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Sun Tracking Solar Panel

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Abstract: Earth receives 84 Terawatts of power and world consume about 12 Terawatts of power per day. We are trying to consume more energy from the sun. Thus, the tracking of the sun's location and positioning of the solar panel are important. The goal of this project is to design an automatic tracking system, which can find location / position of the sun. The tracking system will move the solar panel so that it is positioned perpendicular to the sun for maximum energy conversion at all time. Photo resistor will be used as sensors in this system. The system will consists of light sensing system, micro controller, gear motor system, and a solar panel. The Sun illuminates the earth every day by irradiating an enormous amount of energy of which a majority is lost or not utilized because of the unscientific placement of solar panels. Thus, tracking the location of the sun and the position of the panel is of huge importance in this project.

Keywords: Solar Panel, Tracking, Arduino, Sensor

I. INTRODUCTION

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. We have already read a post about how to install solar panel for home. Solar panel absorbs the energy from the Sun, converts it into electrical energy and stores the energy in a battery.

This energy can be utilized when required or can be used as a direct alternative to the grid supply. Utilization of the energy stored in batteries is mentioned in below given applications. The position of the Sun with respect to the solar panel is not fixed due to the rotation of the Earth. For an efficient usage of the solar energy, the Solar panels should absorb energy to a maximum extent.

This can be done only if the panels are continuously placed towards the direction of the Sun. So, solar panel should continuously rotate in the direction of Sun. This article describes about circuit that rotates solar panel. The whole world is leaping towards the use of renewable energy, as fossil fuels are slowly disappearing from the face of the earth. It projects to the scenario, 15 years from now, where the whole world could get easily drawn into an all-out conflict over the last remaining stains of non- renewable energy. The easiest way to solve this is, by the use of renewable energy. The best and abundant renewable energy source is the sun.

Solar energy is considered to be the best source of renewable energy since the beginning of its use in 1876. Unfortunately, the current production of electricity using solar energy is not the power originally demanded. This is primarily because solar energy production is significantly affected by the placement and orientation of the panel. To maximize the conversion by this method, the panel has to be oriented perpendicular to the sun all the time. As the traditional solar panels are oriented to face in one direction, this perpendicularity occurs only once in a day and lasts for only some hours. This drastically decreases the conversion rate. This proposed system is intended in orienting the solar panel in such a way that, it faces the sun all day long.

A. PRINCIPLE OF SUN TRACKING SOLAR PANEL

Sun tracking solar panel consists of four LDRs, solar panel and a servo motor and Arduino Uno. Four 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 the sun. Panel is arranged in such a way that light on four 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

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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.

B. OBJECTIVES OF STUDY

The main objective of the project is to harness the maximum amount of sunlight from sun and converting it to electricity so that it can be easily used and transferred. This can be done by aligning the solar panel perpendicular to sun rays so that maximum sunlight can be converted into electrical form.

Solar Trackers are used to keep solar collectors/solar panels oriented directly towards the sun as it moves through the sky every day. Using Solar Trackers increases the amount of solar energy which is received by the solar energy collector and improves the energy output of the heat/electricity which is generated.

C. PROBLEM STATEMENT

A solar tracker is a device that orients a payload toward the sun. The use of solar trackers can increase electricity production by around a third, and some claim by as much as 40% in some regions, compared with modules at a fixed angle.

The five most common problems with solar panels

1. Hot spots on the panels. Hot spots are places on the panels which are overloaded and therefore become warm.
2. Micro-cracks. One phenomenon we regularly encounter is 'micro-cracks' in crystalline PV panels.
3. Snail trail contamination.
4. PID Effect.
5. Internal corrosion, delamination.

II. PROPOSED METHODOLOGY

The below figure is the general block diagram of our idea, where the energy is taken from the sun rays. which falls on the panel. A motor is connected to the panel, it helps to rotate the panel in the direction of the sun's rays. We are taking a digital processor where the complete process is going to run on this processor. Sensors are connected to the processor and the panel can be controlled automatically with the help of the sensors. And finally, the power supply should be given to the processer.

