>
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<th>Power Tracking Technique</th>
<th>Power is less than expected power then actual MPP present. MPPT algorithm operate at maxima</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Circuit Design</td>
<td>Digital or Analog</td>
</tr>
<tr>
<td>4. Tuning of Circuit</td>
<td>Oscillation is present or not around MPP or not</td>
</tr>
<tr>
<td>5. Speed of Convergence</td>
<td>Time required to achieve MPP</td>
</tr>
<tr>
<td>6. Type of Implementation</td>
<td>Manually or Generally</td>
</tr>
<tr>
<td>7. Sensing Device</td>
<td>Variable dependency</td>
</tr>
</tbody>
</table>

V. Conclusion

In this paper we present an overview about the different 62 MPPT algorithms. Thus for the comparison among these algorithm we use the various parameters like complexity of system, sensors used, type of circuits, and the dependent nature on various parameters. Thus to allow the user to choose an effective algorithm we present the result of various techniques thus its allow user to choose the correct algorithm which fits its specifications. We also present a overview about the three widely used MPPT algorithms.

References


