Scientific Journal Impact Factor (SJIF) : 3.518
International Journal of Modern Trends in Engineering and Research
ISSN (ONLINE) : 2349 - 9745 ISSN (PRINT) : 2393 - 8161

DUAL AXIS SOLAR TRACKER USING ARDUINO FOR MAXIMUM POWER TRACKING

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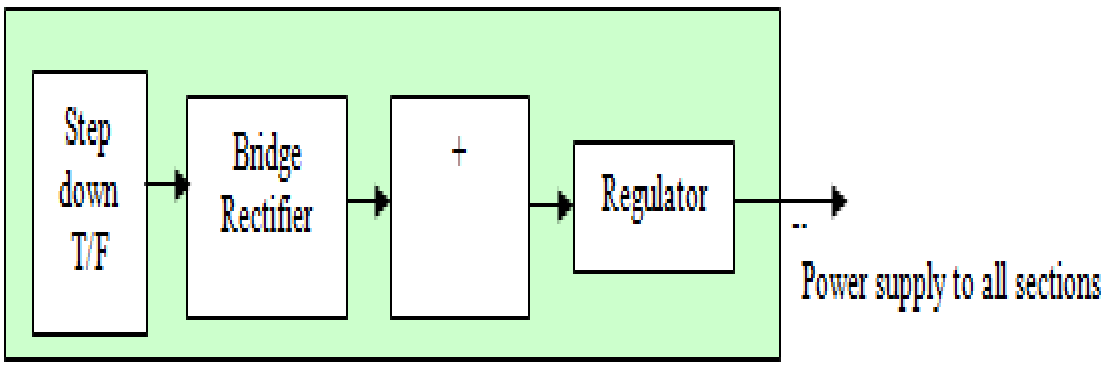
Abstract— This paper focuses on a microcontroller based Dual Axis Solar Tracker with a view to grab maximum solar energy. As the tracking system is being used, it greatly improves the power gain from solar radiation. The process of development of solar panel tracking systems has been ongoing for several years now. By considering sun's movement across the sky during the day, the solar tracking system is advantageous. Proposed dual axis solar tracker tracks the location of the sun anywhere in the sky. For producing the maximum amount of solar energy, a solar panel must always be perpendicular to the source of light. Because the sun moves in two manners such that, throughout the day as well as throughout the year, a solar panel must be able to follow the movement of the sun with a view to produce the maximum possible power.

Keywords— Solar system, solar panel, microcontroller ATmega328, LDR, DC motor, power supply, battery

I. INTRODUCTION

In recent decades the demand for effective as well as pure(pollution free) form of electricity derived from nonconventional energy sources has been increased. The best example of renewable source is solar power. The system aims to maximize the amount of power absorbed by Photo Voltaic systems. It has been found that 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 viable source of renewable energy over the past two or three decades, and now a days broadly used for a variety of industrial and domestic applications. These systems are based on a solar collector, which has been designed to collect the sun's energy and to convert it into either electrical power or thermal energy. Generally, the power developed in such applications depends fundamentally upon the amount of solar energy captured by the collector, and thus the problem to develop tracking schemes capable of following the sun's trajectory throughout the course of the day and throughout year has received good coverage in this system. The required power supply for all sections will be obtained by using power supply circuit. Fig ure bellow shows the block diagram of regulated dc power supply.



The Block diagram of the system is shown in figure 2 below.

