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Single Axis Sun Tracking Solar Panel

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ABSTRACT:

In this advancing era of technology, we are more concerned about the advancements made in technology rather than thinking upon the alternativesources of energy. As solar energy which is a renewable form of energy can be used to offset some of the power coming from the main grid that isgenerated by let us say non-renewable sources of energy. And creating these renewable sources in such a way that these provide us with the maximum efficiency is our main goal. This paper proposes a solar tracking system designed with Arduino Uno and LDRs that will actively track the sun and change its position accordingly, with help of servo motor, to maximize the energy output. The LDRs incorporated on solar panel helps to detect sunlight which in turn moves the panel accordingly

Keywords: Arduino Uno, LDR, Servo motor, Solar panel.

1. INTRODUCTION:

It seems like we cannot walk down the street these days without coming across a solar panel. We can find them for mobile charging in rural areas, as well as simple little sidewalk path lights. Solar is easy to use, readily available, and inexpensive.

Every panel we see is in a fixed position. While this approach is extremely simple and meets the needs of most small applications, it is not producing as much energy as it could be. Solar tracking system is a device that orients a solar panel according to the movement of sun for maximizing the intensity of sunlight.

Our tracker is a single axis tracker, which means, precisely it follows the direction of the sunlight throughout the day to produce enough energy to run a house instead of using the electricity.This tracking system can move a 180 degree of rotation.

2. LITERATURE SURVEY:

[1]Chaiko and Rizkdeveloped a tracking system using solar panels efficiently. They designed a simple single axis tracking system using stepper motor and light sensor. They observed that this system stretches the efficiency of power collection by keeping a solar panel perpendicular to the sun rays. And they also found that the power gain was increased by 30% over static PV system.

[2]Guiha Li, Runsheng Tang, Hao Zhong investigated horizontal single-axis tracked solar panels. They obtained result as east-west axis tracking was poor to improve the energy while tracking the sun about south-north was best. The efficiency increased for both east-west axis and south-north axis.

[3]Siti Amely Jumaat has a detailed circuit of sun tracking solar panel. They also showed that the solar panel can also be integrated with embedded systems which makes it complex and has high cost.

[4]Prof. Vaibhav J. Babrekar developed the solar panel using Arduino uno and microcontroller which has very lengthy steps to be followed. They gave more details about the efficiency based on their design which gives out various varied efficiency. They showed how to achieve maximum efficiency that can be expected and also the minimum efficiency value it can go upto.

[5]Jaya Prakash S.T. they designed the horizontal single axis solar tracker which uses components of minimal cost which makes it cost efficient. The design also generates maximum power, but in turn gives less efficiency.

[6]Ashwin R, presented a sensor based single axis solar tracker. It keeps tracking continuously for the maximum strength of light. This system spontaneously changes its direction when the sun moves from its position to get maximum light energy. Therefore, the experimental result shows the robustness and productiveness of the proposed method.

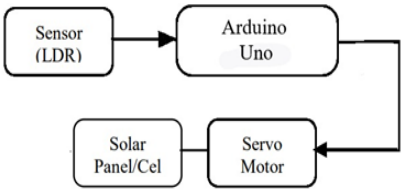

Fig1. Block diagram of solar tracking system

3. METHODOLOGY:

The system consists of sensors, Arduino uno, solar panel which is monitored by servo motor.The Arduino has been dumped with the code that assists the rotation and detection of the panel and light respectively. The LDRs serves as the sensors for the light intensity. Then, they send the information to the Arduino uno to which the servo motor is connected. Based on the received data, rotation of the servo motor happens which in turn rotates the solar panel. Below is the block diagram (Fig1.) and the flow chart (Fig2.) which is basically followed in this project.

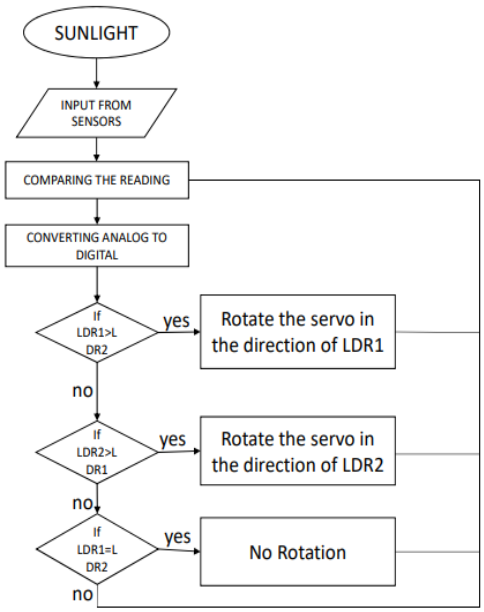

Fig2. Flow Chart of the solar tracking system

We know that sun rises in east. As the sun rays hit the solar panel, the panel starts rotating. The light intensity falling on LDR1 is greater than that of the LDR2. Therefore, the panel rotates towards the east side.

Due to the rotation of the earth, the position of sun also changes. Now, it is overhead that is, noon time. But here, there would be no rotation of the solar panel. As the light intensity falling on both the LDRs is the same.

As the sun starts setting in the west, the light intensity falling on LDR2 is much higher than the other LDR1. So, the panel is rotated to the west side.

As we see, due to the above-mentioned cases, the sun light captured is greater when the solar panel follows the sun light rather than being fixed in one place.

