

DESIGN OF AUTOMATIC DUAL AXIS SOLAR TRACKING SYSTEM

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1.ABSTRACT

Renewable energy sources plays a vital role in the environment which can be utilized efficiently. Renewable energy sources like solar wind, bio-mass could be utilized up to a extend .The renewable energy is generated from natural resources such as sunlight , wind, rain and geothermal energy. This paper includes the design and manufacture of dual axis solar tracking system. Sun is arriving at an angle of 11 degrees to the axis of the earth , which arises from east to west .To utilize the sun rays up to the whole day by turning the solar panel along with the sun. The axis rotation of the solar panel to absorbs the sun rays to convert into electrical energy .This system consists of x-axis light sensor , y-axis light sensor, limiter switch and micro-controller. This whole system tracks the sun rays which absorbs the sun's radiation and convert it into electrical energy. Solar panel is fabricated from silicon wafers to transfer charges from valance band to the conduction band . The intensity level decides the energy absorption of the silicon ions to move with high mobility to increase the conduction and the current .

KEYWORDS

LDR , ATME1, Solar tracker, solar panel , dc motor, dual axis tracker , limiter switch.

2.INTRODUCTION

Power and water is the key factor for the survival of man . The renewable energy comes under non hazardous source[1].During the last few years the solar energy is one of the renewable energy sources have gained much importance in all over the world . Solar power is the fleetest growing means of renewable energy production to meet the growing demand of energy harnessing of non-conventional /renewable energy is the necessity. Among the all available renewable energy sources , solar energy is the most evident and which is uniformly distributed[4-5]. The temperature of the sun is about 5800K , which emits high amount of energy in the form of radiation. The sunlight has two components , direct beam and the diffuse beam. The direct radiation will not get scattered and carries about 90% of the solar energy and rest of the energy are carried by the diffused beam. A device called solar tracker which keeps photo voltaic or photo thermal panels in a peerless position

(i.e) perpendicular to the solar radiation pecuniary single axis and the dual axis tracker follows the sun's changing altitude angle. In general, India has a relatively longer sunny days than the cloudy days. It has more than 10 months of sunny and partly cloudy sky for rest of two months. During the day time it is used to increase the collected energy up to 50% . Countries like Rajasthan ,Gujarat , Madhya Pradesh etc are very rich in solar energy .The movement of the sun in the east –west direction is followed by the single axis tracker and the changing altitude of the sun is followed by dual axis tracking system [8-11] . The sun tracking system is used to improve the efficiency of the solar system with the help of tracking equipment in various methods. The inclination ranges between -90 degree after sunrise and +90 degree before sunset passing with 0 degree at noon [3]. The dual axis solar tracking system can be rapidly deployable and transportable as well as default position in extreme weather conditions .The dual axis solar system has different configurations under critical snow and wind conditions .It works effortlessly in all weather conditions listless of the presence of clouds for long period and also to interrogate the efforts of using two axis sun tracking system on electrical generation of the flat photovoltaic system (FPVS) and it is carried out with the local climate [6-7] .In the tracking system the degree of the sun radiation accuracy ,returns to original position at the end of the day which should be followed .The projection of the sun beam on the PV cell ,which is oriented perpendicularly to the radiation direction .The solar panel composed of modules together forms a photovoltaic cells which absorb the sun's radiation is converted to the electrical energy through photovoltaic effect [2] .The cell which acts and operates as a "quantum device" which convert photon of energy into electrons which produces sufficient amount of electricity. The process can be improved from the existing system by increase in efficiency and made it cost effective.

