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Solar Tracker Using Arduino

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Abstract:- Solar energy is the most efficient form of energy ,and used for domestic such as cooking , solar panels and for industrial purposes for producing electricity, transportation, solar batteries. So in today's time usage of solar cells for installing solar panels is considered cardinal. They are installed in the direction of maximum radiation of sunlight. Since the sun keeps moving maximum radiation of sun cannot be obtained during all the time. The maximum radiation receiving position comes once in 24 hours.

Sunlight consists of two components, one is the "direct beam" which carries the maximum part of solar energy, and the second being "diffuse sunlight" which carries the remaining sunlight – the diffuse portion refers to the blue sky on a clear day, and on cloudy days consists the larger portion. Since direct beam constitutes majority of energy, to have maximum efficiency the sun needs to be visible to panel utmost.

The earth receives $16x10^{18}$ units of solar energy every year, which is 20,000 times the requirement of mankind on earth. The function of Solar panels is to convert light energy into electrical energy. Solar power generation system using moving panel is an efficient power generating method using sun radiation. To sense the direction of maximum intensity of light two sensors are used. The difference between the outputs of the sensors is then calculated and given to the microcontroller unit.

The energy from the direct beam inclines with the cosine of the angle between the incoming light and the panel. And for the angles of incidence up to around 50°the reflectance is constant, beyond which reflectance reduces significantly.

Microcontroller processes the input voltage and controls the direction in which the motor has to be rotated so that it will receive maximum intensity of light from the sun.

Keywords:- *Solar Energy, Solar Panels, Sensors, Microcontroller.*

I. INTRODUCTION

Nowadays solar energy is becoming one of the most reliable sources of energy as a result of its surplus and environmental friendly. According to reference a system that tracks the sun will be able to know the position of the sun in a manner that is not linear. The operation of this system should be controlled independently. Maximum energy is produced by a solar PV panel when it is positioned at right angle to the sun. Therefore, the aim of this research is to develop an Arduino based solar tracking for energy improvement of solar PV panel.

The device used to convert light energy to electrical energy is known as solar cell. The principle behind is photovoltaic effect. Solar panels are made of photovoltaic modules where solar cells are its building blocks .In solar tracking system, the module surface tracks position of the sun automatically as the day runs by. The position of the sun varies as the sun keeps on moving. For a solar powered equipment to work at its best, must be placed near the sun, and the solar tracker can increase the efficiency of that equipment at any fixed position. Based on sophistication, costs and performance one common type of tracker is the heliostat, a movable mirror that reflects the position of the sun to a fixed location. Solar trackers accuracy depends on the application. Concentrators, especially in solar cell applications, which requires high degree of accuracy to make sure that the sunlight is concentrated exactly on the powered device, which is close to the focal point of the reflector or lens. Since tracking is important for concentrator systems to work single –axis tracking is mandatory. The applications which doesn't require directed sunlight needs less accuracy, and are likely to work without any tracking. If tracking is done with more accuracy with can improve both the amount of total output power produced by a system, and that produced during critical system demand periods (usually late afternoon in hot climates). Researches have been done to improve the energy production of solar panels. These researches include: double- sided panels, conversion stages improvement, building panels integration geometrically and so on. Maximum energy is produced by a solar PV panel when it is positioned at right angle to the sun. For this reason, several researches developed different types of solar panel tracking systems. Therefore, the primary purpose of this work is to develop a solar panel tracker based on Arduino advances so as to enhance the energy production of solar panel.