4. CIRCUIT DIAGRAM:

The circuit contains the components:-

1.LDR (Light Dependent Resistor): Also known as photocell. They are used to indicate the presence or absence of the sunlight. And also to measure the light intensity.

2. Resistors: They are basically used to limit the flow of current. Here we have used 10kΩ.

3. Servo motor: They are used to give a controlled angular or linear rotation. They have sensors for the position feedback.

4. Arduino uno: It is a microcontroller. They are used to read input- light on the LDR, and give output- rotating of the servo motor.

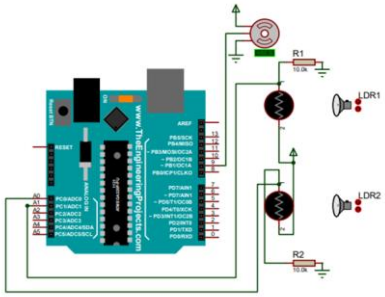

Fig 3. Schematic diagram of solar tracking system

The simulation was performed on Proteus software, for better understanding of the design and to check the desired output.

The one terminal of the LDR1 and LDR2 are connected to the A_0 and A_1 pins respectively of the Arduino uno. The other terminals are connected to the supply battery of 5V. Depending on the received input, the Arduino uno gives the output to the servo motor data/signal pin which is connected to the Arduino uno pin D9. The ground pin of servo motor is connected to the ground pin of Arduino uno. The power pin of the servo motor is connected to the +5V for powering.As the first rays of the sun falls on the sensor LDR1, they sense the light and sends information/data to the Arduino Uno. The solar panel which is connected to the servo motor starts rotating in -90˚direction keeping the reference of the initial position as 0˚. Accordingly, the solar panel captures the light and the cells in them stores the radiations. At noon, the sun is overhead, and the light intensity sensed by both the sensors, i.e., LDRs are equal. Thereby, the servo motor stays in the initial position. As the sun starts setting and moving towards the west-side, the light falling on the LDR2 is more. Thereby, the Arduino uno sends the data to the servo motor which then follows the same direction as that as the sun. The rotation is measured as +90˚. The resistors are used here to limit the flow of the current. The terminals of R_1 and R_2 are connected to the A_0 and A_1 pins which are already connected to the LDRs. The other two terminals of the resistors are connected to the ground pin. The stored energy in the cells is converted to required energy form by using inverters.

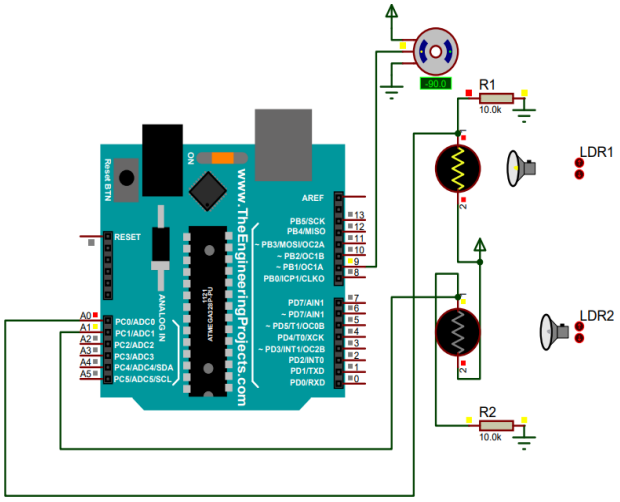

Fig3.1. Rotation of servo towards LDR1

Here the servo motor reads as -90˚, which says that the rotation is happening depending on the light intensity falling on the sensor, LDR1.

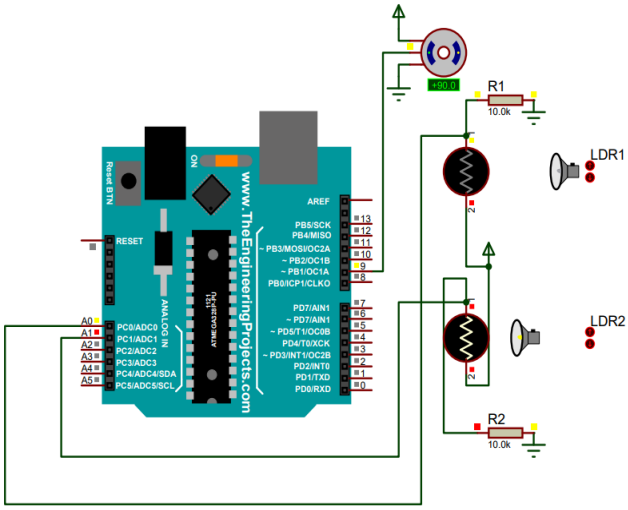

Fig3.2. Rotation of servo towards LDR2

The servo motor reads as +90˚, which depicts that the solar panel faces the sun light which is sensed by the sensor, LDR2.

5. CONCLUSION:

In this paper, we see that compared to the traditional way of fixing the solar panel, the rotation of the solar panel adds more value. We have seen how a solar tracking system can be built with low cost, low maintenance using Arduino uno with its development environment, Arduino IDE, along with basic components like servo motor, resistors, LDRs. The system achieves the controlling and monitoring the movement of the solar panel based on the intensity of light falling on the LDR. Also, it generates more power during the hours as compared to the fixed panel does. Being user friendly, it can be easily installed anywhere. From the study of technologies, the use of Arduino in solar tracking system, the efficiency increases. The servo motor adds to this increase in the efficiency by rotating as per the light reception from the LDRs. This is a flexible installation.

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