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DUAL AXIS SOLAR TRACKING SYSTEM FOR MAXIMUM POWER USING ARDUINO

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ABSTRACT

This paper deals with a microcontroller based Dual Axis Solar Tracker with a view to grab maximum solar energy. The utility of a tracking system greatly improves the power gain from solar radiation. Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. Development of solar panel tracking systems has been progressed several years now. As the sun moves across the sky during the day, the solar tracking system is advantageous. Dual axis solar tracker trail the location of the sun anywhere in the sky. To produce the maximum amount of energy, a solar panel must be perpendicular to the light source. Because the sun moves both throughout the day as well as throughout the year, a solar panel must be able to trace the sun's movement to produce the maximum possible power.

Keywords: Solar System, Solar Panel, Microcontroller Atmega328, LDR, DC Motor, Power Supply, Battery

I. INTRODUCTION

In recent decades there is increase in demand for reliable and clean form of electricity derived from renewable energy sources. One such example is solar power. The system will tend to maximize the amount of power absorbed by Photo Voltaic systems. It has been found that making the use of a Dual axis tracking system, over a fixed system, can increase the power output by 40% - 60%. Solar energy systems have emerged as a possible source of renewable energy over the past two or three decades, and are now utilized for a variety of household and industrial applications. Such systems are based on a solar collector, it designed to collect the sun's energy and to convert it into either electrical power or thermal energy. In general, the power developed in such applications depends upon the amount of solar energy captured by the collector, and thus the difficulty of developing tracking schemes capable of following the trajectory of the sun throughout the course of the day on a year-round basis has received significant coverage in this system. The Block diagram of the system is shown in figure 1.1 below.

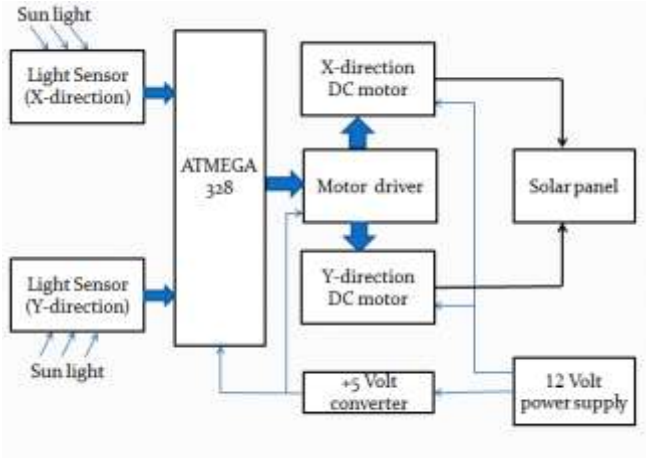

Figure 1: Block Diagram of system

The required power supply for all sections will be obtained by using power supply circuit. Block diagram of power supply is shown in figure bellow.

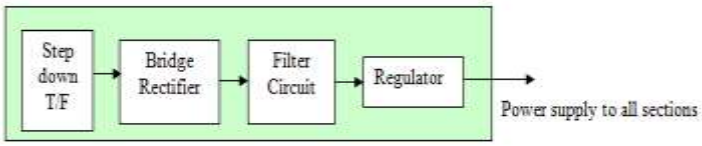

Figure 2: Power Supply block diagram

II. TRACKING PRINCIPLE

Many other methods have been proposed and used to trace the position of the sun. The simplest of all uses an LDR – a Light Dependent Resistor use to detect light intensity changes on the surface of the resistor. The proper and efficient use of LDR reduces the overall cost as well. The resistivity of LDR decreases significantly with increasing illumination. Figure 2(a) shows the general resistivity vs. illumination plot of an LDR.

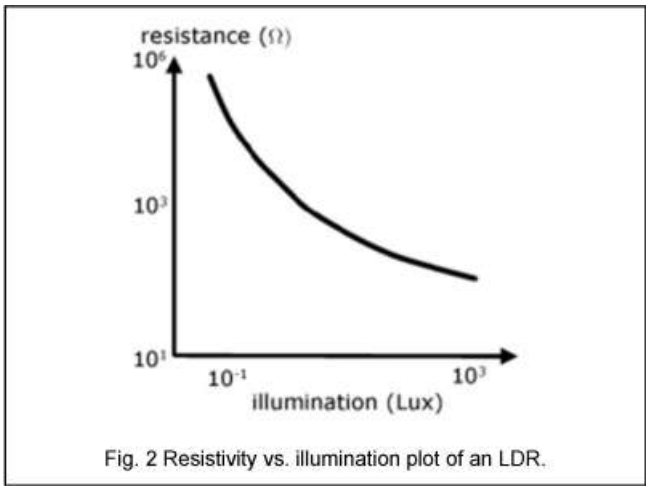

Figure 2(a): Resistivity vs. illumination plot of an LDR

III. WORKING PRINCIPLE

In the setup of the hardware for the greater utilization of this project, the LDRs must be placed on the surface of a large curvature. And the process should be done so that any immediate two LDRs remain active at a time. And the dc motor will follow the bit pattern and the solar panel connected on the shaft of the dc motor will always face the sun normally. The LDR combination plays the important role. Actually these combinations of signals are fed to the microcontroller and this directs the motor connected to it. The required bit pattern is shown in Table1.