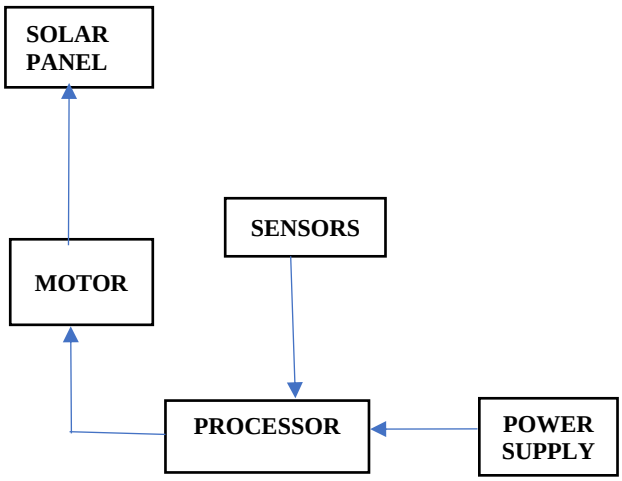

Fig 1: General Block Diagram of Proposed Methodology

This project uses a single axis sun tracking solar panel that can rotate automatically with the help of four LDR sensors and servo motor. Arduino UNO board is utilized to implement all software requirements of the system. For automatic mode, the microcontroller converts the analogs values of LDR sensors, (pins A0, A1, A3, A4) into digitals. The LDRs are used to detect light levels, their resistance decreases as the light intensity increases. The solar panel absorbs the energy which is coming from the sun and it converts into electrical energy. The LDRs are arranged in a manner that is

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compares all LDRs intensity among them then they move towards that LDR. For example, if the intensity of LDR1 is greater than the intensity of LDR2, 3, 4 (LDR1>>LDR2,3,4) then the solar panel moves towards the LDR1.

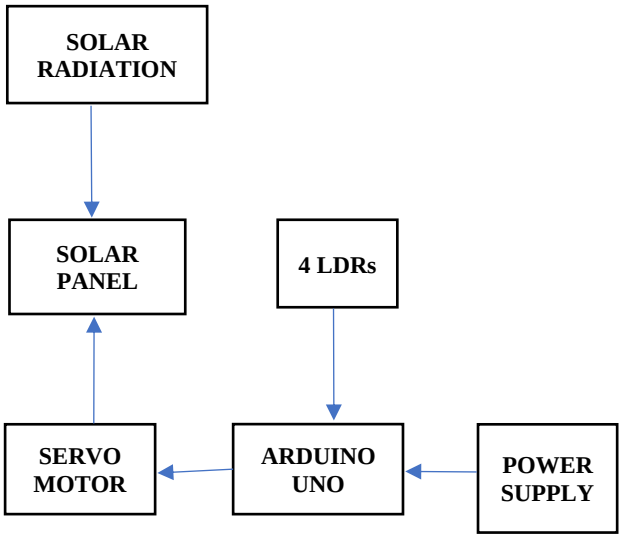

Fig 2: Detailed Block Diagram of Proposed Methodology

The electric energy is taken from the solar panel, we can store that electricity energy or we can use it directly.

III. IMPLEMENTATION WITH RESULTS

The four LDRs and resistors are shorted accordingly, the other end of the resistors are shorted and connected to the GND. The other end of the LDRs is shorted and connected to 5v pin. The shorted point of LDR1 and R1 is connected to A0 pin of the Arduino board. Similarly, LDR 2,3,4 and R2, R3, R4 are connected to A1, A3, A4 pins of the Arduino board. The servo motor is connected to 5v, GND and ~9th pin of the Arduino board.

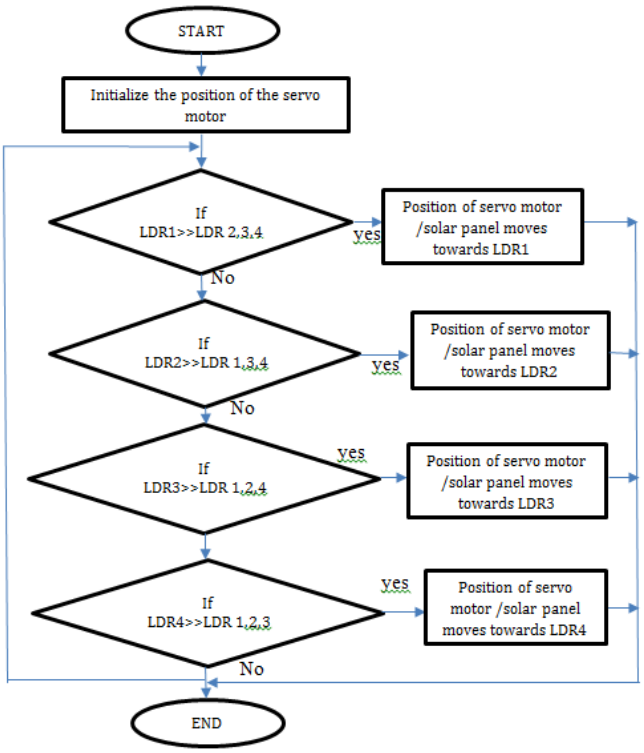

Fig 3: Flowchart of Proposed Methodology

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The four LDR's, LDR1,2,3&4 are connected to analog pins of the Arduino UNO board. A solar panel is attached in parallel to the axis of servo motor and the servo motor is connected to the Arduino UNO board. The design and the arrangement are done in such a manner that the movement of the sun is from LDR1 to LDR4.