Figure 1: Power Supply block diagram

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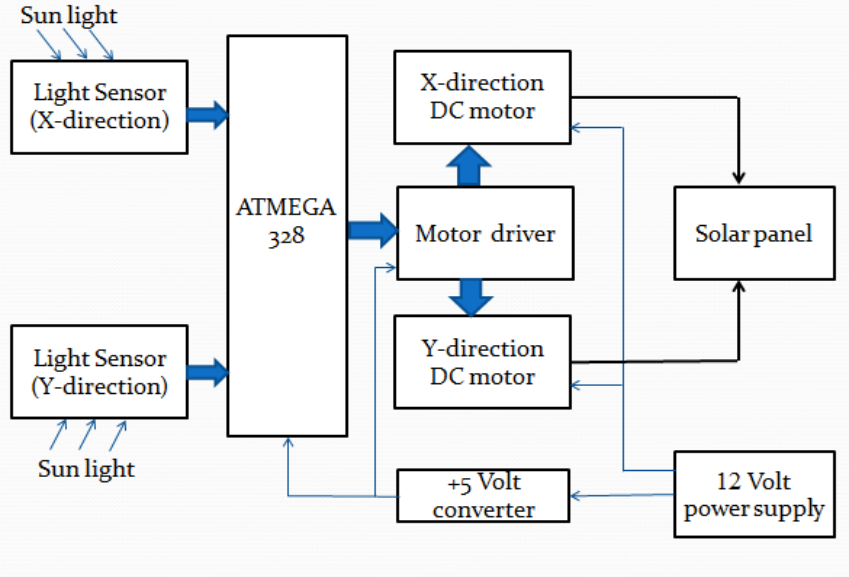

Figure 2: Complete Block Diagram of system

II. TRACKING PRINCIPLE

There are many different methods have been proposed and used for tracking the position of the sun. Among all, the simplest method uses an LDR (Light Dependent Resistor) to detect light intensity changes on the surface of the resistor. The proper and efficient use of LDR also reduces the overall cost of the system. The resistivity of LDR decreases significantly with the increase in illumination. The general resistivity vs. illumination plot of an LDR can be observed in following figure.

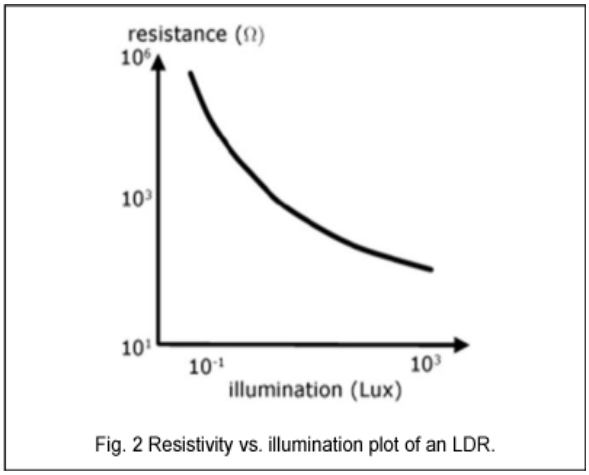

Figure 3: Resistivity vs. illumination plot of an LDR

III. WORKING PRINCIPLE

The setup of the hardware for the greater application of this project includes the placement of LDRs on the surface of a large curvature. The mechanism should be done such that any two immediate LDRs must remain active at the same time. And the dc motor will follow the bit pattern due to which the solar panel connected on the shaft of the dc motor will always face the sun perpendicularly. The combination of LDR plays the significant role in the movement of solar panel. Actually these combinations of signals are fed to the microcontroller and this directs the motor connected to driver. The required bit pattern for motoris 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

Table 1: Desired Bit Pattern

When the stepper motor gets the last bit sequence of the table, the stepper motor will move to its initial position again 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 with ease by home appliances and for Industrial purpose also. The proposed system will be as shown in figure below.

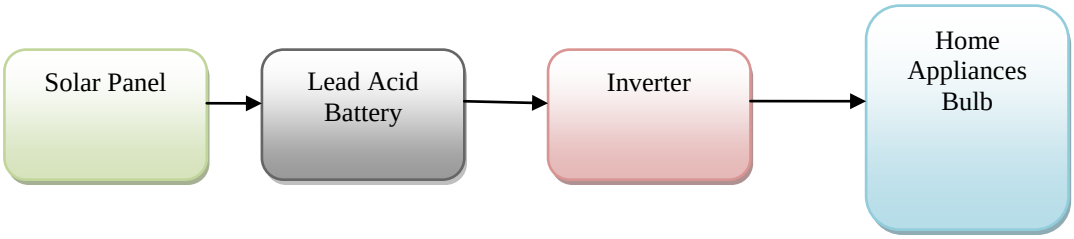

Figure 4: Block Diagram at output side

IV. COMPONENTS USED

The major components used in the system are as follows.

