

DUAL AXIS SOLAR TRACKING SYSTEM WITHOUT LDR USING ARDUINO

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ABSTRACT

This paper deals with arduino based solar tracking system, To grab maximum energy solar is non conventional source of energy with the help of this we developed solar tracking system so that can produced maximum output electricity

But due to revolution of earth solar source, Means sun does not phase panel continuously. Hence less electricity produces. 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 the year a solar panel must be able to track the sun's movement and maximum possible output power.

KEYWORDS: Solar Panels, Arduino, Stepper Motor, SMPS, Card Driver.

I. INTRODUCTION

Energy is primary factor for the development of a nation an enormous amount of energy accepted distributed, converted and consumed in global society daily.

Solar energy is very large, in exhaustible source of energy. The power from the sun interrupted by earth is approximately 1.8/10MW, which are many thousands of times larger than the present consumption rate on the earth of all energy sources.

A large amount of solar radiation fall on India and for most of the country very few days are without sunshine. India lies within the latitude of 7 N to and 37 N with annual average intensity of solar radiation as 500 to 600 cal/cm/day with more such insulations available in arid and semi arid regions. Average solar radiation falling on India in arid and semiarid regions is 7.5 K w h/m/day. Solar energy 5×10^6 K w h/year potential to meet basic energy needs of teeming millions who live in rural India. Solar energy is an important, clean, cheap and abundantly available renewable energy. The sun radiates heat and light. The heat, light received from the sun supports the environment on the earth through the following well known natural effects.

1. Temperature balance on the earth

2. Photo-synthesis by biological plants production of oxygen and organic materials, production of organic chemicals and bio-mass.

3. Wind due to unequal heating of water, land surfaces.
4. Heating of ocean water: ocean thermal energy (OTEC)
5. Waves in ocean: ocean wave energy
6. Tides in ocean: ocean tidal energy (due to gravitational forces)

The sun produces enormous amount of energy of heat and light through sustained nuclear fusion reactions. The solar energy received on the earth in the form of radiation is used for heating and producing an electrical energy.

Among the non-conventional sources of energy solar energy is the most promising. Hence our project is based on the solar tracking system using arduino.

WORKING PRINCIPLE

We have tried to track the sun with the help of arduino programming. In which we track the sun as early as possible since from the sunrise to the sunset without using LDR.

As per our survey the sun rotate about in 108 degree angle since sunrise to sunset at our place or this place. So we programmed the stepper motor in a such manner that the solar panel will track the sun completely from sunrise to sunset. To track that solar panel 108 degree angle we rotated the solar panel horizontally 12 degree/hour since from 8 AM to 5 PM i.e. East to West.

Now the second axis of tracking i.e. North to South. As per sources sun rotate about 47 degree angle in 183 days from North to South and vice versa. So we programmed our second stepper motor in that manner. For the days between 21st march -22nd june the sun will move towards north by the 23.5 degree and it takes 91 days to reach there. After 22nd june sun moves again towards it's first position on 21st of march after that that will reaches on 21st of September and after that it moves toward south till 22nd december and it moves back till 21st of march. so the second axis rotate by 5 degree/20 days.

BLOCK DIAGRAM

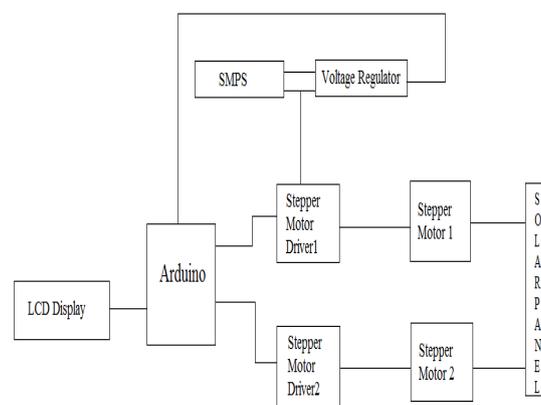


Figure-1-Block diagram of dual axis solar tracking system

SOLAR PANEL

PHOTOVOLTAIC PRINCIPLES

The photo-voltaic effect can be observed in nature in a variety of materials that have shown that the best performance in sunlight is the semiconductors as stated above. When photons from the sun are absorbed in a semiconductor, that create free electrons with higher energies than the created there must be an electric field to induce these higher energy electrons to flow out of the semi-conductor to do useful work. A junction of materials, which have different electrical properties, provides the electric field in most solar cells for the photon interaction in a semiconductor. A solar cell consists of

