Dual Axis Solar Panel Tracker With MPPT

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1. Summary

The following report will explain the steps of design and implementation of the dual axis solar panel tracker using the maximum power point tracking unit (MPPT) in order to extract the maximum power from the PV panel.

2. Objective

- Design and build a dual axis solar panel tracker, using photoelectric tracking technique
- Design and build a MPPT unit, using the SEPIC Converter as a power electronic circuit to obtain the MPPT
- Testing and comparing the PV system's efficiency, using the fixed solar panel and the dual axis solar panel tracker

3. The PV system Block Diagram

The block diagram contains the PV panel, voltage and current sensor, power calculation, MPPT algorithm, PWM controller, DC-DC converter, and the load.

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MPPT	Contr	M offer

6. The PV System Simulation & Results

- The PV system is simulated by MATLAB SIMULINK.
- The MPPT unit is built and tested under the natural condition for several days.
- The dual axis solar panel tracker is used along as using the fixed solar panel in order to distinguish the different amount of power extracted from the PV panel under these two circumstances



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4. The Dual Axis Solar Panel Tracker Design

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- This report uses the photoelectric tracking technique to track the sun in order to receive more illumination by set the PV panel perpendicular to the sun. This reports suggests two 55g MG995 servo motors, The Arduino Uno board as a microcontroller, and four light dependent sensors to build the tracking system.
- The Arduino Uno will receive the analogue signal from the LDRs and change the angle of the servo motors in order to set the PV panel toward the sun.





Figure4: The Dual Axis Solar Panel Tracker's Mechanical Construction & MPPT Unit

5. The Maximum Power Point Tracker Unit

- On the I-V and P-V curve of a PV panel, there is an operating point that in that point PV panel produces and deliver maximum power to the load.
- The MPPT unit track this point and allows that the PV system operates at maximum power.
- The MPPT unit contains a dc-dc converter, microcontroller, and voltage and current sensors.
- Microcontroller uses an algorithm method for tracking the MPPT. Changing the duty cycle will change the input voltage of the PV system in order to track the MPPT.
- This report introduces Arduino Nano as a microcontroller, the SEPIC converter, the ACS712 half effect low current sensor, and Perturb & observe algorithm.



The dual axis solar panel tracker responds to the position of the sun, flows the sun position and sets the PV panel perpendicular to the sun. The MPPT unit has been tested for several days . The practical experiments show that the PV system with dual axis solar panel tracker extracts about 27% more power from the PV panel compare to the fixed solar panel. The efficiency of the designed PV system using tracking system is about 8% more than the PV system without tracking system. The efficiency of the PV system is about 61% it can be improved by using the more efficient PV panel, increasing the frequency and reducing the value of the inductors.