DUAL AXIS SOLAR TRACKING SYSTEM AND ENERGY DISTIBUTION

[1]Pakhare Priyanka Anant, [2]Patil Priyanka Shankar,
[3]Phalake Sneha Krishna, [4]Huddar Vishwanath Venkatesh,
[5] Prof. N.S.Jadhav

[1,2,3,4,5]Sanjeevan Engineering and Technology Institute

Panhala, Kolhapur, Maharastra (India)

ABSTRACT

Solar energy is very important means of expanding renewable energy sources. This paper described the design and construction of a Arduino based "Dual axis solar tracking system". Solar is a nonconventional source of energy. Considering this, we developed solar tracking system so that we can fulfill our electricity need. But due to revolution of earth, solar source i.e. sun does not face the panel continuously hence less electricity is produced. The solar panel should face the sun till it is present in a day. The problem of above can be solved by our system by automatic tracking of solar energy. The LDR sensors are used which sense the maximum sunlight. A solar tracker is basically device on which solar panel is fixed which tracks the sun and give maximum output. Its active sensors constantly monitor the sunlight and rotate the panel towards the where intensity of sunlight is maximum. LDR light detector acts as sensor used to trace the sunlight and detect the maximum level of sunlight. While to rotate the appropriate position of the panel, a dc geared motor is used. The system is consisting of dc motor driver, arduino. This project is covered for dual axis solar tracking and is designed for more power generation and residential applications. When our domestic demand is fulfilled then surpluses energy can be given to commercial purpose. The energy consumed by domestic and commercial purpose is seen with the help of wattmeter display.

Keywords: Arduino, LDR- Light dependent resistor, solar panel tracker

I. INTRODUCTION

In last ten years, many of residential around the world used electric solar system as a sub power at their houses. This is because solar energy is an unlimited energy resource, set to become increasingly important in the longer term, for providing electricity and heat energy to the user. Solar energy also has the potential to be the major energy supply source in the future. Solar tracker is an automated solar panel which actually follows the Sun to increase the power. The sun's position in the sky varies 21 degrees left or right in six month intervals. The solar tracker can be used for several applications such as home applications, commercial use. The solar tracker is very useful for device that needs more sunlight for higher efficiency such as solar cell. Many of the solar panels had been positioned on a fixed surface such as a roof. As sun is a moving object, this approach is not the best method. One of the solutions is to actively track the sun using a sun tracking device to move the solar panel to

follow the Sun. With the Sun always facing the panel, the maximum energy can be absorbed, as the panel is operating to give maximum energy. The main reason for this project is to get the maximum power.

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 used is the 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 and complexity of the system. The resistivity of LDR decreases with increase in illumination.

2.1. Working Principle

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.
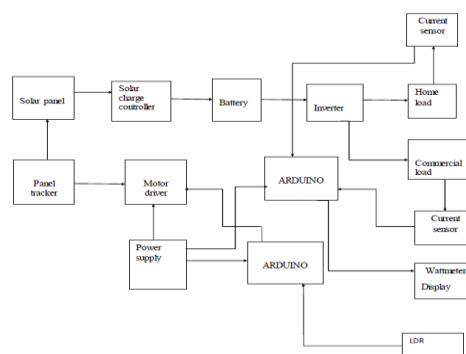
2.2. Block Diagram

Fig 2.1:- Block diagram of solar panel tracking system

2.3. Working of Dual Axis Solar Tracking System

The main working of our project is totally based on luminosity i.e. the sun rays. The arduino has one advantage over microcontroller i.e.it has both analog as well as digital input and output pins. The luminosity of sun rays has value of 0-1024 lumens. The sun rays are fall on solar panel and LDR's. After that this value is fed to the arduino which is analog in nature. If this value is greater or equal to the predefined value then maximum energy is generated and panel will not move. But if this value is less than that of predefined value then arduino sends signal to the driver circuit and solar panel is start to rotate the panel. After tracking some angle if the LDR gets value equals to predefined value then driver circuit is stopped by arduino.

The one driver circuit is used for single axis tracker system which is for daily basis axis i.e. from east to west. The panel moves from one side to other and when the limit switch is push, the weight of solar panel, the DC geared motor runs in opposite side and panel comes to its original position. The process is continuous every day and we get maximum output.

For dual axis, there is no need of limit switch. It rotates only once in a 6 months or more. Two LDR's were used for this monthly axis. One LDR is right to left and other is exactly opposite i.e. from left to right. One driver circuit is used for this all process. The sensed value by LDR is fed to arduino which is in analog in nature. The

arduino decides in which direction solar panel is to be rotate. This total system is used for monthly axis tracking system.

2.5 Components Used

1. Solar panel
2. Arduino
3. LDRs
4. Lead Acid Battery
5. Inverter
6. Dc geared motor
7. 12v and 5v dc power supply
8. Solar charge controller
9. Current sensors
10. Wattmeter display

2.5.1 Solar panel and solar tracking system

32v, 20watt solar panel is used in our project. There are two types of solar tracking system single axis and dual axis solar tracking system. Single axis solar tracking system is only from east west. Single axis tracker is less efficient than dual axis tracker system. Dual axis tracker has two degree rotation. It rotates horizontally and vertically.

