SELF TRACKING SOLAR PANEL

[1]Akhil Lalu, [2]Ancy Davis, [3]Jemin Joseph, [4]Maria Joy

[1234]Department of Computer Science and Engineering

[1234]Sahrdaya College of Engineering and Technology Kodakara,
Thrissur
Affiliated to APJ Abdul Kalam Technological University

Abstract— In modern solar tracking systems, the solar panelsare fixed on a structure that moves according to the position of the sun. LDRs are used as the main light sensors. Two servo motors are fixed to the solar panels structure that holds the solar panel. The program for solar panel usingArduino is uploaded to the microcontroller. The working of the project is as follows. LDRs sense the how many amount of sunlight falling on them. Four LDRs are divided into different parts such as top, bottom, left and right. For east – west tracking, the analog values are sense from two top LDRs and two bottom LDRs are compared and if the top set of LDRs receive more light when the vertical servo will move in that direction. If the bottom LDRs receive more light when the servo moves in that direction. For angular deflection of the solar panel, the rotation from the analog values from two left LDRs and two right LDRs are compared. If the left set of LDRs receive more light than the right LDRs, the horizontal servo will move in that direction. If the right set of LDRs receives more light, the servo moves in that direction.

I. INTRODUCTION

Solar panels are devices that convert light energy into electricity. A solar panel is a large collection of solar cells. Large number of small solar cells spread over a large area can work together. That can provide enough power to be useful. The light that hits on a cell, the more electricity it produces. Though solar panel produces enough electricity, they need a direct impact of rays to get maximum of its production. The LDRs placed on the corners of the solar panel detect the inclined direction of light. The Arduino calculate the angle from the analog signals from the LDRs. According to angle the Arduino generate values to rotate the servo motors. So the two servo motors rotate in such a way that the direction of solar panel changes in such a way that the panels are perpendicular to direction of light.So the Solar Trackers generate more electricity than their stationary solar panelsdue to increased direct hiting to solar rays. This increases can be as much as 10 to 25% depending on the geographic location of the tracking system. The solution to the daylight issue is to include storage batteries-this enables the solar power system to store all power generated by solar panels to be stored on the batteries for later use. Solar energy panels use a lot of space compared to simply drawing electricity from the grid. Solar energy panels require solar inverters.

One of the most promising renewable energy sources characterized by a large potential of conversion into electrical power is the solar energy. The output power produced by the solar panels strongly on the incident light radiation. The continuous modification of the sun-earth relative position determines a continuously changing of incident radiations on a fixed solar panel. The point of maximum received energy is reached energy is reached when the direction of solar radiation is perpendicular on the panel surface. Thus an increase of the output energy of a given solar panel can be obtained by the panel on a solar tracking device that follows the sun trajectory.

II. DRAWBACKS OF EXISTING SYSTEM

- A natural consequence of the solar panels are that it cannot generate electricity at night.
- The solution to the daylight issue is to include storage batteries-this enables the solar power system to store all power generated by solar panels to be stored on the batteries for later use.
- Solar energy panels use a lot of space compared to simply drawing electricity from the grid.
- Solar energy panels require solar inverters.

III. SYSTEM STUDY

A. Existing system-

The solar panels are fixed in a position and it can absorb the radiations when the Sun reaches in the line of sight. A natural consequence of the solar panels is that it cannot generate electricity at night. The solution to the daylight issue is to include storage batteries-this enables the solar power system to store all power generated by solar panels to be stored on the batteries for later use. Solar energy panels use a lot of space compared to simply drawing electricity from the grid. Solar energy panels require solar inverters.

B .Proposed system-

A Solar tracker is an automated solar panel which actually follows by the sun to get maximum power. Even though a fixed and rotatable flat-panel can be set to collect a high proportion of available noon-time energy. More power is available in the early mornings and late afternoons when the misalignment with a fixed panel becomes excessive energy to collect a reasonable proportion of available energy. In the proposed system the Solar Panel is automated by using LDRs and Arduinomicrocontroller.The LDRs placed on the corners of the solar panel detect the inclined direction of light. The Arduino calculate the angle from the analog signals from the LDRs. According to angle the Arduino generate values to rotate the servo motors. So the two servo motors rotate in such a way that the direction of solar panel changes in such a way that the panels are perpendicular to direction of light. The continuous modification of the sun-earth relative position determines a continuously changing of incident radiations on a fixed solar panel. The point of maximum received energy is reached energy is reached when the direction of solar radiation is perpendicular on the panel surface. Thus an increase of the output energy of a given solar panel can be obtained by the panel on a solar tracking device that follows the sun trajectory.

