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Dual Axis Solar Tracking System With Weather Sensor

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Abstract:

Solar power is the fastest growing means of renewable energy. The project is designed and implemented using simple dual axis solar tracker system. In order to maximize energy generation from sun, it is necessary to introduce solar tracking systems into solar power systems. A dual-axis tracker can increase energy by tracking sun rays from switching solar panel in various directions. This solar panel can rotate in all directions. This dual axis solar tracker project can also be used to sense weather, and it will be displayed on LCD. This system is powered by Arduino, consists of servo motor, stepper motor, rain drop sensor, temperature and humidity sensor and LCD.
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Keywords

1. Solar power is the fastest growing means of renewable energy. The project is designed and implemented using simple dual axis solar tracker system.

2. Introduction

The world population is increasing day by day and the demand for energy is increasing accordingly. Oil and coal as the main source of energy nowadays, is expected to end up from the world during the recent century which explores a serious problem in providing the humanity with an affordable and reliable source of energy. The need of the hour is renewable energy resources with cheap running costs. Solar energy is considered as one of the main energy resources in warm countries.

In general, India has a relatively long sunny day for more than ten months and partly cloudy sky for most of the days of the rest two months. This makes our country, especially the desert sides in the west, which include Rajasthan, Gujarat, Madhya Pradesh etc. very rich is solar energy. In general, India has a relatively long sunny day for more than ten months and partly cloudy sky for most of the days of the rest two months. This makes our country, especially the desert sides in the west, which include Rajasthan, Gujarat, Madhya Pradesh etc. very rich is solar energy. Many projects have been done on using photovoltaic cells in collecting solar radiation and converting it into electrical energy but most of these projects did not take into account the difference of the sun angle of incidence by installing the panels in a fixed orientation which influences very highly the solar energy collected by the panel. As we know that the angle of inclination ranges between -90o after sun rise and +90obefore sun set passing with 0oat noon. This makes the collected solar radiation to be 0% at sun rise and sun set and 100% at noon. This variation of solar radiations collection leads the photovoltaic panel to lose more than 40% of the collected energy. Month and at any time during the day. The position is decided by two angles in

spherical coordinates; the Altitude angle which is the angle of the sun in the vertical plane in which the sun lies, and the Azimuth angle which

represents the angle of the projected position of the sun in the horizontal plane. These two angles will be discussed deeply later in this document. Fig. 1.2 shows a curve for the relationship between the solar radiation and the solar angle of incidence. This figure shows that solar radiations falling on the solar array will be maximum when the angle of incidence on the panel is 0dergree which means that the panel is perpendicular to the sun.

3. SOLAR POWER IN INDIA

In July 2009, India unveiled a US$19 billion plan to produce 20 GW(20,000MW) of solar power by 2020. Under the plan, the use of solar-powered equipment and applications would be made compulsory in all government buildings, as well as hospitals and hotels. On November 18, 2009, it was reported that India was ready to launch its National Solar Mission under the National Action Plan on Climate Change, with plans to generate 1,000 MW of power by 2013.

Indias largest photovoltaic (PV) power plants

Reliance Power Pokaran Solar PV Plant, Rajasthan, 40MW 02011-06June 2011 Commissioning in March 2012

AdaniBitta Solar Plant, Gujarat, 40MW 02011-06 June 2011 To be Completed December 2011

Moser Baer - Patan, Gujarat,30MW 02011-06 June 2011 Commissioned July 2011

Azure Power - Sabarkantha, Gujarat, 10MW 02011-06 June2011 Commissioned June 2011

Green Infra Solar Energy Limited - Rajkot, Gujarat, 10M W 02011-11-29 November 29, 2 011 Commissioned November 2011

The daily average solar energy incident over India varies from 4 to 7 kWh/m2with about 1500–2000 sunshine hours per year (depending upon location), which is far more than current total energy consumption. For example, assuming the efficiency of PV modules were as low as 10%, this would still be a thousand times greater than the domestic electricity demand projected for 2015.

