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Two Axis with Four Sensors Solar Tracking System

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Abstract - *The main purpose of the system is to raise up the heating potentiality of solar tracking system to get maximum power. To construct and enact elementary and inexpensive solar tracker using light dependent resistor (LDR) with original aspect suppressed the solar panel, two motor and LDR sensor module and ball-joint and electronic circuit. Two axis with four sensors solar tracking system (altitude angle along with azimuth angle) is installed over Arduino UNO controller based on Sun Earth Geometry. It is shows that two axis with four sensor solar tracking system gives more output power than fixed solar power system. The solar collector plate with two axis should always be normal to the incident radiation of sun to get the maximum extraction of energy from the sun. As the sun changes its position, solar panel also get change with respect to incident radiation of sun. The energy ability of photovoltaic panel increases essentially with solar tracking system. Two axis solar tracker is more reliable, automatic system and highly efficient than fixed solar system*

Key Words: **Arduino UNO, Azimuth Angle, Dual-Axis Solar Tracking System, Elevation Angle, LDR, Photovoltaic (PV) Panel**

1. INTRODUCTION

As we all knows that the solar energy is renewable energy source. It is the endless part of the energy source. Solar panels are generally used for the generation of the electricity. To increase its efficiency than its without tracking system for electricity generation, solar tracking should be used. This solar tracking system is cheap in cost. The tracking system are of two types viz. single axis and dual axis solar tracking system. Solar tracking is the moving mechanism of solar panel according to incidence of light. Single axis system having single direction movement with respect to sun path and the dual tracking system is moved with the incidence of high light radiation by changing its position in any direction. It does not have any restrictions of movement except the high light intensity. Dual axis system is the new prototype of tracking system. The mechanism is done by using four LDR which used to remove the errors of altitude and azimuth angle. Also two angle sensors are used to check whether the present position of the plate with earth surface.

The Sun's rays spectrum is very wide from 150nm to 4000nm wavelength [1]. Visible are only the rays with wavelength in range 400 to 800nm [2]. So our electronic device used to increase power generation of photovoltaic panel by 20 to 40% without wasting much time than fixed plate for same amount of power generation.

2. Literature Survey

A solar tracker is a device used for placed a photovoltaic array solar panel or for concentrating solar reflector or lens toward the sun. The position of the sun in the atmosphere is varied both with seasons and time of day as the sun moves across the sky. Solar powered component work best when they are pointed at the sun. Therefore, a solar tracker increases how efficient such equipment are over any fixed position at the cost of additional intricate to the system. There are different types of trackers. Extraction of usable electricity from the sun became possible with the discovery of the photoelectric mechanism and ensuing development of the solar cell. The solar cell is a semiconductor material which converts visible light into heat and to the direct current. Through the use of solar arrays, a series of solar cells electrically connected, there is generation of a DC voltage that can be used on a load or stored in battery for further use. There is an increased use of solar arrays as their efficiencies become maximum. They are specially popular in remote areas where there is no connection to the grid. Photovoltaic energy is that which is acquired from the sun. A photovoltaic cell, commonly known as a solar cell, is the technology used for conversion of solar directly into electrical power. The photovoltaic cell is a non mechanical device made of silicon alloy. The photovoltaic cell is the simple building block of a photovoltaic system. The individual cells can vary from 0.5 inches to 4 inches across. One cell can however produce only 1 or 2 watts that is not enough for most small or electronics appliances. Performance of a photovoltaic array depends on sunlight. Climatic conditions like clouds and fog notably affect the amount of solar energy that is received by the array and therefore its performance. Most of the PV modules are between 10% and 20% efficient [3].

Fig.1: Solar Cell

3. OBJECTIVE

The main objective of the prototype of solar tracking is to track the ultraviolet light rays to solar panel to get the maximum output. The system prove that the tracking indeed increases the efficiency considerably. The range of increase in efficiency is expected up to 40% than fix system at the same time.

4. METHODOLOGY

The elevation angle is used interchangeably with altitude angle and is the angular height of the sun in the sky measured from the horizontal. Both altitude and elevation are used for description of the height in meters above the sea level. The elevation is 0 degrees at sunrise and 90 degrees when the sun is directly perpendicular to the solar plate. The angle of elevation varies throughout the day and also depends on latitude of the particular location and the day of the year. According to position sun panel also can be change its angle with the surface. The solar tracking prototype composed of hardware as well as software part. In hardware part, the system consists of solar panel, gears, DC motors, motor drive, battery, electronic circuit of Arduino UNO, LDR, resistors, diode, etc. And for the software system, computer programming of Arduino is being provided according to our construction and requirement for controlling of motors.

4.1. LDR

Fig.2: LDR

LDR is photo conductivity, that is nothing but an optical phenomenon. When the light is absorbed by the material then the conductivity of the material reduces. When the light falls on the LDR, then the electrons in the valence band of the material are eager to the conduction band. It is act as a sensor.

