Advancement on Single Axis Sun Tracking System with Automatic Cleaning of Solar Panels using Arduino Atmega

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Abstract: The main purpose of this paper is to build an automatic system for solar panels so, that the system will provide better alignment and a better cleaning mechanism. The proposed system will change the direction of the panels in a dual-axis to trace the sunlight with the help of sensors. This system helps to improve the tracking ability of the panel's inefficient way and cleaning of panels on a regular basis. The Dual-axis system has superiority over the single-axis solar tracker system.

Keywords: Photovoltaic Panels, Arduino Atmega, Light Dependent Resistor.

INTRODUCTION:

In this Universe there are various kinds of energy sources are present. But Sun is the most promising energy source in this world. Solar energy is a mixture of heat and radiation. Solar energy is present in abundance. It is an inexhaustible source of energy. There are many problems associated with the use of this energy as the availability varies widely with time. This occurs due to the rotation of the Earth in its orbit. So, to rectify this problem solar panels have to capture the sunlight in a maximum amount in the daytime. The old arrangement of solar panels traps most of the sunlight in the noontime only when the Sun is above or nearly perpendicular to the surface of the panels. There is a need for such a system with solar panels to capture the maximum amount of sun rays to produce maximum energy. This can be done by using solar trackers to track the path of the Sun to trap the maximum amount of sunlight. Many types of solar trackers are available, but the dual-axis tracker system tracks the Sun in both the axis. This dual-axis tracker system helps the panels to adjust their alignment according to the Sun's direction. This tracker system tracks the Sun with the help of sensors i.e. LDR (Light Dependent Resistors). Due to this system, the panels can traps the sunlight from sunrise to sunset. This helps the panels to increase the efficiency with some percentage.

Panels efficiency is decreased due to the dust and dirt which gets accumulated on the surface of panels and covers the solar cells to capture the sunlight. The other problems occur during the old cleaning method there is a risk of human life and accidents occur during the traditional human cleaning method. There is a need for such a system that avoids the risk of life and which reduces the time for cleaning. So, there is a need for an automatic cleaning system that uses water to clean the surface of the panels. This system helps to clean the panels in every equal interval of time. Due to the problems of tracking and cleaning we are tried to make a tracking plus cleaning system. So, the proposed system helps to increase the panel's efficiency by simultaneous tracking and cleaning of the panels to reduce the manpower and avoid accidents that occurs during the cleaning of the solar panels manually.

A)   Design and construction of Dual Tracking System :

Design and construction of a solar tracking system, In this tracking system we have arranged a proper gear for dual-axis for tilled a PV panel toward the sun. LDR sensors are mounted at the side edges of the PV panel and when sunrise happens in the morning PV panels change their location towards the sun. According to light intensity on PV panel is a decrease it means sun rays are not properly incident on PV panel that time sensors are calibrated and compare their received values and give an indication to the controller for changing a panel direction.

Setup has two parts (i) Electronic sensors (ii) Mechanical Mechanism

(i)   Electronic Sensors: Here, We are using four LDR i.e. LDR1, LDR2, LDR3 LDR4. If there is any intensity difference between the four LDR then they produce signals. These signals reach the controller and then it is evaluated here. Then required are reaches to the motor which is attached to the mechanism of tracking and the motor rotates the PV Panel. The panel rotates according to this control signal and the movement of the PV panel stops at the position where it directly faces the Sun.

(ii)   Mechanical Mechanism: Setup is fabricated to rotate the panel about two axes, horizontal and vertical axis. Gear arrangement is used for rotation of a vertical axis and horizontal axis with attached with this a motor for functioning this mechanism PV panel is placed on 'H' shaped frame. And this arrangement is looked like an 'I' shaped frame. This frame is easily placed on any hard surface as shown in fig 1.
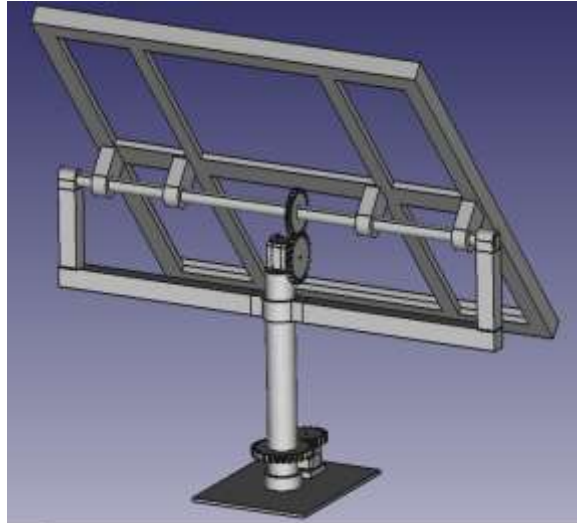

Fig.1. Illustration of Sun Tracking System[10]

A)   Cleaning System :

Traditionally, the cleaning of the solar panels done manually using the human labour. Due to this, there is a risk of human lives, damage to panels, movement difficulties, etc. To overcome these difficulties arises due to traditional cleaning method and also to create a productive, non-comparable and to avoid the traditional manual cleaning system. This automatic cleaning system cleans the solar panels in such a way that there is no involvement of human labour and reduces the chances of accidents and risk of human life and damage of solar panels. This automatic cleaning system enhances the efficiency of the solar panels as the dust accumulated doesn't harm the panels and most of the sunlight gets trapped by the panels to produce a maximum amount electric energy through solar energy.

The efficiency of the panels are checked when there is accumulation of dust on the panels after 1 week or 2 weeks and the efficiency of panels are checked after cleaning the solar panels for se time intervals. After comparing both the efficiencies, we can show that the efficiency of the solar panels increases when the panels are cleaned after regular interval of time in a day.

Fig.No.2: Cleaning Arrangement[11]

So, the main motive of this project is to traps maximum amount of solar energy in a day bay tracking the sun direction and to protect he panels and increase it's efficiency by cleaning the panels without damaging the panels and avoiding the risk and the accidents occur during the traditional manual method.

OBJECTIVES OF THIS PROJECT:

• To maximise the use of solar radiation for production of solar power.
• To avoid the risk created through the manual cleaning.
• To clean panels efficiently.
• To avoid the dust related problems on the panels.
• To track the Sun's direction in throughout the day.
• To make the system automated using the Arduino Atmega.

APPLICATIONS:

1. Photovoltaic power stations
2. Rooftop solar PV systems
3. Standalone PV system
4. Solar vehicles
5. Solar panels on spacecraft and space stations
6. Solar planes
7. Solar hybrid power systems
8. The main application of solar tracking system with automatic cleaning mechanism is in desert areas where accommodation of dust is frequent on solar panel.
9. In Solar power plants which are located near to mining area

FUTURE SCOPE:

The proposed paper gives an brief idea about the dual axis solar tracker system with automatic cleaning system. This system will provides the solar panels to get the proper orientation and alignment towards the Sun as the LDR sensors plays a vital role in tracking the sun's path the efficiency of the panels get increases as the panels. Collect more energy from the sunlight during whole day from sunrise to sunset. Also automatic Cleaning of solar panels avoids the risk of accidents and there is less accumulation of dust and dirt because of regular interval cleaning.

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