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Hybrid Automatic Solar Tracking System for Different Types of Solar Cells: A review

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Abstract

The objective of this paper is to present review on the use of different material of Solar panel in a solar tracking system at Stationary, Single Axis, Dual Axis & Hybrid Axis solar tracker to have better performance with minimum losses to the surroundings, as the solar tracker ensures maximum intensity of sun rays hitting the surface of the panel from sunrise to sunset. Solar cells are playing a role of increasing importance in household and other areas of electricity consumption. Due to the atmosphere the sun energy is not as great in the morning and evening compared to noontime.

Keywords: Solar Tracker, Three way rotating freedom mechanism, Amorphous & Crystalline Panels, Microcontroller.

Introduction

Today, awareness of using renewable energy is growing & has gained much attention nowadays. Green energy can be recycled, much like solar energy, micro hydro power, wind power, biomass energy, terrestrial heat, temperature difference of sea water, sea waves, morning and evening tidesetc. Solar energy technology is one of the promising sourcesof future energy supplies because it is clean and remarkably abundant.Solar energy can be converted into electricity through the solarcells. So far the efficiency of generating power from solar energy is relatively low. Thus, increasing the efficiency of generatingpower of solar energy is very important.The amount ofcurrent a PV panel produces has a direct correlation with the intensityof light the panel is absorbing.Solar collector systems require high-precision solar trackers to increase their photovoltaic efficiency. Solar cells are playing a role of increasing importance in household and other areas of electricity consumption. Applying solar tracking systems can increase the electric energy produced by the solar cells and enhance the overall efficiency of solar cell systems as well.

Methodology

The methodology used in the Hybrid automatic Solar Tracking system is drawn below with the help of block diagram.The primary benefit of a tracking system is to collectsolar energy for the longest period of the day, with the most accuratealignment as the sun's position shifts with the seasons.The construction of the tracker is made up of three segments, the mechanical, computer Science and electronics & electrical part respectively.

The key component of the system under above three segments is clearly mentioned in the block diagram used to convert solar energy into electricity.

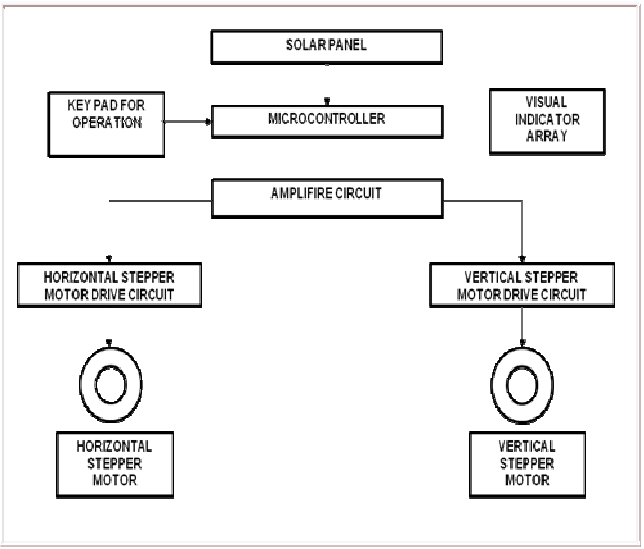

Fig. 1Block diagram of the Hybrid Automatic Solar tracking system

The project is built using a balanced concept which is two signals from the different sensors are compared. Light Dependent Resistor (LDR) as a light sensor has been used. The two light sensors are separated

by divider which will create shadow on one side of the light sensor if the solar panel is not perpendicular to the sun.

For the controlling circuit, microcontroller PIC16F877A acts as a brain that controls the movement of the motor via relay. Data received from the sensors and processed by the microcontroller. The microcontroller will send a data to the Bi-directional DC-geared motor via relay to ensure solar panel is perpendicular towards the Sun. Relay controls the rotation of the motor either to rotate clockwise or anticlockwise. The solar panel that attached to the motor will be reacted according to the direction of the motor.

