Design & Development of Dual Axis Solar Tracking System to Get Optimum Power

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Abstract - In the recent decades have seen that non conventional energy sources are becoming widely spread in all over the world. Our sun is also a very good source of energy. Our challenge that to optimum power capture from the sun rays from the sun conversion into electricity. The efficiency of solar panel can be maximized by tracking the solar panel with the sun. In this project the sun tracking system, offers a convenient and reliable method of aligning a solar panel with the sun on dual axis. This project is based on ATmega328p microcontroller and a special mechanical arrangement for solar tracking system.

Key words: ATmega328p Microcontroller, Stepper motor, DC Motor, LDR sensor, ADC, Solar panel.

I. INTRODUCTION

Energy is one of the major factor for the economic development of any country. With the rapid increase in population create energy crisis. One of the way to solve this problem if we use Renewable energy sources. Solar energy one of the most popular renewable energy source. It is clean, cheap, abundantly available energy. This energy is captured by solar collectors to produce thermal effect or to produce electricity by means of photovoltaic cells.

One of the most challenging phase to collect maximize sun rays to get highest output efficiency. In order to get maximize efficiency from the solar panels, that need is to keep the panels always perpendicular with the sun. In this paper used dual axis solar tracking system to get highest power output from the solar energy. The solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems.

II. METHODS AND MATERIAL

There are many different components being used to track sun rays. This system is combination of microcontroller and electronic circuit. The basic components of this project are

Solar panel, Stepper motor, DC Motor, ATmega328p microcontroller, L293D, ULN2803, Analog to Digital Converter (ADC), Light dependent register (LDR).

III. BLOCK DIAGRAM

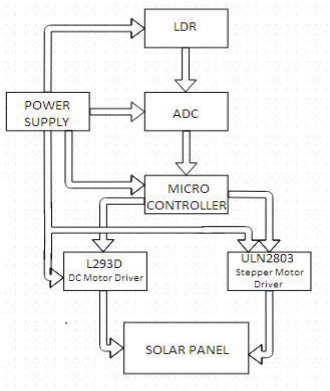


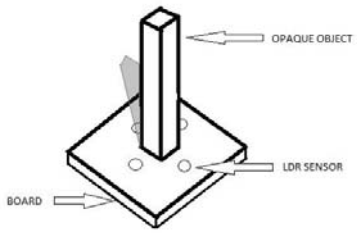
Fig. 1 Block diagram of solar tracking system

IV. OBJECTIVES

In environmental concern solar energy one of the best energy sources in all over world. One of the best way to get optimum solar energy by tracking sun rays. In fixed plate or single axis solar tracking system is not sufficient to get maximize output electrical energy. In this concern dual axis solar tracking system is perfect for collect sun rays and gets optimum energy. Block diagram of solar tracking system as shown in figure 1.

V. METHODOLOGY

To develop a dual axis sun tracking system Light dependent resistors (LDR) are use as light sensing element .We are using two 12 volt motors one is geared stepper motor another is geared dc motor. Stepper motor is used for east-west tracking and a geared dc motor with a threaded rod for linear up down motion for north-south movement. The four ldr's are sensing the light intensity as shown in figure 2. For tracking a sun movement dual axis is necessary. In that way we can get optimum power of solar energy. The main objective of this paper is to improve the power gain by accurate tracking of the sun. The daily motion of the sun to appear in east to west direction over the earth on the other hand annual motion of sun to differ 23.5 degree in east west direction. So we can't get optimum efficiency by a single tracking system. In this project L293D and ULN2803A used for conversion binary data to mechanical data.



LDR Sense position
figure. 2

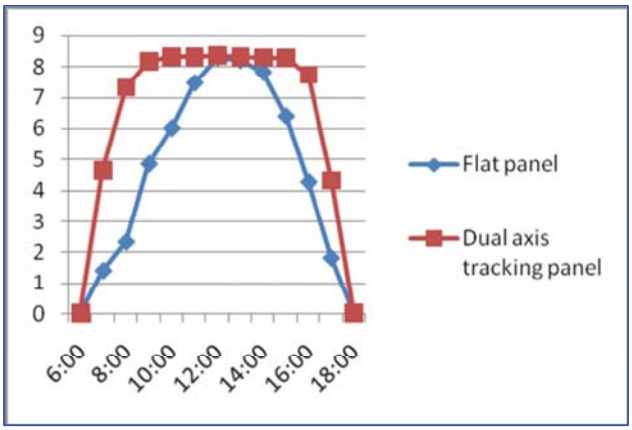
In this project ATmega328p microcontroller is the main control unit of the whole system. The output from the light comparison unit comes to input of the microcontroller which determines direction of the movement of the motors in both axis.