Gujarat government has signed a MoU with Clinton Foundation to build the world's largest solar-power plant in the region. The 3,000-megawatt plant near the border between India and Pakistan would be one of four planned by the initiative, a William J. Clinton Foundation program to promote renewable energy. The other proposed sites are in California, South Africa, and Australia.

3 LITERATURE REVIEW:

The main review of this project work is

Sun-synchronous navigation is related to moving the solar powered rover(robot) in such a way that its solar panel always points toward the sun and which results into maximum battery charging and hence the rover can work for long hours. The unique feature of this solar tracking system is that instead of taking the earth as its reference, it takes the sun as a guiding source. Its active sensors constantly monitor the sunlight and rotate the panel towards the direction where the intensity of sunlight is maximum. The light dependent resistor's do the job of sensing the change in the position of the Sun. The control circuit does the job of fetching the input from the sensor and gives command to the motor to run in order to tackle the change in the position of the sun. By using this system the additional energy generated is around 25% to 30% with very less consumption by the system itself. The paper gives the design and implementation of a fuzzy logic computer controlled sun tracking system to enhance the power output of photo voltaic solar panels. The tracking system was driven by two permanent magnet DC motors to provide motion of the PV panels in two axis. The project describes the use of a arduino based design methodology of an automatic solar

tracker. Light dependent resistors are used as the sensors of the solar tracker. The tracking system maximizes solar cell output by positioning a solar panel at the point of maximum light intensity. This paper describe the use of DC motors, special motors like stepper motors, servo motors, real time actuators, to operate moving parts of the solar tracker. The system was designed as the normal line of solar cell always move parallel to the rays of the sun. The Aim of this project is to develop and implement a prototype of two-axis solar tracking system based on a arduino. The parabolic reflector or parabolic dish is constructed around two feed diameter to capture the sun's energy. The focus of the parabolic reflector is pointed to a small area to get extremely high temperature. The temperature at the focus of the parabolic reflector is measured with temperature probes. This auto-tracking system is controlled with two 12V, 6W DC gear box motors. The five light sensors (LDR) are used to track the sun and to start the operation (Day/Night operation). The paper adopts the PWM DC motor controller. It is capable of archiving the timeliness, reliability and stability of motor speed control, which is difficult to implement in traditional analog controller. The project concentrates on the design and control of dual axis orientation system for the photovoltaic solar panels. The orientation system calculations are based on astronomical data and the system is assumed to be valid for any region with small modifications. The system is designed to control the Altitude angle in the vertical plane as well as the Azimuth angle in the horizontal plane of the photo voltaic panel workspace. And this system is expected to save more than 40% of the total energy of the panels by keeping the panel's face perpendicular to the sun. In the previous solutions, each tracking direction is controlled by using a Sun sensor made by a pair of phototransistors. The single matrix Sun sensor (MSS) controls both axes of the tracking system. The inspiration for the MSS is the antique solar clock. MSS comprises 8 photo resistors and a cylinder The difference between a shaded photo resistor cell and a lighted cell is recognized using an electronic circuit and corresponding output voltage signals are given to the DC motors which will move the array toward sun. In order to improve the solar tracking accuracy, the author comes up with combining program control and sensor control. Program control includes calendar-check tracking and the local longitude, latitude and time, to calculate the solar altitude and solar azimuth by SCM (single-chip microcomputer), servomotor is used to adjust the attitude of the solar panel. Sensor control is that sun ray is detected by photoelectric detector and then the changed signal is transmitted to control step motor to adjust the attitude of the solar. The paper discusses the technology options, their current status and opportunities and challenges in developing solar thermal power plants in the context of India. The National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's energy security challenge. It will also constitute a major contribution by India to the global effort to meet the challenges of climate change

4. AIM OF THE PROJECT:

The aim of the 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 vertical and horizontal motion of the panel is obtained by taking altitude angle and azimuth angle as reference. The fuzzy controller has been used to control the position of DC motors. The mathematical simulation control of dual axis solar tracking system ensures the point to point motion of the DC motors while tracking the sun.

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