IV. SYSTEM DESIGN

A. System architecture-

In figure.4.1 the LDRs are connected to 5V Vcc through the series resistors 100K each. The output from the LDRs is connected to A0, A1, A2 and A3 pins of the Arduino board. Two servo motors are connected to the output pins 9 and 10 respectively of the Arduino board. Servo motors are connected 5V Vcc. When the intensity of light falling on the LDRs changes the resistance values of the LDRs will change. The change in the resistance makes the voltage across the LDRs change. These voltages are given to the analog input pins of the Arduino board. The Arduino board is programmed in such a way that servo motor turns in a direction which gives maximum sunlight intensity on solar panels.

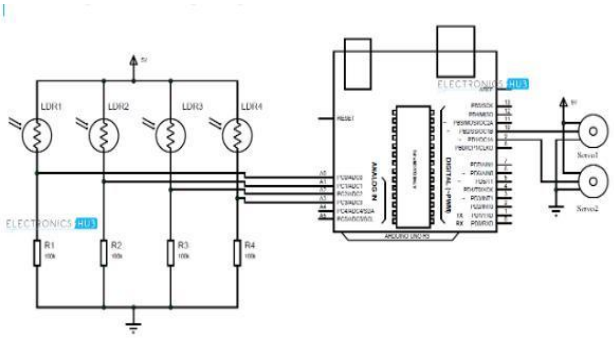

Figure 4.1-System Architecture

The system operation is explained in the use case diagram of figure 4.2. The resistance value of the LDR is changed by the intensity of light falling on them. The intensity of the light will be maximum when the LDRs are directly aligned towards the sun. Corresponding to this the output energy of the solar panel will be maximum. If the LDRs are not completely aligned to the sun the resistance of the LDRs will be different, thereby the voltage across the LDR will be different. The difference in the voltage across the LDRs is used by the Arduino board to rotate servo motor in such a direction that the LDRs are correctly aligned towards the sun. This will make the solar panel also align towards the sun thereby maximizing the output power. This is illustrated in the use case diagram above. The output energy of the solar panel can be used to charge the battery

. Figure 4.2-Use case diagram

V. METHOD

sunlight on to the photoreceptors on the solar panel. All of this maximize the amount of solar energy collected from the sun within a specific time frame; thus, increasing the efficiency of solar panel is absorbing solar energy by at least 15%. In future, a battery is connected to the solar panel to fully charge it in 8 hours.

The sun tracking solar panel consists of two LDRs, solar panel and a servo motor and ATmega328 microcontroller. It consist of Four light dependent resistors are arranged on the edges of the solar panel. Light dependend resistors produce low resistance when light falls on them. The servo motor connected to the panel rotates the panel in the direction of sun. Panel is arranged in such a way that light on two LDRs is compared and panel is rotated towards LDR which have high intensity that is low resistance compared to other. Servo motor rotates the panel at certain angle. When the intensity of the light falling on right LDR is more, panel slowly moves towards left. In the noon time, sun is ahead and intensity of light on both the panels is same. In such case, panel is constant and there is no rotation.

Advantages:-

- Solar tracker generate more electricity than their stationary solar panels due to increased direct hitting on to the solar rays.
  - This increase can be as much as 10 to 25 %.
- Solar trackers generate more electricity in roughly, same amount of space needed for fixed and tilt systems, making them ideal for optimizing land usage.

VI. CONCLUSION

Current design of the solar panels is stationary and absorbs very less energy. From the design of experimental set up with Micro Controller Based Solar Tracking system using stepper motor if we compere tracking by the use of LDR with fixed solar panel system we found that the efficiency of micro controller based solar tracking system is improved by 30-45% and it was found that all the parts of the experimental setup are giving good results. The require power is used to run the motor by using step-down T/F by using 220V AC. Moreover, this tracking system can track the sun in a continuous manner. And this system is more efficient and cost efficient in long run. From the results it is found that, by automatic tracking, there is 30% gain in increase of efficiency when compared with non-tracking system. The solar tracker will be enhanced additional features like rain protection and wind protection .

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