4.2. DC BO MOTOR

Fig.3: BO Motor

Low-cost geared DC Motor. It is an alternative to our metal gear DC motor. It comes with an operating voltage of 3 to 12V and is perfect for building small and medium electronics project. Available with 60 and 150 RPM. This motor set is inexpensive, small, easy to install. Small shaft with matching wheels gives an optimized design for your application. Mounting holes on the body & light weight makes it suitable for in-circuit placement. This motor can be used with 69mm Diameter Wheel for Plastic Gear Motors and 87mm Diameter Multipurpose Wheel for Plastic Gear Motors.

4.3. ARDUINO UNO

Fig.4 Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. For the electronic circuit, the pins of Arduino UNO A0, A1, A2, A3 are used to give command to the system.

4.4. MOTOR DRIVER

Fig.5: Motor Driver LN298

Motor drivers acts as an interface between the motors and the control circuits. Motor require high amount of current whereas the controller circuit works on low current signals. So the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor.

The main working of the system is as shown in circuit diagram of fig.6

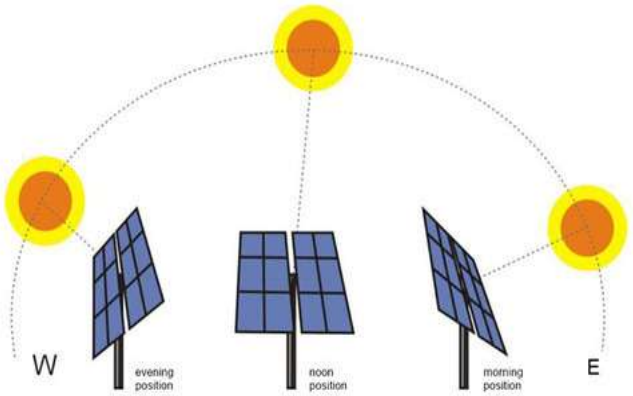

Fig.6: Changing position of Solar panel

5. BLOCK DIAGRAM

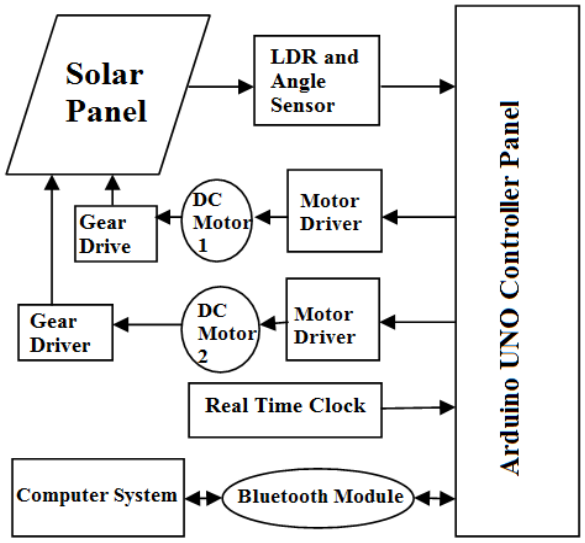

Fig.7 Block Diagram of Solar Tracking Prototype

6. WORKING

The dual axis solar tracking system is placed over the support which can move the solar panel according to our application. This support will move the plate by using gear driver which is connected to the BO motor having the pre-installed gears. The mechanism of the gear is to control the speed of the motor. BO motor is the DC motor which helps to rotate the solar panel. Over the solar plate, four LDR placed which helps to track the high intensity light according to which the solar panel starts moving. In this prototype, the pins of Arduino UNO i.e. A0, A1, A2, A3 are used which directly connected to LDR and resistors of 1KΩ. The LDR and resistors are connected in parallel with each other to provide the sufficient current to the electronic device. The Arduino UNO are instructed by the program having while loop statement as this solar panel can be continues to rotate. When the light of ultraviolet rays incident on the LDR, it acts as sensor which gives the input of high and low current value in 0 and 1 form. Consider, if LDR1 have high light intensity then it will sense the light intensity and give command to the Arduino. This Arduino will instruct to the motor to rotate over the side of LDR1 position where it is being placed. The same this process gets continues according to light effect. The input stage is designed with a voltage divider circuit so that it gives desired range of illumination for bright illumination conditions or when there is dim lighting. This made it possible to get readings when there is cloudy weather. For the steady position purpose, the real time clock system is provide which will give pause and rotate mechanism to motor through the electronic circuit. As we are providing two motors with four LDR then it will rotate in any direction i.e. East, West, North as well as South direction. And energy will produce 40% more than the fix plate. This power will stored in Battery in the form of DC supply.

7. CONCLUSION

A solar panel that tracks the sun was designed and executed. The required program was provided to give required actions to solar plate. While dual axis trackers are more efficient in tracking the sun. Dual trackers are most suitable in regions during changing in the position of the sun.

As this system requires cheap circuitry, it is beneficial to install such prototype to all the solar panel. According to study, the solar panel will be in continue in working condition in day time with the maximum intensity of light so it will gives the generation of maximum power. This is the eco-friendly system and long lasting without any investment after installation because it is the endless energy source. This energy source will stored in battery and the stored energy used as a street lighting and domestic purpose.

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