Dual axis solar Power Tracking using Arduino

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Abstract: Solar energy is rapidly advancing as an important means of renewable energy resource. It is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis. Trackers direct solar panels or modules toward the sun. These devices change their orientation throughout the day to follow the sun's path to maximize energy capture..

Keywords: .Dual axis,Maximum power tracking,solar panel,Aurdino.

1. Inroduction

Sun is an abundant source of energy and this solar energy can be harnesses successfully using solar photovoltaic cells and photovoltaic effect to convert energy into electrical energy. But the conversion efficiency of a normal PV cell is low. One of the main reason for this is that the output of PV cell is dependent directly on the light intensity and with the position of sun in the sky changing continuously from time to time, the absorption efficiency of an immobile solar panel would be significantly less at certain time day and year, for the solar photovoltaic cells are maximum productive when they are perpendicular to the sun and less productive otherwise. So to maximize the energy generation and improve the efficiency solar trackers are required. The solar tracker also provided lucrative solution for third world countries to integrate it into their solar system with a comparatively low cost through software based solution. The study revealed that use of stepper motor enables accurate tracking of sun and LDR resistors used to determine the solar light intensity. Researchers concluded that embedding the tracking system with solar panel can response accurate and applicable to meet the power demands at different operational conditions.

Panel can response accurate and applicable to meet the power demands at different operational conditions. A solar tracking system designed with microcontroller and LDR's that actively track the sun and change its position accordingly to maximize the energy output. The LDR incorporated on solar panel helps to detect sunlight which in turn moves the panel accordingly

2. TYPES OF SOLAR POWER TRACKING:

- **Fixed solar power tracking**

  Fixed Tilt Arrays are arrays of Solar Panels placed at a fixed angle which is usually the optimum tilt. To obtain maximum efficiency from the solar panels they need to be pointed in the direction that captures the most sun. Fixed tilt arrays, being immobile, are simple in construction, easy to design and maintain. Since they have no moving parts, fixed systems are resilient and need little maintenance. This system won't be optimally aligned. This means it will produce less energy.

- **Single axis solar power tracking**

  Single axis trackers have one degree of freedom that acts as an axis of rotation. The axis of rotation of single axis trackers is typically aligned along a true North meridian. It is possible to align them in any cardinal direction with advanced tracking algorithms. There are several common implementations of single axis trackers. These include horizontal single axis trackers, horizontal single axis tracker with tilted modules, vertical single axis trackers, tilted single axis trackers and polar aligned single axis trackers. The orientation of the module with respect to the tracker axis is important when modeling performance. The horizontal type is used in tropical regions where the sun gets very high at noon but the days are short. On the other hand, the vertical type is used in high latitudes where the sun is not very high but summer days can be very long.

- **Dual axis solar power tracking:**

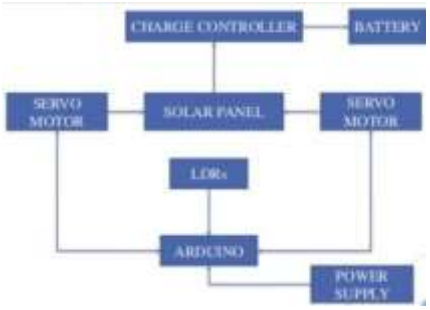
  Dual axis trackers have two degrees of freedom that act as axes of rotation. These axes are typically normal to one another. The axis that is fixed with respect to the ground can be considered a primary axis. The axis that is referenced to the primary axis can be considered a secondary axis. There are several common implementations of dual axis trackers. They are classified by the orientation of their primary axes with respect to the ground.

  Two common implementations are tip-tilt dual axis trackers and azimuth-altitude dual axis trackers.

  The orientation of the module with respect to the tracker axis is important when modeling performance. Dual axis trackers typically have modules oriented parallel to the secondary axis of rotation. No matter where the Sun is in the sky, dual axis trackers are able to angle themselves to be in direct contact with the Sun.

3 FUNTIONAL BLOCK DAIGRAM:

The main aim of the proposed system is to develop a cost effective instrument using an Arduino Microcontroller based solar tracking system using Bluetooth module for detection of voltage and getting the result in android app. Block diagram of complete system is shown in Fig. below which consists of power supply, Arduino Uno, LDR sensor, servo motor, and solar panel.



Hardware Implementation:

4.1 Flow chart process:

The given flow chart shows the order of steps taken in the process for designing and working of solar tracking system. The system is designed in order to respond to the sunlight incident on the solar panel, according to which the movement of solar panel is done. Working of system is controlled by arduino microcontroller.

From the flow chart it can be seen that initially the position of both the motors is being set after that the voltage of LDR is checked. After this process the orientation of sun is being estimated, according to which the sunlight falls on the LDR. There are four LDR used on four sides of solar panel at which sunlight falls, out of these two work for horizontal and two works for vertical movement of panel. The voltages of x axis sensors are compared as well as y axis sensors, as a result of which the panel moves in clockwise/anticlockwise or upward/downward direction. The direction of movement of panel is always in the direction of maximum sun light. So, the solar tracker provides higher efficiency

4.2 COMPARISSION OF FIXED, SINGLE AND DUAL AXIS SOLAR POWER TRACKING:

Time	Fixed array	Single axis	Dual axis
8:00	0.15	0.45	0.92
9:00	0.87	0.54	19.19
10:00	16.89	20.24	30.89
11:00	20.18	22.25	32.51
12:00	19.24	19.61	33.56
13:00	20.25	26.77	36.94
14:00	14.71	17.76	29.58
15:00	16.36	18.25	27.57
16:00	8.44	18.89	26.40
17:00	1.09	8.76	24.67
18:00	0.70	1.026	7.46

5.. Hardware Set up:

Conclusion

The proposed dual axis solar tracker automatically tracks position of sun and maximise the solar power with help of arduino. As compared to single axis, dual-axis system provide high abundant electrical energy output when compared to the fixed mount system. The Dual axis tracker is having more efficiency. The main aim of this work is to develop two axis solar tracker system that uses four sensors(ldr s) to predict the sun position.

Secondly, program is dumped on to Arduino (ATmega 328 p) so that rotation of servo motor can be controlled by employing the microcontroller. The programming part consists of 5 cases which has been stated and analyzed. Thirdly, to investigate the voltage differences from the sensor (light depending resistor LDR) based on intensity of light received by the sensor. The output has plotted into a graph and compared with static system. And proposed system is eco friendly, and widely used.

References

[1] Berberi, P., S. Thodhorjani, P. Hoxha, and V. Muda. 2013. Photovoltaics: between a bright outlook and uncertainty. Energy Sci. Eng. 1:72–80.

[2] Chakraborty, S., P. K. Sadhu, and N. Pal. 2015. Technical mapping of solar PV for ISM- an approach

[3] M.D.Singh and Khanchandani: “Power Electronics

[4] www. arduino.cc

[5] C. Hua and C. Shen (1998) Comparative study of peak power “ tracking techniques for solar storage system’’, Applied Power Electronics Conference and Exposition, vol. 2, pp. 679-685.

[6] Chin, C.S., Babu, A. and McBride, W. (2011) Design, Modeling and Testing of a Standalone Single Axis Active Solar Tracker Using MATLAB Renewable Energy, 36, 3075-3090.