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Dual Axis Solar Tracker using Arduino

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***Abstract*: The variation in the solar energy occur daily due to variation in day night cycle and also because of seasonal variations throughout the year. Population of the world is increasing very rapidly. From past decade of years, the non-renewable energy sources like coal and oil are extinguishing and so it become serious problem for providing he reliable energy to the world. But solar energy plays important source of primary energy. In this project we propose dual axis solar tracking system by which it is possible to catch maximum amount of solar energy by using Arduino as main processing unit.**

***Keywords*: Dual axis solar tracker, Arduino, LDR Sensor, DC gear motor.**

1. Introduction

In the present scenario the variation in the climatic changes have reached the critical level. The main reasons for climatic changes are due to natural causes and man-made destructions like global warming and greenhouse gases are effecting the climatic conditions around the world.

In the past decade of years there is increase in demand for reliable and abundant electrical energy derived from renewable energy sources renewable energy plays important role in energy crisis of country. The government started to decrease the usage of conventional energy sources and encouraging people to use renewable energy sources like hydro and solar. One such example of renewable energy is solar power. Solar energy is a very large, inexhaustible source of energy. The reason is sun is only source we can find anywhere it anywhere. The solar power received by the earth is approximately 1.8*1011MW.The system will tend maximize the amount of power Absorbed by Photo voltaic systems. It has been found that making the use of a Dual axis tracking system, over a fixed system, can increase the power output by 40% - 60%. Solar energy systems have emerged as a possible source of renewable energy over the past two or three decades, and are now utilized for a variety of household and industrial applications. Such systems are based on a solar collector, it designed to collect the sun's energy and to convert it into either electrical power or thermal energy. In general, the power developed in such applications depends upon the amount of solar energy captured by the collector, and thus the difficulty of developing tracking schemes capable of following the trajectory of the sun throughout the course of the day year-wound basis has received significant courage in this project.

2. Solar tracker

Solar tracker is a device which is used to collect the solar energy emitted by the sun. Solar tracking is Nothing but changing position of panel with respect to sun. usually photo voltaic module assembled in solar tracker is more powerful than critical irradiance in the fixed system. Solar trackers are classified on basis of performance, coast respectively. by tracking system, we can catch 40-50% more efficiency compared to fixed panel. Among them dual axis provides increased efficiency of 48% as compared with single axis tracker. Advantage of Dual axis trackers are catching the position of the sun anywhere in the sky due to seasonal variations. The following figures represent solar tracking systems.

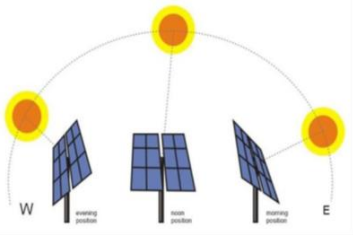

Fig. 1. Solar tracker

3. Hardware requirement

Since it is hard ware-based project the main components are light dependent resistors (LDR), Servo motors, Arduino as main controller.

A. Light dependent resistor(LDR)

Fig. 2. Light dependent resistor

LDR Are also named as photo conductors (or) photo resistors. Which works on the principal of photo conductivity.

LDR resistance decrease with increase in light intensity and vice versa. LDR's are mainly used for sensing purpose in order to catch the solar energy and provide analog input to Arduino.

B. Solar panel

Solar energy is the photovoltaic cell which convert light energy received from sun into electrical energy. The name behind "solar" panel is they grab high powerful energy emitted from the sun. The solar panel finds its applications in street lights, domestic and industrial areas.

Fig. 3. Solar panel

C. Arduino

Arduino is the type of microcontroller. The purpose of microcontroller is to control the position of motor. so At mega 328p microcontroller is used. Arduino consist of 6 analog inputs and 14 digital i/o ports out of them 6 acts as pwm signals. In addition to this it consist of 16 MHZcrystal oscillator, a USB cable through which program is dumped. And arduino get powerd by the power jack. Advantages of arduino is low cost, roubst construction and platform independent.

Fig. 4. Arduino

D. DC gear motor

Fig. 5. DC gear motor

An electric gear motor is an electrical machine that converts electrical energy into mechanical energy. The reverse of this is the conversion of mechanical energy into electrical energy and is done by an electric generator, which has much in common with a motor. Most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force. In certain applications, such as in regenerative braking with traction motors in the transportation industry, electric motors can also be used in reverse as generators to convert mechanical energy into electric power.

4. Implementation

A. Block diagram

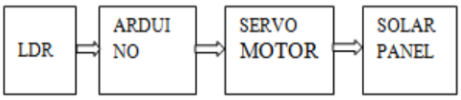

Fig. 6. Block diagram

The principle of the solar tracking system is done by Light Dependant Resistor (LDR). Four LDR's are connected to Arduino analog pin AO to A4 that acts as the input for the system. The built-in Analog-to-Digital Converter will convert the analog value of LDR and convert it into digital. The inputs are from analog value of LDR, Arduino as the controller and the DC motor will be the output. LDR1 and LDR2, LDR3 and LDR4 are taken as pair. If one of the LDR in a pair gets more light intensity than the other, a difference will occur on node voltages sent to the respective Arduino channel to take necessary action. The DC motor will move the solar panel to the position of the high intensity LDR that was in the programming.

B. Circuit diagram

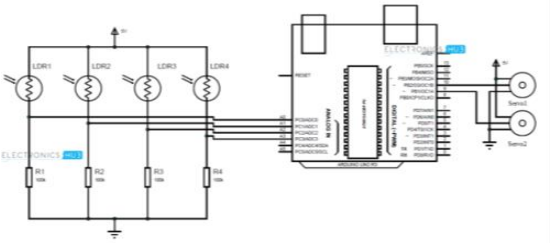

Fig. 7. Circuit diagram

5. Results

The following tables shows voltage drawn by solar panel with and without tracking respectively.

Table 1
Results

Time	Voltage without tracking	Voltage with tracking
11:00AM	12V	14.4V
12:00PM	12.56V	12.78V
1:00PM	12.1V	13.5V
2:00PM	11.4V	14.3V
3:00PM	12.4V	13.5V
4:00PM	12V	13.5V

6. Conclusion

The proposed dual axis solar tracker automatically tracks position of sun and maximize the solar power with help of

Arduino. As compared to single axis, dual-axis system provides 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.

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