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Dual Axis Solar Tracker using AVR

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ABSTRACT: Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. As such, it is vital that those in engineering fields understand the technologies associated with this area. In this project the design and construction of a arduino-based solar panel tracking system is included. Solar tracking allows more energy to be produced because the solar array is able to remain aligned to the sun. The solar tracker project is to keep the solar photovoltaic panel perpendicular to the sun throughout the year in order to make it more efficient. The dual axis solar photovoltaic panel takes astronomical data as reference and the tracking system has the capability to always point the solar array toward the sun and can be installed in various regions with minor modifications. The horizontal and vertical motion of the panel is obtained by taking altitude angle and azimuth angle as reference.

The aim of our projects is to utilize the maximum solar energy through solar panel. For this a digital based automatic system is proposed. This paper project helps the solar power generating equipment to get the maximum sunlight automatically thereby increasing the efficiency of the system. The solar panel tracks the sun from west to east automatically for maximum intensity of light.

KEYWORDS*:* Solar cell, solar panel, solar tracker, photocell, microcontroller, sensor, stepper motor.

I. INTRODUCTION

It is One of the most promising renewable energy sources characterized by a huge potential of conversion into electrical power is the solar energy. The conversion of solar radiation into electrical energy by Photovoltaic (PV) effect is a very promising technology, being clean, silent and reliable, with very small maintenance costs and small ecological impact. The interest in the Photovoltaic conversion systems is visibly reflected by the exponential increase of sales in this market segment with a strong growth projection for the next decades. According to recent market research reports carried out by European Photovoltaic Industry Association (EPIA), the total installed power of PV conversion equipment increased from about 1 GW in 2001 up to nearly 23 GW in 2009.

The constant research preoccupation of the technical community involved in solar energy harnessing technology refers to various solutions to increase the PV panel's conversion efficiency .PV efficiency improving solutions: solar tracking, optimization of solar cells geometry, enhancement of light trapping capability, use of new materials. In this output power produced by the PV panels depends strongly on the incident light radiation. The continuous modification of the sun-earth relative position determines a continuously changing of incident radiation on fixed PV panel. Thus an increase in output energy of a given PV panel can be obtained by mounting the panel on a solar tracking device that follows the sun trajectory. Fixed Photovoltaic panels, the mobile ones driven by solar tracker are kept under optimum isolation for all the positions of the Sun. PV cells, known commonly as solar cells ,convert the energy from sunlight into DC electricity. As PVs offer added advantages over other renewable energy sources in that they give off no noise. The tracking system must be able to follow sun with a degree of accuracy, return the collector to original position at end of the day and also track during periods of cloud over.

II. DESCRIPTION OF SOLAR PANEL

It is a large component made up of the no of photovoltaic cells connected internally with each other. Used to grab the sunlight and to convert it into the electricity. Solar panels is a device that convert light energy into electrical energy. They are sometimes called photovoltaic which means "light-electricity". Solar cells depend on the photovoltaic effect

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to absorb the energy of sun and cause current to flow between two oppositely charged layers .collection of solar cells is solar panel. The solar cells spread over a large area can provide enough useful power; solar panels have to be pointed directly at the Sun to get the most power.

III. EVOLUTION OF SOLAR TRACKER SYSTEM

Sun moves across the sky, in order to get the best angle of exposure to sunlight for collection of energy. The tracking mechanism is incorporated to the solar arrays to keep array pointed towards the sun. It is a device on which solar panels is fixed which track the direction of the sun across the sky to gather the maximum energy. When compare the price of the PV solar panels, the price of a solar tracker is low. Most of the PV solar panels are fitted in fixed location- example on the sloping roof of a house. Since the sun moves across the sky though the day, this is far from an ideal solution. Therefore evening and morning sunlight hits the panels at an acute angle reducing the amount of electricity which can be generated every day. During the day the sun appears to move across the sky from left to right and up and down above the horizon from sunrise to noon to sunset. Figure shows the schematic above of the Sun's apparent motion as seen from the Northern Hemisphere.

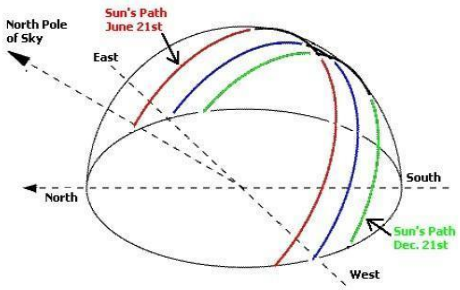

Fig. 1: Sun's apparent motion

The end-user will prefer the tracking solution rather than a fixed ground system to increase their earnings because of following;

- The efficiency increases by 30-40%.
- The space requirement for a solar park is reduced, and they keep the same output.
- The return of the investment timeline is reduced.
- The tracking system amortizes itself within 4 years.
- In terms of cost per Watt of the completed solar system, it is usually cheaper to use a solar tracker and less solar panels where space and planning permit.
- A good solar tracker can typically lead to an increase in electricity generation capacity of 30-50%.

A. *Solar tracker*-It's a device used for orienting a solar PV panel towards the sun by using the solar or light sensors connected (ex: stepper motor, servo motor). Therefore, the sun tracking systems can collect more energy than fixed panel.

