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Solar Tracking System Using Arduino

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Abstract: Sun Tracking Solar Panel is a project which will track the Sun and position the solar panels accordingly. As the non-renewable energy resources are decreasing, use of renewable resources for producing electricity is increasing. Solar panels are becoming more popular day by day. This energy can be utilized when required or can be used as a direct alternative to the grid supply. Taking a look at the present scenario it is evident that conventional sources of energy such as coal, natural gas, oil, etc. are at the edge of extinction. Being in mortal combat with time itself to fulfil every demand for energy the demand for these resources for energy has escalated to its zenith. The conventional use of energies due to the burning of fossil fuels like coal, oil and natural gas, the whole environment is getting polluted. The present project, therefore, is orchestrated with components like LDR module, DC Motor, Photovoltaic array etc. according to which while the functioning of, unlike other use of the conventional energies, would not emit any pollution and in turn act as a reservoir of energy taken from the Sun itself.

Key words: Arduino Uno, LDR , Solar Panel, Servo motor, Resistors 10k.

Introduction: Energy is the prime factor for the development of a nation. An enormous amount of energy is extracted, distributed, converted and consumed in the global society daily. 85% of energy production is dependent on fossil fuels. The resources of the fossil fuels are limited and their use results in global warming due to emission of greenhouse gases. To provide a sustainable power production and safe world to the future generation, there is a growing demand for energy from renewable sources like solar, wind, geothermal and ocean tidal wave. The sun is the prime source of energy, directly or indirectly, which is also the fuel for most renewable systems. Among all renewable systems, photovoltaic system is the one which has a great chance to replace the conventional energy resources. Solar panel directly converts solar radiation into electrical energy. Solar panel is mainly made from semiconductor materials. Si used as the major component of solar panels, which is maximum 24.5% efficient. Unless high efficient solar panels are invented, the only way to enhance the performance of a solar panel is to increase the intensity of light falling on it. Solar trackers are the most appropriate and proven technology to increase the efficiency of solar panels through keeping the panels aligned with the sun's position. Solar trackers get popularized around the world in recent days to harness solar energy in most efficient way. This is far more cost-effective solution than purchasing additional solar panels.

Increasing the cell efficiency, maximizing the power output and employing a tracking system with solar panel are three ways to increase the overall efficiency of the solar panel. Improvement of solar cell efficiency is an ongoing research work and people throughout the world are actively doing research on this. Maximizing the output power from solar panel and integrating solar tracking system are the two ways where electronic design methodology can bring success. A number of MPPT algorithms have been developed and employed around the world. MPPT technology only offers the maximum power that can be received from a stationary array of solar panels at a particular time; it cannot, however, increase the power generation when the sun is not aligned with the system.

COMPONENTS REQUIRED:

The components required are as follows Arduino uno , servo motors , light dependent resistors , 10K resistors.

Arduino uno: Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital I/O pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, ICSP header and a reset button.

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

Figure. 1 Arduino Uno

Solar panel: A solar panel is a flat construction resembling a window, built with technology that allows it to passively harvest the heat of the sun or create electricity from its energy through photovoltaics. Passive solar panels include those used to heat water for home heating and to provide hot water on tap. Most commonly, photovoltaics are assumed when speaking of solar panels. Photovoltaic solar panels use positively- and negatively-doped silicon working in conjunction with conductors on the alternately-charged surfaces.

Figure.2 Solar panel

Light dependent resistors: An LDR or light dependent resistor is also known as photo resistor, photocell, photoconductor. It is a one type of resistor whose resistance varies depending on the amount of light falling on its surface. When the light falls on the resistor, then the resistance changes. Fig 4.3.1: LDR 12 These resistors are often used in many circuits where it is required to sense the presence of light. These resistors have a variety of functions and resistance. For instance, when the LDR is in darkness, then it can be used to turn ON a light or to turn OFF a light when it is in the light. A typical light dependent resistor has a resistance in the darkness of 1MOhm, and in the brightness a resistance of a couple of Kohm.

Figure.3 LDR

Servo motor: servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft. The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position.

Figure.4. Servomotor

WORKING PRINCIPLE: The Sun tracking solar panel consists of two LDRs, solar panel and a servo motor and ATmega328 Micro controller. Two light dependent resistors are arranged on the edges of the solar panel. Light dependent resistors produce low resistance when light falls on them. The servo motor connected to the panel rotates the panel in the direction of Sun. Panel is arranged in such a way that light on two LDRs is compared and panel is rotated towards LDR which have high intensity i.e. low resistance compared to other. Servo motor rotates the panel at certain angle . When the intensity of the light falling on right LDR is more, panel slowly moves towards right and if intensity on the left LDR is more, panel slowly moves towards left. In the noon time, Sun is ahead and intensity of light on both the panels is same. In such cases, panel is constant and there is no rotation. Single axis solar tracker system content servo motor which help it to move in two directions on one axis. for example, it is for the x-axis then it will move in the +x axis and -x axis. and the rotating degree is dependent upon us usually we use 60 degrees in each direction. now, understand the working of this project.

