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Automatic Sun Tracking and Cleaning Solar Panel

Mahima Patil[1], Manali Patil[2], Neha Hulle[3], Smita Parlekar[4], Monika Mangave[5], Shailesh Bhise[6]
[1,2,3,4]*Student, Department of Electronics and Telecommunication, Latthe Polytechnic, Sangli, India*
[5]*Lecturer, Department of Electronics and Telecommunication, Latthe Polytechnic, Sangli, India*
[6]*Professor & HoD, Department of Electronics and Telecommunication, Latthe Polytechnic, Sangli, India*

***Abstract*: Now a day's solar power is very helpful in our everyday life. This power is used in many ways such as homemade electrical appliances, vehicles, satellites and industries etc. The title of this project is "Automatic Solar Cleaner and Solar Tracking Based on Arduino". In simple terms this project's objective is to have a solar panel outputting its maximum possible power all day long, this occurs when the panel tracks the sun and rotates the accordingly, to receive sunlight to the fullest extent always during the day time. This movement is achieved by installing a couple of servo motors with the solar panel that changes its direction according to the positioning of the sun. There are basically three major parts of this project, sensor, Arduino and two servo motors. ATmega328 Arduino have been used for this purpose. It receives sensor output signal and controls servo motors according to the assigned program. One servo motor is used horizontally to move the panel upward and downward. The other is used vertically from left to right direction. As the solar panel is connected in servo motor so the position of solar panel is same to the servo motor. Since the maximum solar ray is fallen down on the solar panel module so that the maximum power output can be achieved.**

***Keywords*: IR (Infrared sensor), LDR(Light Dependent Resister)**

1. Introduction

Energy is the prime factor for the development of a nation. An enormous amount of energy is extracted, distributed, converted and consumed in the global society daily. 85% of energy production is dependent on fossil fuels. The resources of the fossil fuels are limited and their use results in global warming due to emission of greenhouse gases. To provide a sustainable power production and safe world to the future generation, there is a growing demand for energy from renewable sources like solar, wind, geothermal and ocean tidal wave.

Solar panels directly convert solar radiation into electrical energy. Solar panel is mainly made from semiconductor materials. Si used as the major component of solar panels, which is maximum 24.5% efficient. Increasing the cell efficiency, maximizing the power output and employing a tracking system with solar panel are three ways to increase the overall efficiency of the solar panel. Improvement of solar cell efficiency is an ongoing research work and people throughout the world are actively doing research on this.

Solar tracking approaches can be implemented by using single-axis schemes, and Dual-axis structures for higher accuracy systems. In general, the single-axis tracker with one degree of freedom follows the Sun's movement from the east to west during a day while a dual-axis tracker also follows the elevation angle of the Sun. In recent years, there has been a growing Volume of research concerned with dual-axis solar tracking systems. However, in the existing research, most of them used two stepper motors to perform dual-axis solar tracking. With two tracking motors designs, two motors were mounted on perpendicular axes, and even aligned them in certain directions. In some cases, both motors could not move at the same time.

Also in this proposed system automatic solar panel cleaning is implemented. In industries where large number of solar panels is used, the output power of solar is reduced due to dust also so, there is necessary to clean the panel. Here they manually clean the power. But in this project solar panel is going to be cleaned automatically. Here IR sensor is used to detect the dust. As the dust comes in path of the IR sensor it sends high signal to the Arduino and the cleaning process starts and if there is no dust present on the panel of solar then IR sensor sends the low signal to the Arduino and no process is carried out.

Solar energy is the term used for the heat and light which the sunlight contains. As sunlight reaches to earth in the form of photons. Photons are nothing but energy packets that contain light in it. Solar energy is considered as a renewable energy source because it does not destroy our eco system and it is present naturally in the environment free of cost.

2. Literature review

[1]. Bhavesh Pandey, Anita Agrawal "Automatic Sun Tracking System Using PSoC", IJIRSET,Nov 2012: Author has described uses a PSoC device to control a small model of solar tracker.

[2] Muhammed Faheem Khan,Rana Liaqat Ali "Automatic Sun tracking System (ASTS)" May 2005, Author has proposed ASTS is a hybrid hardware / software prototype.