1. Semi-conductor in which electron hole pairs are created by the absorption of incident solar radiation.
2. Region containing a drift field for charge separation.
3. Charge collecting front and back electrodes.

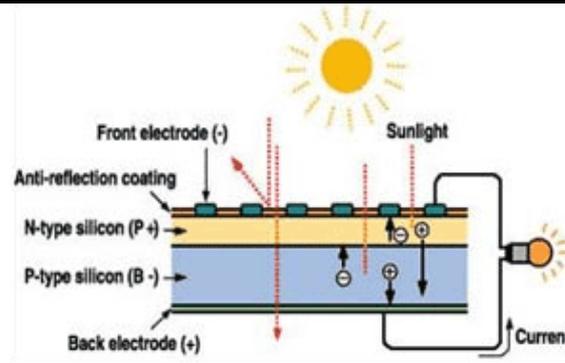


Figure-2 Photovoltaic cell

PHOTOVOLTAIC EFFECT

The photo-voltaic effect can be described easily for p-n junction in a semi-conductor. In an intrinsic semi-conductor such as silicon, each one of the four valence electrons of the material atom is tied in a chemical bond, and there are no free electrons at absolute zero. If a piece of such a material is doped on one side by a five valence electron material, such as arsenic or phosphorus, there will be an excess of electrons in that side, becoming an n-type semi-conductor.

The excess electrons will be practically free to move in the semi-conductor lattice. When a three valence electron material, such as boron dopes the other side of the same piece, there will be deficiency of electrons leading to a p-type semi-conductor. This deficiency is expressed in terms of excess of holes free to move in the lattice. Such a piece of semi-conductor with one side of the p-type and the other, of the n-type is called p-n junction. In this junction after the protons are absorbed, the free electrons of the n-side will tends to flow to the p-side, and the holes of the p-side will tend to flow to the n-region to compensate for their respective deficiencies. This diffusion will create an electric field from the n-region to the p-region. This field will increase until it reaches equilibrium for voltage, the sum of the diffusion potentials for holes and electrons. If electrical contacts the connected through an external electrical conductor, the free electrons will flow from the n-type material through the conductor to the p-type material as shown in the figure. Here the free electrons will enter the holes and become bound electrons thus both free electrons and holes will be removed. The flow of electrons through the external conductor constitutes an electric current, which will continue as long as move free electrons and holes are being formed by the solar radiation. This is the basis of photo-voltaic conversion that is the conversion of solar energy into electrical energy. The combination of n-type and p-type semiconductors thus constitutes a photo-voltaic cell or solar cell. All such cells some rate direct current that can be converted into alternating current it desired. The photo-voltaic effect can be observed in almost any junction of material that have different electrical characteristics, but the best performance to date has been from cells using semiconductor material especially all of the solar cells used for both space and terrestrial applications have been made of the semiconductor silicon. Future cells may use such materials as the semiconductors like Gallium arsenate, copper sulphate cad sulphide etc. The device used to utilize the photovoltaic effect is solar cell.

ARDUINO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible pack

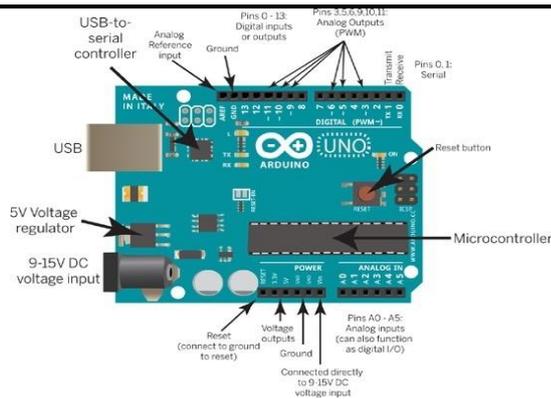


Figure-2 Arduino UNO

The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. We'll talk about what's on it and what it can do later in the tutorial.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

ARDUINO PIN DIAGRAM

A typical example of Arduino board is Arduino Uno. It consists of ATmega328- a 28 pin microcontroller.