There are four cases that are to be followed:
CASE 1: (LDR1>>LDR2,3,4)
If the light is on the LDR1 the light intensity is high compared to the LDR 2,3&4. Now panel rotates towards LDR1 then the panel absorbs the energy.
CASE 2: (LDR2>>LDR1,3,4)
If the light is on the LDR2 the light intensity is high compared to the LDR 1,3&4. Now panel rotates towards LDR2 then the panel absorbs the energy.
CASE 3: (LDR3>>LDR1,2,4)
If the light is on the LDR3 the light intensity is high compared to the LDR 1,2&4. Now panel rotates towards LDR3 then the panel absorbs the energy.
CASE 4: (LDR4>>LDR1,2,3)
If the light is on the LDR4 the light intensity is high compared to the LDR 1,2&3. Now panel rotates towards LDR4 then the panel absorbs the energy.

The following figures are the results of the working of sun tracking solar panel. It works by rotating solar panel, according to the sun's direction by using the LDR sensors.

Fig 4: Sideview of the Design

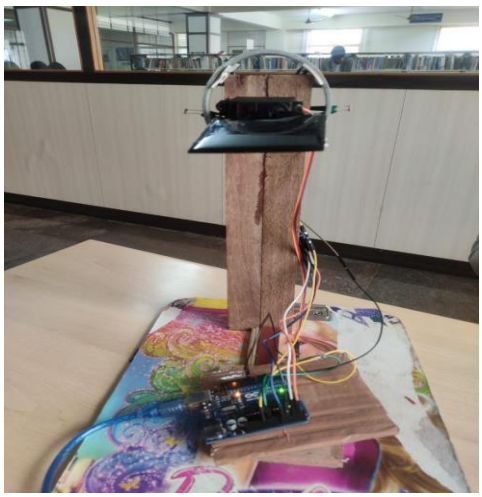

Fig 5: Complete Design

A. ADVANTAGES

- Solar trackers generate more electricity in roughly the same amount of space needed for fixed-tilt systems, making Trackers generate more electricity than their stationary counterparts due to increased direct exposure to solar rays. This increase can be as much as 10 to 25% depending on the geographic location of the tracking system.
- There are many different kinds of solar trackers, such as single-axis and dual-axis trackers, all of which can be the perfect fit for a unique jobsite. Installation size, local weather, degree them ideal for optimizing land usage.
- In certain states, some utilities offer Time of Use (TOU) rate plans for solar power, which means the utility will purchase the power generated during the peak time of the day at a higher rate. In this case, it is beneficial to generate a greater amount of electricity during these peak times of the day. Using a tracking system helps maximize the energy gains during these peak time periods.
- Advancements in technology and reliability in electronics and mechanics have drastically reduced long-term maintenance concerns for tracking systems.
- Solar cells have a lower sensitivity of the photovoltaic effect to dust deposited on the surface, thanks to the better angle of incident of the sun's radiation.

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B. APPLICATIONS

1. High Precision Sun Tracking Algorithm
2. Calculated Angles
3. High Quality, Industrial Hardened Components Controllers built to industry standards (UL, IEC, CE, etc.)
4. Off-the-Shelf (OTS) Components
5. Supply Chain Solutions
6. Secure Remote Access/Monitoring
7. Fast, Efficient Data Communications
8. Faster Development/Troubleshooting
9. Product Life Cycle

IV. CONCLUSION

The paper gives a brief overview of solar tracking system based on controller and also describes about the simple and attractive features of tracking system. This solar tracker operation costs and maintenance cost are comparatively low. Here the use of servo motor in solar trackers enables accurate tracking of the sun and light dependent resistors are used to determine the solar light intensity. The paper concludes that solar tracking system provides more effective method to track the solar insolation and provide economic consistency for generation of electric power. Solar power technology is constantly advancing and improvements will intensify in future.

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