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

Other useful components are-

1. Resistor (10KΩ. 1KΩ.)
2. Capacitor (10µF, 33pF)
3. 12V and 5V dc power supply

V. CIRCUIT DIAGRAM & DISCRIPTION

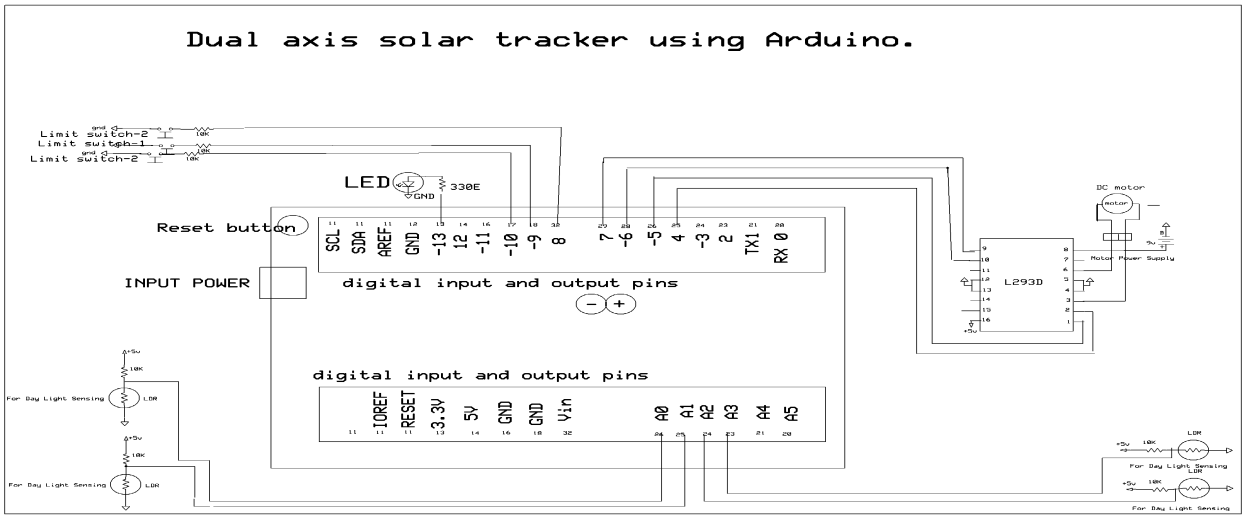

Figure 5: Circuit Diagram

An automated dual axis solar tracking system by using Arduino is proposed. Here microcontroller ATmega328 controls the solar panel's movement which rotates and follows the motion of the sun anywhere in sky. There are three limit switches used in the circuit. Among which two are attached to the solar panel to mark its maximum angular positions in the east and west. The limit switch's status is read by microcontroller and the maximum angular position in either direction is indicated. When this position has been reached the panel should not be driven any further. And third limit switch is used to mark its angular position horizontally (i.e.360º). As the plane of the panel is always kept perpendicular to the direction of the sun, maximum amount of thermal energy can be obtained from the solar panel.
The Arduino Board used here is shown in Figure bellow.