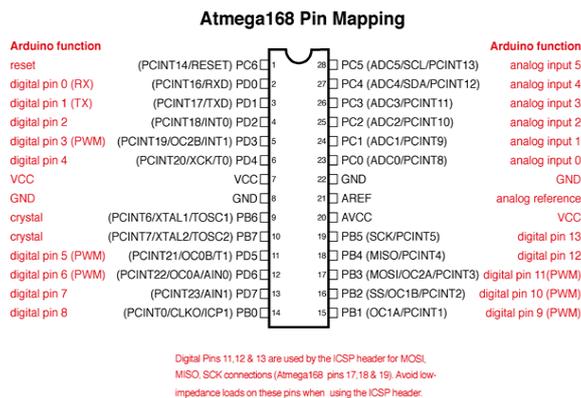


Figure -4Pin Diagram Of Arduino

Arduino Uno consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button

Power Jack: Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on an external supply of 7 to 12V. Power can be applied externally through the pin Vin or by giving voltage reference through the IOREf pin.

Digital Inputs: It consists of 14 digital inputs/output pins, each of which provide or take up 40mA current. Some of them have special functions like pins 0 and 1, which act as Rx and Tx respectively , for serial communication, pins 2 and 3-which are external interrupts, pins 3,5,6,9,11 which provides pwm output and pin 13 where LED is connected.

Analog inputs: It has 6 analog input/output pins, each providing a resolution of 10 bits.

AREf: It provides reference to the analog inputs

Reset: It resets the microcontroller when low.

STEPPER MOTORS

Stepper motors are DC motors that move in discrete steps. They have multiple coils that are organized in groups called "phases". By energizing each phase in sequence, the motor will rotate one step at a time. With a computer controlled stepping you can achieve very precise positioning and/or speed control.

A Stepper Motor or a step motor is a brushless, synchronous motor which divides a full rotation into a number of steps. Unlike a brushless DC motor which rotates continuously when a fixed DC voltage is applied to it, a step motor rotates in discrete step angles. The **Stepper Motors** therefore are manufactured with steps per revolution of 12, 24, 72, 144, 180, and 200, resulting in stepping angles of 30, 15, 5, 2.5, 2, and 1.8 degrees per step. The stepper motor can be controlled with or without feedback.



Figure -5 Stepper Motors

ADVANTAGES OF USING STEPPER MOTORS

- 1. A wide range of rotational speeds can be utilized since the speed of a step motor is proportional to the frequency of the input pulses from your controller.
- 2. Precise open-loop positional control is possible with a stepper motor without any feedback mechanism.
- 3. Very low speed rotation is possible with a load that is coupled directly to the shaft of the stepper motor.
- 4. A stepper motor is quite reliable because there are no contact brushes. Generally, the life of a stepper motor is determined by the life of the stepper motor bearing.
- 5. A stepper motor is very good at starting, stopping, and reversing direction.
- 6. A stepper motor provides precise positioning and repeatability of movement.
- 7. An energized stepper motor maintains full torque at standstill position

ADVANTAGES OF THE PROJECT

1. This system is more efficient compare with normal solar panel system
2. solar power is non-conventional energy source so it is pollution free whenever using.
3. Dual axis solar tracking system able to optimum maximum output power and this power almost constant a time period.

FUTURE SCOPE

1. To overcome the problem of losses by heating and cooling system can be introduced.
2. We can track the system by using pilot panels.

CONCLUSION

The dual axis solar tracking system can generates 40% more output power than fixed solar panels. It absorbs more sunrays and generating the maximum output power.

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