[3] Neha Soni, Chirag Arya, Er. Kamlesh Kumar,"

Automatic Sun Tracking System" IJSER, May 2015, Author have presented use of 8051 microcontroller and stepper motor to move solar panel according to position of sun. Photo resistors are also used to detect light intensity.

[4] Pratik Kumar Das, Mir Ahasan Habib, Mohammed Mynuddin," Microcontroller Based Automatic Solar Tracking System with Mirror Booster" IJSGE 2015 This paper deals with the design and construction of solar tracking system by using a stepper motor, gear motor, photo diode.

3. Proposed work

A. *Methodology*

Automatic Solar tracking & auto cleaning is done as shown in Fig. 1.

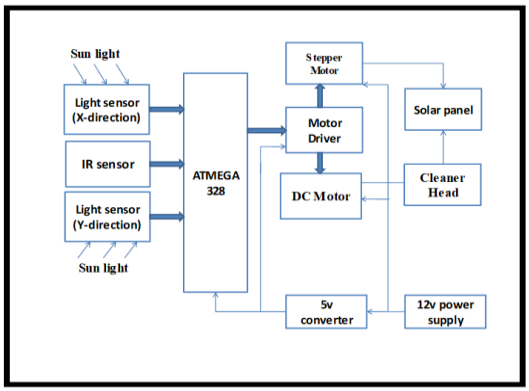

Fig. 1. Block diagram of proposed system

The proposed system works as follows:

- *Tracking:* Solar tracker provides three ways of operation and control mechanism through the programmer written in microcontroller.
- *Normal day light condition:* Two photo resistors are used in the solar tracker to compare the output voltages from two junctions. As the sun rotates from east to west in the day time, AIN0 needs to provide higher voltage than AIN1 to sense the rotation of the sun. This condition is considered as normal day light condition and tracker rotates the panel 3.75° after every 15 minutes.
- *Bad weather condition:* When the sky gets cloudy, there will be less striking of light on both the photo resistors and so sufficient voltages might not be available at junction point. The difference of voltage at junction point will not be greater than the threshold value to rotate the tracker. At the meantime, sun continues rotating in the western direction. To solve this problem, a short delay is provided which will check for voltage input from junction point in every 1.5 minutes. Microcontroller will use the variable Count to check for consecutively 10 times to make the 'wait' state equal to 15 minutes (moderate delay) to rotate the stepper motor one step.
- *Bidirectional rotation:* At day time, the solar tracker will rotate in only one direction from east to west. Variable (I) will count the total rotation in day time and that is approximately calculated as 40 rotations considering 150° rotation. When the sun sets, no more rotation is needed in western direction. For the next day, the solar panel needs to go to the initial position in the morning to track the sun's position again. To do so, the variable (I) that counts the number of rotation in the day time will work out. When the variable (I) shows value greater than 40, the tracker stops rotating in the western direction and rotates reversely in the eastern direction to set the tracker to the initial position for the next day. When it goes to initial position, power supply to the tracker will be turned off and the tracker will be in stand by till sunlight in the next morning.

B. *Advantage of Tracker*

The main aim to use a solar tracker is to reduce the cost of the energy we want to capture. Tracker generates more power over longer time than secondary array with same number of modules.

C. *Cleaning*

In cleaning first IR sensor detects the dust on panel. If the sensor gives 1 signal to microcontroller means no dust accumulated or its density does not affect solar panel performance. When it gives 0 to controller means need to remove dust by cleaning mechanism. Microcontroller take action as per programmed in uploaded in it. It drives the drive mechanism within control of limit sensors and make one complete cycle for cleaning After further check IR module check for dust on panel if it is clean then wait for dust to be accumulated as on cycle is going on.

D. *Resources required*

For Tracking

- Solar panel
- Stepper Motor
- Arduino
- LDR

For Cleaning

- *IR Sensor:* used for detecting dust on solar panel
- *Arduino Uno:* Open source low cost micro controller
- *Driver:* 12volt dc motor driver.

4. Conclusion

There are many benefits from such system. Firstly, economical benefit, where there is no more money will be paid to a cleaning agency. Second, it is time saving, where there is no time will be spent to clean those solar panels. Besides that, frequently cleaning will ensure that the solar panel works with a good transmittance. Finally, safety and health of workers in

sites. Since robots are capable of working in hazardous environments, more dangerous operations are being handled by robots. Thus the safety and health of workers is ensured, thereby reducing expenditures on health and medicines.

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