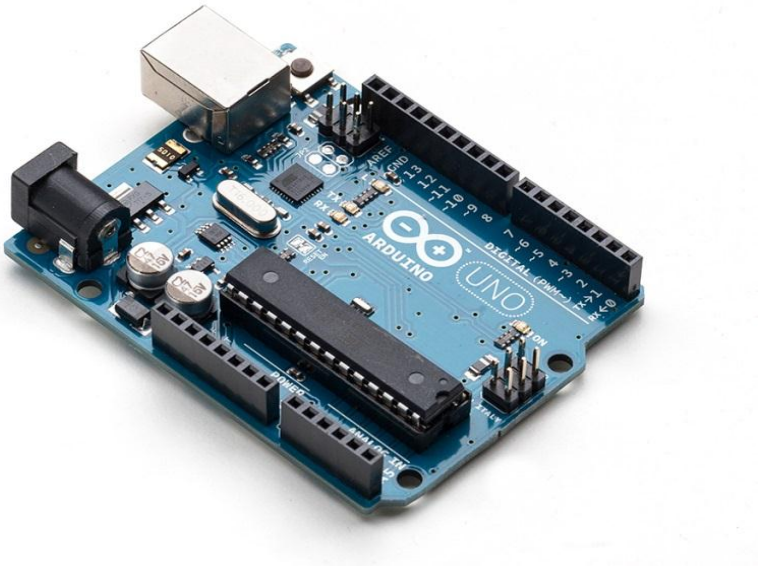

Figure 6: Arduino Board

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. This is specially designed for the ease of artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino receives an input signal from different sensors to sence the Environment, and is able to affect its surroundings by controlling motors, lights, and other type of actuators. The microcontroller mounted on the board can be programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing).

5.1 TECHNICAL DETAILS:

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
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

5.2. ADVANTAGES

1. Solar power is pollution free during use.
2. More efficient compared to normal arrangement
3. Proposed system has High degree of accuracy.
4. After spending the initial capital cost of building a solar power plant, maintainance cost are extremely low compared to existing power technologies.
5. System is very useful as the sun's position in the sky will change gradually over the course of a day and over the seasons throughout the year.
6. The power obtained by solar tracking is almost constant over a period of time as compare to the output obtained by a Stand- alone (without tracking) solar panel.

5.3. APPLICATIONS

1. for solar photovoltaic (PV) panel applications
2. It is used in solar thermal dish/engine applications
3. Remote places
4. Its main application is being found in the industrial processes such as energy stations and powerhouses to produce electricity.
5. It also finds its applications in pool filtration systems, for irrigation methods in an agriculture and solar water heating systems.

VI. CONCLUSION

The proposed sun tracker automatically tracks the sun and grabs maximum solar power with the help of microcontroller. The system tracks the sun in any weather(normal and bad) condition. Still there is a scope for improvement in this system. It can be hoped that further study should be carried out for further advancement in the solar tracking system.

REFERENCES

[1] International Journal Of Electrical Engineering & Technology (IJEET) Volume 4, Issue 1, January- February (2013), pp. 109-114
[2] C. Hua and C. Shen (1998) Comparative study of peak power " tracking techniques for solar storage system'', Applied Power Electronics Conference and Exposition, vol. 2, pp. 679-685.
[3] A. K. Saxena and V. Dutta (1990), "A versatile microprocessor based controller for solar tracking'', Photovoltaic Specialists Conference, vol. 2, pp. 1105-1109.
[4] Saravanan C. , Dr .M.A. Panneerselvam, I. William Christopher, "A Novel Low Cost Automatic Solar Tracking System", International Journal of Computer Applications (0975 – 8887) Volume 31– No.9, October 2011.
[5] Soumen Ghosh, Nilotpal Haldar , International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 12, December 2014)
[6] B.Suchitha Samuel, J.Mrudula, ―Design of Intelligent Solar Tracker Robot for Surveillance, ‖ International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 10, October 2013.
[7] Bhavesh Pandey1, Anita Agrawal, ―Automatic Sun Tracking System Using PSoC, ‖ International Journal of Innovative Research in Science, Engineering and Technology, Vol. 1, Issue 1, November 2012.
[8] Sobuj Kumar Ray, Md. Abul Bashar, Maruf Ahmad & Fahad Bin Sayed , ―Two Ways of Rotating Freedom Solar Tracker by Using ADC of Microcontroller ‖, Global Journal of Researches in Engineering General Engineering ‖, Volume 12 Issue 4 Version 1.0 Year 2012.
[9] Mazidi Md.Ali, Mazidi J.G.,―The 8051 Microcontroller and Embedded systems ‖, Pearson Education, 2nd edition.