Literature Review

The solar panel that many of the users use is only in a one way direction. If the sun located at the direction that is not perpendicular to the solar panel, the power that can be generate is low compare to the when the sun located exactly perpendicular to the solar panel. The sun is rotate from east to west but the highest power that can be generate by the solar panel is when location of sun is perpendicular to the solar panel. Sunlight is made of photons, small particles of energy. These photons are absorbed by and pass through the material of a solar cell or solar photovoltaic panel. The photons 'agitate' the electrons found in the material of the photovoltaic cell. As they begin to move (or are dislodged), these are 'routed' into a current. This, technically, is electricity - the movement of electrons along a path. Solar panels made of silicon to convert sunlight into electricity. Solar photovoltaic are used in a number of ways, primarily to power homes that are inter-tied or interconnected with the grid Some of the review paper for the reference topic is mentioned below-

Nur Mohammad, Tarequlkarim *[etal] 2012 [1] This paper present a microcontroller based energy efficient automatic solar- tracking system. In this paper a comparative analysis was performed using four systems, i.e. hybrid tracking, dual axis, single axis and stationary module. The result showed that the use of the dual axis tracking system produced 18% gain of power output, compared with a single axis tracking system. The gain of output power with the Hybrid tracking System was much higher 54% when compared with a stationary system inclined at 23.5 deg to the horizontal.
Journal of Solar Energy Engineering by ASME Vol. 135/011012-1

Okpeki U.K., Otuagoma.S.O*[etal] Feb 2013[2] This paper concern the design and construction of a bi-directional solar tracking system. In this research test showed that powerused by tracker system is less than the power gain by tracking the sun accurately. The most important conclusion of this research is that the total cost of construction of the tracker system is very low.
This method utilizes a cost effective International Journal of Engineering AndScience Issn: 2278-4721, Vol.2 Issue 5 (February 2013) Available online on www.Researchinventory.comPp 32-38

Saboj Kumar Ray, Md Abdul Bashar *[etal] 2012 [3] This paper represents a simple method, low cost microcontroller based solar tracker of two way of rotating freedom in order to achieve the right positioning of photovoltaic solar cell to get the much sunlight during the day light session and as a result produce more electricity.In this research a comparison has been made on a conventional solar follower plant and tracking system.
Global Journal of Research In Engineering, General Engineering Vol 12 ISSUE 4 Version 1.0 Year 2012, Publisher : Global Journals Inc. (USA) Online ISSN 2249-4596 & print ISSN: 0975-5861.

Asmarashid Ponniran1,*, AmmarHashim *[etal] 2011 [4] The objective of this paper is the development of an automatic solar tracking system in which solarpanels will keep aligned with the Sunlight in order to maximize in harvesting solar power. The system focuses on the controller design whereby itis able to tracks the maximum intensity of Sunlight is hit. When the intensity of Sunlight is decreasing, this system automatically changes its direction to get maximum intensity of Sunlight. LDR light detector acts as a sensor is used to trace the coordinate of the Sunlight by detecting brightness level of Sunlight. While to rotate the appropriate position of the panel, a DC-geared motor is used. The system is controlled by two relays as a DC-geared motordriver and a microcontroller as a main processor.Single Axis Solar Tracking System prototype model is successfully developed. The designed system is focuses on designing controller part and the main concern is to design appropriate circuits and the circuits suppose to be able to control DC-gear motor rotation direction without considering motor speed.
asmar@uthm.edu.myAsmarashidPonniran, Int. J. Of Integrated Engineering Vol. 3 No. 3 (2011) p 5-9

Adrian Catarius, Mario Christiner2010[5] This paper presents people in underprivileged countries could benefit from the use of a solar distributed generation system. To provide an efficient solar distributed generation system, a scaled down dual-axis solar tracker was designed, built and tested. At maximum, the solar tracker was perpendicular to the light source by 1.5 degrees. The built system had a calculated annual energy gain of 48.982% compared to an immobile solar panel. Compared to a single axis tracker, the dual-axis tracker had an annual energy gain of 36.504%.

