Major Research Project (MRP)

Design and Development of Control Strategies for Solar Panel Automatic Tracking System

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Project Summary:

Energy crisis is the most important issue in today's world. Conventional energy resources are not only limited but also prime culprit for environmental pollution. Fossil fuels are energy sources such as coal, oil and natural gas. With this rate the world virtually depends on the supply of fossil-fuel. But the common issue presented to us is that fossil-fuels are running out. In fact it would take millions of years to completely restore the fossil fuels that we have used in just a few thousand. This means fossil fuels are non-renewable sources of energy. Renewable energy resources are getting priorities in the whole world to lessen the dependency on conventional resources.

Renewable energy comes from many commonly known sources such as solar power, wind, running water, and geothermal energy. Solar energy used to provide electricity and to provide heat. Renewable energy sources are wonderful options because they are limitless. The solar energy is widely available on the earth and every one can take the advantage of the endless energy. Because of this reason solar energy is rapidly gaining the focus as an important means of expanding renewable energy uses. Majority of solar panels in use today are stationary and therefore do not output the maximum amount of power that they can actually produce. The solar tracker follows the sun from east to west during the day. More energy is collected by controlling the solar panel to follow the sun like a sunflower. The solar tracking system is a mechatronic system that integrates electrical and mechanical systems, and computer hardware and software.

The main objective of the project includes design and development of the various control strategies on the solar panel tracking system. Mechanical tracking and electronic tracking are the important areas of research in solar plant used to extract the maximum power out of the system. The maximum power point tracking is one of the challenging fields in the renewable energy area. Maximum power point tracking (MPPT) is an algorithm implemented in solar or photovoltaic (PV) system to continuously adjust the impedance of the solar array to keep the PV system operating at, or close to, the maximum power point of the PV panel under varying conditions of environment like changing solar irradiance, temperature, and load at the output. The various MPPT algorithms are popular for tracking the maximum power in presence of varying environmental conditions.

In this project various maximum power point tracking techniques are simulated using MATLAB /SIMULINK environment. The hardware for the project is developed includes combination of solar panel array, dc-dc converter, electrical load, and MPPT controller. The duty cycle of the converter modulated as per MPPT algorithm technique to achieve the MPP of the solar panel at given environmental conditions including irradiation and temperature change and relative load change. The dc-dc boost converter acts as variable impedance between the solar panel and load.

Solar panels generate free power from the sun by converting sunlight to electricity with no moving parts, zero emissions, and no maintenance. In order to increases the use of the solar energy we need to increase the efficiency and reduce the cost. While choosing a solar system for a specific application the different point we need to take into consideration. These points directly or indirectly related with efficiency of a solar panel. Some of the important points are requirement of a power, which is directly related to the size of the solar panel, shading & shadows on solar panels, temperature & wind loading considerations. With the help of detail analysis of environment and location one can decide the solar panel mounting. In order to increase the efficiency again we need to work on comparative analysis of different control strategies.

The project mainly focuses on various control strategies that can apply to the tracking system. By studying the result of the various control strategies we can able to suggest the best control strategy in terms of accuracy and cost effective solution. By selecting proper control strategy one can effectively use the solar panel.

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