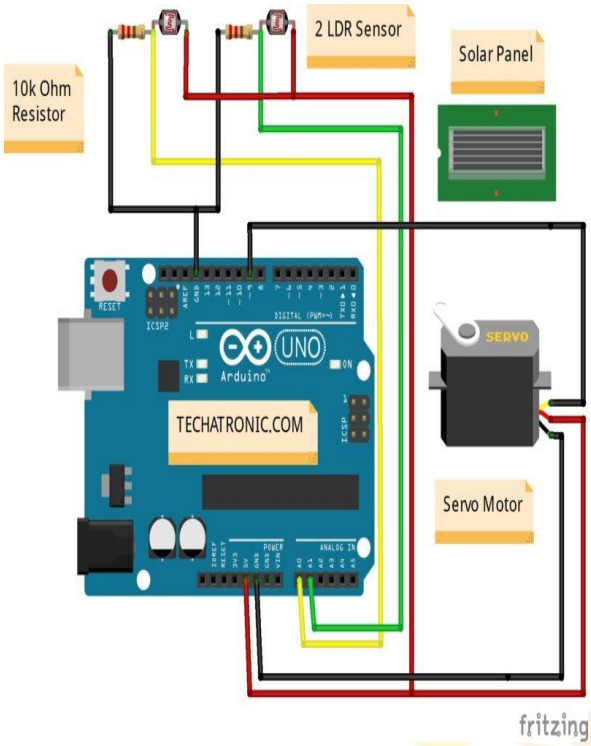

Figure. 5. Circuit diagram

ADVANTAGES:

- Solar trackers generate more electricity than the fixed solar tracking systems due to an increased direct exposure to solar rays.
- There are many different kinds of solar tracker, such as single-axis and dual-axis trackers, which can help you find the perfect fit for your need. Installation size, local weather, degree of latitude, and electrical requirements are all important considerations that can influence the type of solar tracker that's best for you.
- Solar trackers generate more electricity in roughly the same amount of space needed for fixed tilt systems, making them ideal optimizing land usage.
- These trackers provide an efficient, simple, and low-cost way to improve the functioning of solar installations.
- The solar energy can be reused as it is non-renewable resource.
- This also saves money as there is no need to pay for energy used (excluding the initial setup cost)
- Also, the tracker system does not require long term maintenance because of the advancements in technology and reliability of mechatronics.
- In certain states, some utilities offer Time of Use (TOU) rate plans for solar power. This utility will purchase the power generated during the peak time of the day at a higher rate. The solar tracking system is used to maximize the energy gains during these peak time periods.

CONCLUSION:

Solar tracking systems are used to continually orient photovoltaic panels towards the sun and can help maximize the investment in PV system. They are beneficial as the sun's position in the sky will change gradually over the course of a day and over the seasons throughout the year. Advantages to using a tracker system like this will depend mainly on its placement in determining how well it will increase the effectiveness of the panels. Energy production is at an optimum and energy output is increased year. This is especially significant throughout the summer months with its long days of sunlight available to capture and no energy will be loss.

RESULT: The solar panel mechanism managed to follow light sources ranging from flash lights to the sun with good precision. It worked during lightly cloudy days, but had a bit of trouble finding the sun's position when it was very cloudy. The amount of energy generated when the solar panels were stationary was approximately 0.081 J on average, while the solar tracking solar panels generated approximately 0.12 J. That means that the amount of energy generated increased by 48 %.

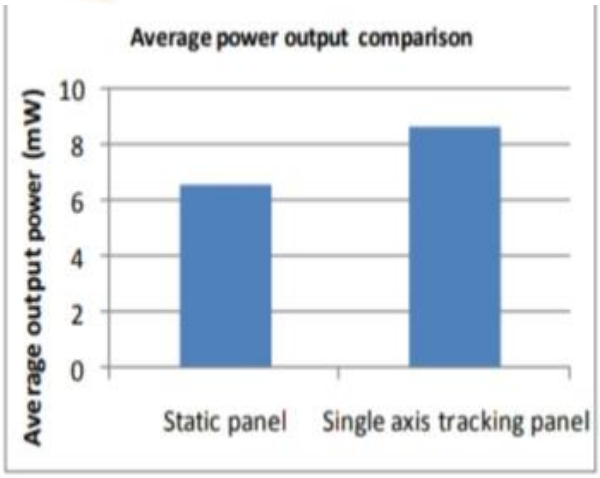

Figure.6.Comparison of Static Panel and Single axis Tracking Panel.

SCOPE OF FUTURE: The very embodiment through which the futuristic conundrum be set aside, is the project called "Automatic Solar Tracking System". A trailblazer by its spirit, this system works in its utmost efficiency, whether that be in terms of its pecuniary ability or in terms of its accessibility. In the smoke of the darkness where pollution

engulfing every spheres of advancement as an outcome of , this device in its very efficiency towards only advancement and development by flushing out the pollution at large.

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