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II. BLOCK DIAGRAM

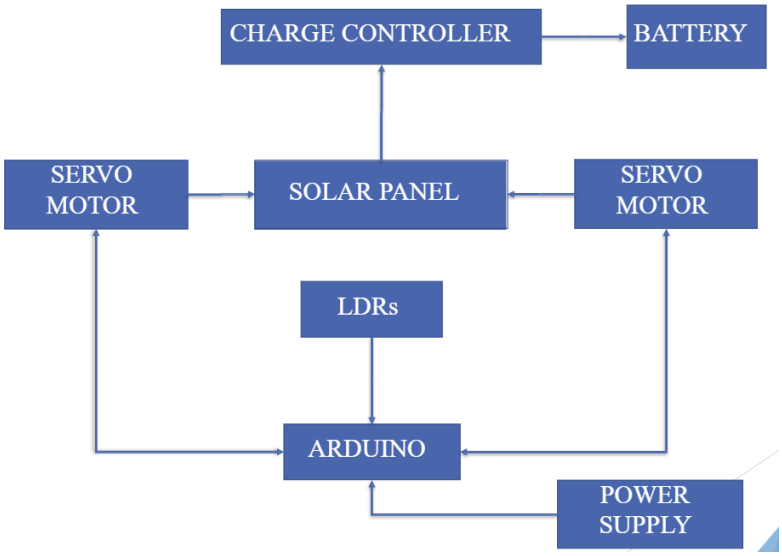

Fig 1

III. WORKING PRINCIPLE

On each four sides of solar panel a LDR is placed. Along with that a Servo motor used to rotate the panel is placed. With the help of motor the solar panel towards the LDR whose resistance apparently will be low, mean towards the LDR on which light is falling, that way it will keep following the light. LDR's does the function of light detectors. First let us understand how the LDR's work. LDR (Light Dependent Resistor) also known as photo resistor is the light sensitive device. when the light falls on it the resistance decreases and vice versa and .this is the reason why it is frequently used in dark or light detector circuit, and the servo is not going to rotate in the presence of same amount of light falling on both the LDR.

The principle behind solar tracking system is Light Dependent Resistor (LDR). Four LDR's which acts as inputs are connected to Arduino analog pin AO to A4. The built-in Analog-to-Digital Converter will convert the LDR's analog value to digital. The analog value of LDR is taken as inputs. Arduino is the controller part and the DC motor provides us with the output value. Two LDRS are taken as pairs that is LDR1 and LDR2, LDR3 and LDR4 respectively .If any one of the LDR in a pair gets more light intensity than the other, a there will be difference on node voltages sent to the respective Arduino channel if any one LDR in each pair gets more light intensity than other then is initiates to take necessary action.

The motor tries to move the solar panel such that both the LDRs have equal resistance. In the sense both the resistors are going to receive the same amount of sunlight. The panel moves towards the lower resistance LDR if resistance of any LDR is reduced

IV. CIRCUIT DIAGRAM

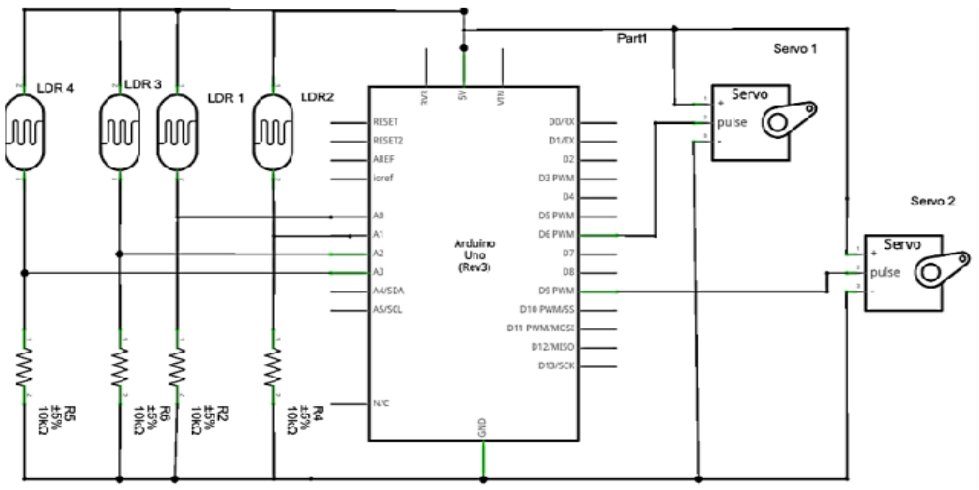

Fig 2

V. ADVANTAGES

- Trackers constitute maximum production of electricity.
- Vivid types of trackers (single-axis, dual-axis) are used for applications depending upon jobsite.
- Factors such as installation size, local weather, degree of latitude and electrical requirements influence the type of solar tracker best suited for specific installation.
- Minimum land usage required.
- Some states offer time of use plans for solar power (utility purchases the power generated at the peak time of day at higher rate) which maximizes the energy gain during peak time periods.
- Long-term maintenance concerns are reduced due to advancement in technology and ease with which we can use electronics and mechanics.

VI. APPLICATIONS

- Solar trackers can be used for large & medium scale power generations.
- It can also be used for electricity generation at remote places.
- It may be used as domestic backup power system.

VII. CONCLUSION

The proposed design helps in enhancing the energy production of solar panel by using Arduino Uno. With further use of batteries with more lifecycle we can have much energy production and can be used for many industrial and domestic applications. This reduces the usage of Non – renewable energy sources and leaves us with better future by using the non exhaustible energy sources.

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