DESIGN OF DUAL AXIS SOLAR TRACKER MOUNT:

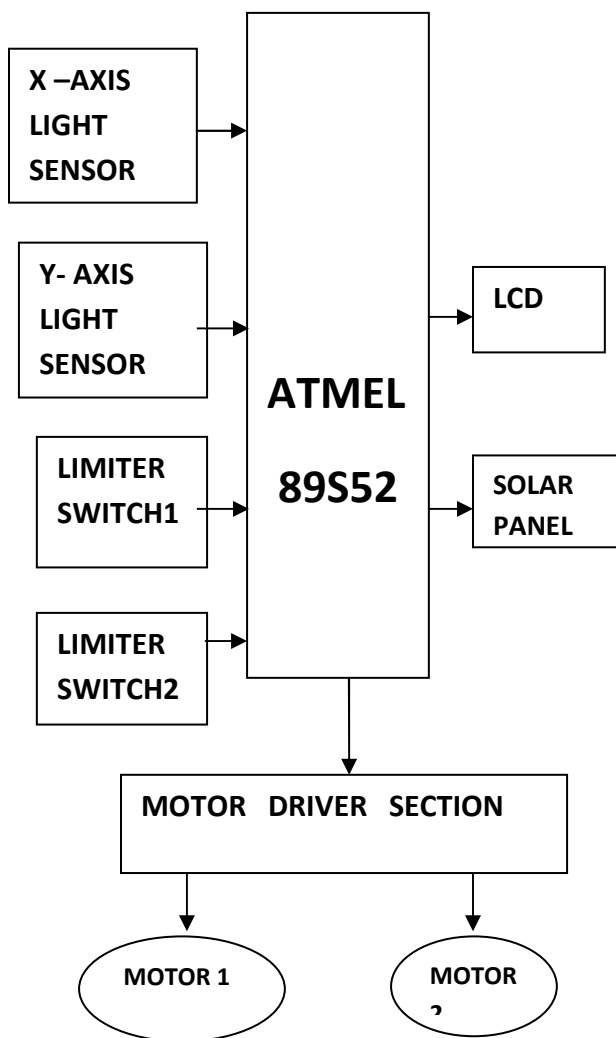
The dual axis solar tracking system is introduced to track the sun in both north-south axis as well as in east-west axis. This is possible only by constructing the solar panel mount to rotate over dual axis. In this device the base of mount

rotates in north-south direction and head of the mount rotates in east-west direction. This mount consists of two stepper motors, one at the base and other at the head. The stepper motor which is located at the base is used to rotate the solar panel in north-south direction and other stepper motor which is located at the head of the mount rotate the panel over east-west axis.

3.SYSTEM DESCRIPTION:

3.1 SOLAR PANEL:

Solar panel is designed to absorb sun's rays as a source of energy for generating electricity .Several cells combined together to form modules



The modules are combined together to form photovoltaic cells

3.2 LDR

Light dependent resistor is a photo resistor which is a passive electronic component, basically a resistor which has a resistance that varies depending of light intensity. A photo resistor is made up of semiconductor materials having high resistance that absorbs photons and based on the quantity and frequency of absorbed photons of the semi conductor material give bound electronic enough energy to jump into the conduction band . the number of electronic is depend of the photons frequency. It is a non linear device which varies with the wavelenght of light incident on them. The structure of light dependent photo resistor consists of light sensitive material deposited on the insulating substance such as ceramic .This material is deposited in a zigzag pattern to get the desired resistance and power rating.It is based on the principle of conductivity .Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material when photons fall on the device the electrons in the valence band of the semiconductor material are excited to the conduction band . LDR are very useful in many electronic circuits especially in alarm switching devices,clocks,streets lights and more. There are some audio applications user such as audio limiters or compressor. The limiters used for turn ON or OFF a device. The variable resistor which is connected at LCD pin 3(VD) and ground to control the LCD display contrast .When you apply resistor or a variable resistor to VD , a small current flows through and a voltage develops over the resistor ,normally this voltage is small between zero and 1 volt . when the suns's radiation is maximum LDR senses about 1V and when it is minimum LDR senses between 4 to 5V.

3.3 DC MOTOR:

The DC motor consists of permanent magnet on the outside and armature on the inside .The permanent magnet is known as stator and the armature rotates so it is known as rotor .This is based on Fleming's left hand rule . the stepper motor has been used. The drawback of using stepper motor is that it consumes 10-20% in both high and low conditions. So we go for DC motor here power is consumed only in high condition and 0% power is consumed in low conditions.