Fig2.2. Solar panel

2.5.2 Arduino

In earlier system various microcontroller are in use like 8051, PIC ARM. They have their own history and characteristics as well as advantages over each other but drawbacks of microcontroller is complicated interfacing, more power consumption. To overcome drawback of this technology the new technology 'ARDUINO' is invented. It was invented in Italy in 2005. The simple meaning of arduino is brave friends. Arduino is an electronic device which is very flexible, easy hardware and software.
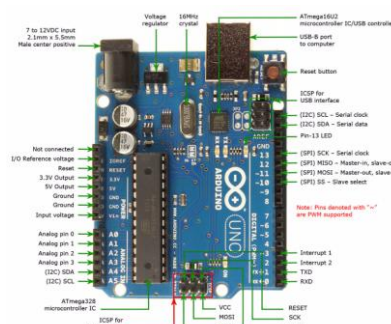
Fig2.3. diagram of Arduino

2.6 Advantages of arduino over microcontroller

1) It is design for those who don't have more knowledge of programming language.

2) It is small in size.

3) The most important advantage over microcontroller that it has analog as well as digital input output pins.

4) It works on 5V dc system.

5) Wide verities of arduino are arduino uno, arduino mega, arduino mini, rasberry.

2.6.1 Use

It is widely used in robotics, musical instruments, engineering technology.

2.7 Light dependent resistor

A photo resistor or light dependent resistor is a light controlled variable resistors. The resistance of photo resistor decreases with increasing light intensity. In other words light dependent resistors exhibits photo conductivity. These are made up of high resistance semiconductor. In the dark a photo resistor have high resistance while in light the resistance is low. In this project we used three light dependent resistors for tracking system. One LDR is used for daily rotation i.e. for single axis system and remaining two LDR's are used for monthly axis i.e. for dual axis system. The LDR detects the luminosity of sun light and sends signal to arduino. If the value is less than predefined value, then it sends signal to motor driver circuit to drive and rotate the panel in required direction.

Fig2.4. Light dependent resister

2.8 Solar charge controller

Solar charge controller used to disconnect the battery from solar panel if battery is fully charged. Also it indicates three main status of battery viz, fully charged, low battery and discharge battery. If solar charge controller is absent then battery gets damaged after some time period. Solar charge controller is used for 6 amp. The output of panel is given to battery through solar charge controller.

Fig2.5. solar charge controller

2.9 Current sensors

The current sensor used is ACS712, 5 amp which is hall-effect based. It is used to sense the current used by both loads due to this wattmeter displays reading of power consumption.

Fig2.6. Hall Effect sensor

2.10 Battery

32 AH battery is used for this project. This used to storage energy and supply it as per our requirement. The two terminals are connected to inverter to convert DC to AC.

Fig2.7. Battery

2.11 Inverter

100 VoltAmp inverter is used to convert supply from DC to AC. As our residential appliances required AC supply this is most important equipment.

2.12 Wattmeter display

The wattmeter display is of 20x4 i.e. it has 20 column and 4 rows. It shows the power consumption of home as well as commercial load.

2.13 Power supply

The 12 volt 2 amp power supply used to start or run the Arduino. Also the supply is given to motor driver circuit.

3.1 Advantages

1. More efficient compared to normal arrangement.
2. Solar power is pollution free during use.
3. The power obtained by solar tracking is almost constant over a period of time as compared to the output is obtained by a standstill solar panel.

3.2Application

1. Remote places.
2. It is found in industrial process such as energy station and power house to produce electricity.
3. Used in solar water heating systems.

3.3 Result

Sr. no.	Time	Output of fixed solar panel		Output of dual axis solar panel	
		Current	Voltage	Current	Voltage
1	9a.m.	0.06	15.38	0.13	17.20
2	10a.m.	0.086	16.20	0.18	19.00
3	11a.m.	0.12	18.55	0.27	20.58
4	12p.m.	0.23	20.68	0.52	24.68
5	1p.m	0.32	22.32	0.69	28.23
6	2p.m.	0.27	19.82	062	25.30
7	3p.m.	0.22	17.92	0.42	23.01
8	4p.m.	0.07	16.36	0.13	20.10
9	5p.m.	0.05	14.08	0.1	17.20

3.4 Future Scope

1. One can also use parabolic solar panel to generate more energy than flat one.

2. To overcome the problem of losses by heating, cooling system can be introduce.

IV. CONCLUSION

A dual axis tracking generates 40% more power from than fixed solar panels. It absorbs more sun rays and generates more and more output than fixed solar panel. It doesn't require any other arrangement or manual tracking system.

REFERENCE

[1] Mayank Kumar Lokhande, "Automatic solar tracking system", international journal of core engineering and management (IJCEM) volume 1, issue 7, October 2014

[2] Arnab Samantal, "Chronological Single axis Solar Tracker", International journal of engineering trends and technology (IJETT) Volume 21, Number 4, March 2015

[3] D. Venkatakrishna*, E. Siva Sai, Sree Hari, "Improved Structure of Automatic Solar Tracking System", International journal of Engineering Science and research technology

[4] Lwin Lwin Oo, Nang Kaythi Haling 'Microcontroller based Two-Axis Solar Tracking System.

Wattmeter display

Hardware Design