A Master Qualifying Project: submitted to the faculty ofWorcester Polytechnic institute

J. Rizk, and Y. Chaiko*[etal] 2008 [6] This paper shows the potential system benefits of simple tracking solar system using a stepper motor and light sensor.This method is increasing power collection efficiency by developing a device that tracks the sun to keep the panel at a right angle to its rays. A solar tracking system is designed, implemented and experimentally tested. The design details and the experimental results are shown.
J. Rizk is with University of Western Sydney, Australia,Y. Chaiko is with Riga Technical.

Minor M. Arturo, García P. Alejandro*[etal] 2010 [7]In this work we propose an innovative system for tracking the sun which is based on the use of a commercial web cam as the sensor element. An experimental electro-mechanism was designed and developed to evaluate its accuracy and efficacy in tracking the sun under different weather conditions. The impact on the system performance caused by intermittent cloud cover and temperature changes were also analyzed. The system showed an accuracy of 0.1º and high immunity to temperature variations. It demonstrated to be able to relocate the sun, as well as extrapolate its position when it cannot be observed for a period of time.
Proceedings of the World Congress on Engineering 2010 Vol IIWCE 2010, June 30 - July 2, 2010, London, U.K.

NurKhuzairy Bin Jamaludin*[etal]2008 [8]
This project is focused to design and build the prototype of solar tracking
system that would be a starting point to build the realistic solar tracking system.
Therefore, this prototype will cover the scope as followed.

- Move 30° each and total movement that this system can do is 180°
- Using microcontroller (16F877A).
- Using stepper motor (bipolar 5 pin).
- Using Light Dependant Resistor (LDR) or Photoresistor as a sensor.
- Using 6 sensors (photoresistor) to detect and compare the solar intensity of light.

ZoltánKvasznicza, György Elmer 2006 [9]
This paper describes a preliminary optimizing investigation of a tracking system planned to be installed for the solar cells. According to the literature at least twice as much energy can be obtained with solar trackers inregions with maximum sun shine.
Institute of Information Technology and Electrical Engineering, Pollack Mihály Faculty of Engineering University of Pécs.

Yinghao Chu, PeterMeisen 2011[10]This paper not only gives a brief introduction about the fast developing solar technologies industry, but also may help us avoid long term switching cost in the future and make the solar systems performance more efficient, economical and stable.We In this work five of the most commonly studied and discussed solar technologies and reviewed their structure, performance, advantages and drawbacks. Concentrated photovoltaic systems, dye sensitized solar cells and solar thermoelectricity systems are emerging technologies under intensive study.

Jeff Muhs, Oak Ridge National Laboratory 2000 [11]This paper describes a systems-level design and analysis of a new approach for improving the energy efficiency and affordability of solar energy in buildings, namely, hybrid solar lighting and full-spectrum solar energy systems.By using different portions of the solar spectrum simultaneously for multiple end-use applications inbuildings, the proposed system offers unique advantages overother alternatives for using sunlight to displace electricity(conventional topside day lighting and solar technologies).

Matthew Wright n, AshrafUddin2012 [12] Organic materials have recently become of great interest for photo voltaic applications, due to their Potential to utilize high throughput, solution phase processing, which will lead to low cost electricity Production. Hybrid solar cells combine organic and inorganic materials with the aim of utilizing the low cost cell production of organic photovoltaic's (OPV) as well as obtaining other advantages, such a stainable absorption spectra, from the inorganic component. ARC Photo voltaic Centre of Excellence, University of New South Wales, Sydney, NSW 2052, Australia 2012 Elsevier B.V.

Conclusion

In this paper, it has been presented a solar-tracking system which is an efficient system. It can be utilize anywhere such as house-hold activities in office even in industrial purposes. Today's world is facing acute power crisis. We need to find new resource and also need to boost efficiency for the production of power from other renewable energy sources.

The use of different material of Solar panel in a solar tracking system at Stationary, Single Axis, Dual Axis & Hybrid Axis solar tracker to have better performance with minimum losses to the surroundings, as the solar tracker ensures maximum intensity of sun rays hitting the surface of the panel from sunrise to sunset.

We also need a better power system to give service to those peoplewho live in remote area. Under this circumstance, this type ofproject can give a good result when energy crisis is one of themost vital issues in the world. Solar cells are playing a role of increasing

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importance in household and other areas of electricity consumption.

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