3.4 MICROCONTROLLER:

The dual axis solar system is done by using AT89S52 which is a typical 8051 microcontroller manufactured by Atmel. AVR is one of microcontrollers which is developed by ATMEL in 1996. This is a 8 bit RISC single chip microcontrollers. It is used as a flash memory for program storage as ROM,EEPROM,or EPROM . This

microcontroller find applications in embedded systems . The ATMEL offers dual band 2.4 GHz b/g/n WiFi chips WLC 1000/WINC 1500 provides full 802.11 b/g/n network. 89S52 has four different ports consisting of 32 I/O pins. VCC is given a supply voltage. Port 0 is a 8 bit bidirectional I/O port which may also be configured to the multiplexed low order address or data bus .Port 0 also receives the code bytes during flash programming and the output of the code bytes during program verification .Port 1 pins are externally pulled low because of internal pull-ups .during flash programming port 1 receives low order address bytes .Port 2 acts as a buffer .Port 2 emits the high-order address bytes during fetches from external program memory and it receives the high order address bits and some control signals . Port 3 output buffers can sink or source four TTL input .Address latch enable output pulse for latching the low byte of the address during access to external memory. In idle mode CPU puts itself to sleep while the other peripherals remain active .The limiter switch which is used for controlling machinery as a part of a control system and regulates the electrical circuit.

3.5 LCD:

The liquid crystal display was first developed at RCA in 1971 .LCD'S doesnot require power to operate .There are two different types of LCD namely twisted nematic and supertwisted nematic .LCD displays are developed in laptops and CRT replacement market. This may be double and triple twisted nematic .

4. RESULT AND CONCLUSION:

In the existing system stepper motor has been used . The drawback of using stepper motor is that it consumes 10-20% in both high and low condition. So we go for DC motor and here power is consumed only in high condition whereas 0% power is consumed in low condition .When the sun's radiation is maximum LDR senses about 1V and when it is minimum LDR senses between 4-5V. The design, implementation and testing of automatic dual axis solar tracking system is presented in the study. Non-renewable energy sources will be exhausted in future but the solar energy which is one of the important renewable energy sources is available throughout the year and does not affect the environment. The automatic solar tracker is evident method for solar radiation collection. The proposed dual axis sun tracking system is a feasible method of maximizing the energy from solar radiation. The solar cell does two main functions simultaneously one is to sense the position of the sun and another is to give input to the motor. The main objective of this project is to maximize the power generation up to 35-40%. When compared to the solar panel which is kept in a fixed position.

REFERENCES:

- [1] S.P.Sukhatme & J.K.Nayak, "Solar Energy Principle of Thermal Collection and Storage",McGraw Hill,2010.ISBN-978-0-08-026064.
- [2] C.S. Solanki,"Solar Photovoltaic fundamental, Technologies and Application" PHI Learning,2011.ISBN-978-81-203-4386-3.
- [3] V.Shirish Murty,"Smart Grid Designs for the improvement in Solar Technology and its development",ISSN:2278-8948,Vo1.2,Jan 2013
- [4] D.S.Chauhan,S.K.Srivastava,"Non-conventional energy resources",New age International,2010.ISBN-978-81-224-1768-5.
- [5] A.K.Saxena,V.Dutta," A versatile microprocessor based controller for solartracking",in Proc.IEEE,1990,pp.1105-1109.
- [6]T.F.Wu,Y.K.Chen, and C.H.Chang,Power porovision and illumination of Solar Light ,ChuanHwa science &Technology BookCO.,LTD,2007.
- [7]C.C.Chuang,Solar energy engineering-Solar Cells,ChuanHwaScience &Technology Book CO.,LTD,2007.
- [8]S.R.Bull,"Renawable energy today &tomorrow,"IEEE Proc.,vol.1.89,no,pp.1216-1226;2001.
- [9]S.Rahaman,"Green power:what is it and where can we find it?"IEEE Power and energy magazine,vol.1,no.1,pp30-37,2003.
- [10]D.A.Pritchard ,"sun tracking by peak power positioning for photovoltaic concentrator arrays,"IEEE Contr.syst.Mag.,vo1 3,no.3,pp.2-8,1983.
- [11]A.Konar and A.K.Mandal,"Microprocessor based automatics untracker,"IEEE proc.sci., Meas.Technol., vol.138, no.4 pp.237-241,1991.