VI. EXPERIMENTAL SETUP

Table 1 shows the output values voltages received from both the static and dual axis tracking panel for different times in a day. From this table it is seen that output voltage of dual axis solar tracker is much efficient compare to the fixed solar plate except at 12 noon. Figure 3 shows the graphical representation of dual axis solar tracking system vs fixed plate system and it is represent that how much efficiently work dual axis solar tracking system.

Time	Flat panel	Dual axis tracking panel
6:00	0	0
7:00	1.40	4.63
8:00	2.33	7.31
9:00	4.85	8.16
10:00	6.01	8.31
11:00	7.47	8.31
12:00	8.29	8.36
13:00	8.20	8.32
14:00	7.82	8.29
15:00	6.39	8.27
16:00	4.27	7.72
17:00	1.81	4.32
18:00	0	0

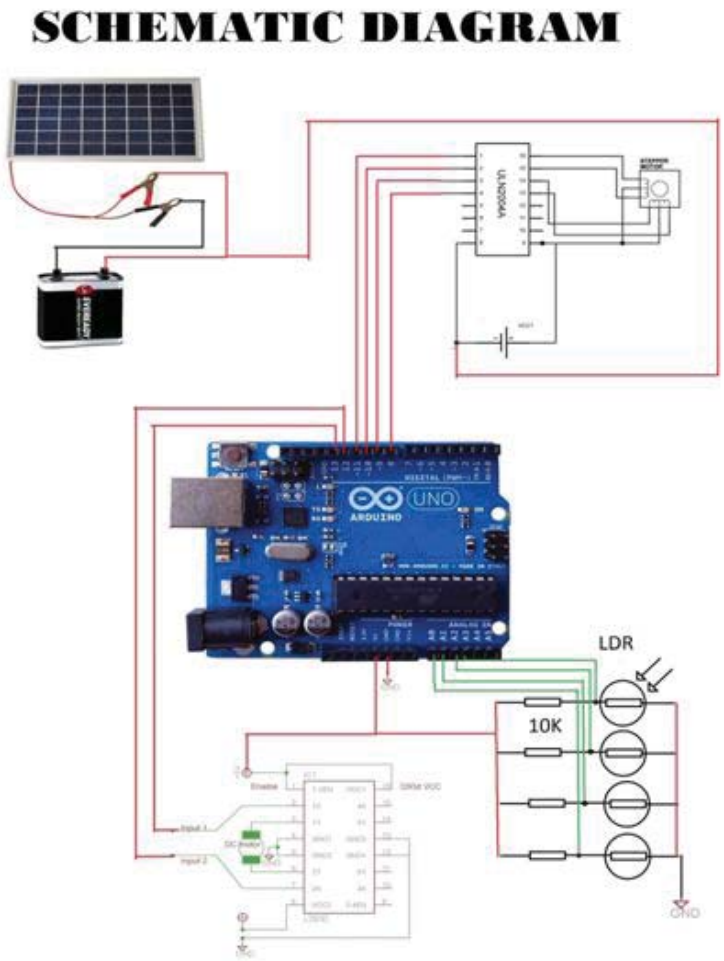
OUTPUT VALUES IN THE FORM OF VOLTAGES (VOLT) AND TIME (HOUR)
Table 1



Graphical Representation
Figure 3

VII. SCHEMATIC DIAGRAM

The schematic diagram of dual axis solar tracking system as shown in figure 4.



Schematic Diagram of dual axis solar tracking system
Figure 4

VIII. RESULT

Efficient energy from the sun is gained by the solar panels. And track the position of the sun by using the LDRs. One geared stepper motors and a geared DC motor are used to move the solar panel so that sun's beam is able to remain aligned with the solar panel and get optimum power.

IX. CONCLUSION

This project, the dual axis sun tracking system is developed based on Arduino Uno ATmega328p microcontroller as shown in figure 5. The microcontroller ATmega328p based circuit is used in this system with a minimum number of components and the use of stepper motor and DC Motor enables accurate tracking of the sun rays. After verifying the information obtained in the data table section and in plotted graph, It has been shown that the dual axis sun tracking systems can collect maximum output energy than a fixed panel system. This tracker achieves highest efficiency through this tracking system.

Snapshoot of dual axis solar tracking system
Figure 5

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