LDR 1	LDR 2	LDR 3	LDR 4
1	1	0	0
0	1	1	0
0	0	1	1
1	0	0	1

Table1: Desired Bit Pattern

When the stepper motor gets the last bit pattern of the table, the stepper motor will move to its initial position and follow these steps again, as the sun traverse from the beginning in next day. Then the output of solar panel is given to the lead Acid battery. The dc power from battery is given as an input to the Inverter, which converts it into an alternating power so that it can be used by home appliances and for Industrial purpose also. The proposed system will be as shown in figure below.

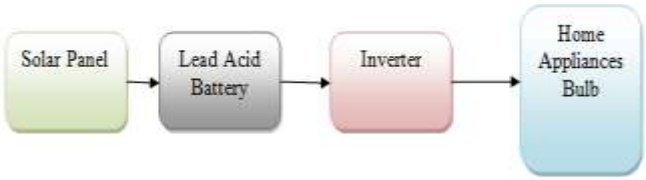

Figure 3: Block Diagram at output side

IV. COMPONENTS USED

The major components used in the system are as follows.

1. Solar Panel
2. Microcontroller
3. LDRs
4. Motor Driver L293D
5. DC Motor
6. Lead Acid Battery
7. Inverter

Other auxiliary components are-

1. Resistor (10KΩ. 1KΩ.)

2. Capacitor (10µF, 33pF)

3. Crystal oscillator (11.0592 MHz)

4. 12V and 5V power supply

There are four types of solar panel available at present as,

Polycrystalline

Monocrystalline

Hybrid

All Black

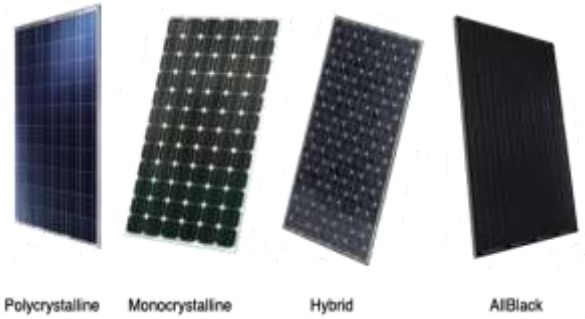

Figure 4: Types of Solar Panel

V. CIRCUIT DIAGRAM

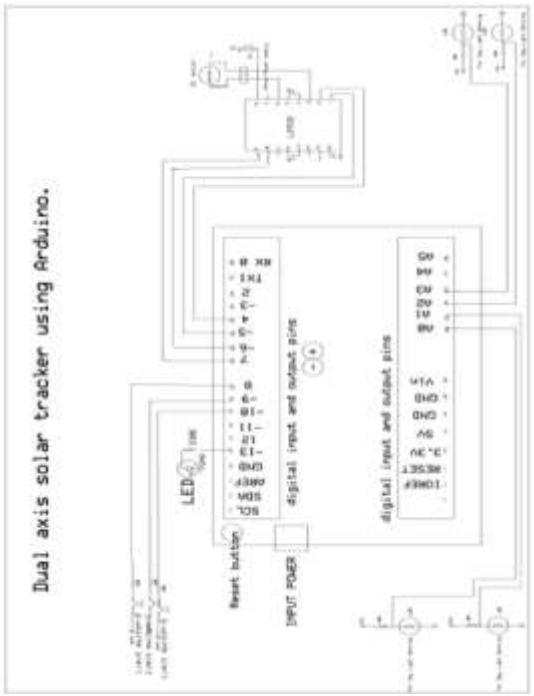

Figure 5: Circuit Diagram of Dual axis solar Tracker

Dual axis solar tracking system for maximum power by using Arduino is proposed. This microcontroller unit controls the movement of a solar panel that rotates and traces the direction of the sun. There are two limit

switches attached to the panel to mark its maximum angular positions in the west and east. The status of the limit switches is read by the microprocessor and point out that the maximum angular position in either direction has been reached and the panel should not be driven any further. And third limit switch is used to point out its angular position horizontally (i.e.360º). As the plane of the panel is always kept prevalent to the direction of the sun, maximum thermal energy is obtained from the solar panel.

The Arduino Board used here is shown in Figure below

Figure 6: Arduino Board

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing).

Table 1: Features

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage(limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
Clock Speed	16 MHz
SRAM	2 KB (ATmega328)

VI. ADVANTAGES

- Solar Power is pollution free during use.
- Solar power more efficient compared to normal arrangement.
- High degree of accuracy.
- Once the initial capital cost of building a solar power plant has been spent, operating costs are extremely low compared to existing power technologies.
- The power obtained by solar tracking is almost constant over a period of time when compared with the output obtained by panel without tracking.

VII. CONCLUSION

The proposed solar tracker automatically tracks the sun capturing maximum solar power with help of microcontroller. The system tracks the sun both in good and bad weather condition. There is still improvement requires for this system and further research can be carried out to further develop the system.

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