B. *Necessity of Solar tracker*-

- Maximum Solar Panel Output
- Increase efficiency of the panel
- Maximum Power per unit Area
- Grab the energy throughout the day

A. *Types of Solar Trackers*-The sun's position in the sky varies both with the seasons (elevation) and time of day as the sun moves across the sky. Hence there are also two types of Solar Trackers

B. *Single axis solar trackers :* This tracker can either have a vertical or horizontal axle. Horizontal type is used in tropical regions where the sun gets very high at noon, but the days are less. Vertical type are used in high latitudes where the sun doesn't get very high, but summer days can be very long. Single axis tracking system is simplest solution and is most commonly used.

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C. Dual axis solar trackers: This tracker have both a vertical and horizontal axle and so this can track the Sun's apparent motion exactly anywhere in the World. This system is used to control astronomical telescopes, and so there is plenty of software available to automatically predict and track the motion of the sun.The efficiency of the solar panels can be increased by 30-40% by tacking of sun.Dual axis.

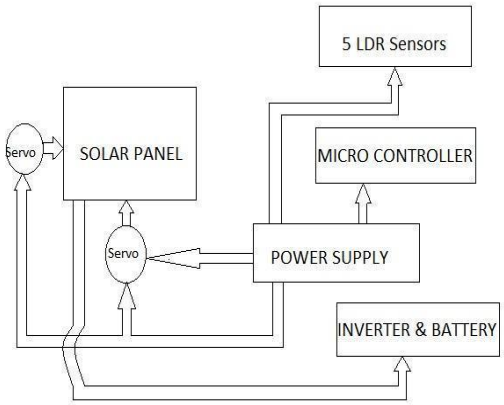

Fig.2: Block Diagram of Dual Axis Solar

IV. BLOCK DIAGRAM DESCRIPTION

A. Microcontroller: It is the major part of the system. The microcontroller controls all the operations. The solar panel is aligned according to the intensity of sunlight under the control of the microcontroller.

B. Sensor: The system consists of two sensors, each composed of LDR. One unit is made up of four LDRs. LDR sensors are placed at the every corners of the solar panel. The intensity of sunlight is sensed by the LDR and the output is sent to the controller.Control unit decides the direction in which the panel has to be move, so that it gets maximum intensity of light.

C. Servomotor: Servo motor is used for the rotation of panel in desired direction. Servo motor is controlled by the controller.

*D. Solar panel:*Solar panel is used for the conversion of solar energy into electricity. It is composed of photovoltaic cells, which convert solar energy into electrical energy.

E. Charge control: Charging of battery is controlled by charge controller. It transmits the status of battery to the microcontroller unit.

F. Battery: It is for the storage of energy received from the panel. For this purpose we have used rechargeable battery.

V. PROBLEM IDENTIFICATION & PROPOSED METHODOLOGY

The main goal of this project is to develop and implement a prototype of two-axis solar tracking system based on a microcontroller. The parabolic dish is constructed around 2 feed diameter to capture the sun's energy.The focus of the parabolic reflector is theoretically calculated down to get extremely high temperature.

This dual axis tracking system has also been constructed using ATMEGA328 microcontrollers. The temperature probes are used to measure focus of temperature of the parabolic reflector. This dual axis tracker is controlled with two 12V, 6W DC gear motors. The four light dependent sensors (LDR) are used to track the sun and to start the operation (Day/Night operation). For stepping the motor and reaching the original position of the reflector Time Delays are used. The dual axis solar tracking system is constructed with both software and hardware implementations.

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VI. CONCLUSION

In this paper an attempt has been made to implement dual axis model by using microcontroller operating on a solar panel. The design is going to extract maximum power from the sun tracking it using a dual axis solar panel. If solar panel is perpendicular to the intensity of light coming from the sun then It is possible to extract maximum power. The paper puts forward a novel approach in improving the output power as well as protection requirements for the circuit from wind and rain.

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REFERENCES

[1]S. Rahman, "Green power: what is it and where can we find it?" IEEE Power and Energy Magazine, vol. 1, no. 1, pp. 30-37,2003.

[2] D. A. Pritchard, "Sun racking by peak power positioning for photovoltaic concentrator arrays," IEEE Contr. Syst. Mag., vol. 3,no. 3, pp. 2-8, 1983. [3] A. Konar and A. K. Mandal, Microprocessor based automatic sun tracker," IEE Proc. Sci., Meas. Technol., vol. 138, no. 4, pp. 237-241,1991.

[3] B. Koyuncu and K. Balasubramanian, "A microprocessor controlled automatic sun tracker," IEEE Trans. Consumer Electron.

[4] J. D. Garrison, "A program for calculation of solar energy collection by fixed and tracking collectors," Sol. Energy, vol. 72, no. 4, pp. 241-255, 2002. vol.37, no. 4,pp. 913-917, 1991.

[5] P. P. Popat "Autonomous, low-cost, automatic window covering system for day lighting Applications," Renew. Energy. vol. 13, no. 1, pp.146,1998.

[6] J. Wen and T. F. Smith, "Absorption of solar energy in a room," Sol. Energy, vol. 72, no. 4, pp.283-297,2002.