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SUN TRACKING SOLAR PANEL

[1]Sanjivani Adsul, [2]Mrunal Dhulap, [3]Advay Dhule, [4]Adityaraje Dhumal, [5]Ajinkya Dhumal, [6]Gayatri Dhumal, [7]Girish Dhurve.

[1]VIT Assistant Professor, [2] B.Tech student, [3]B.Tech student, [4]B.Tech student , [5]B.Tech student, [6]B.Tech student,[7] B.Tech student
[1]DESH Department, [2]Electronics and Telecommunication Engineering, [3]Computer Engineering, [4]CS/AIMl Engineering, [5]Mechanical Engineering, [6]Computer Engineering, [7]AIDS Engineering.
Bansilal Ramnath Agarwal Charitable Trust's Vishwakarma Institute of Technology, Pune, India

Abstract: The biggest challenge for the coming centuries is the generation of power from fossil fuels. Thus, the world has been inclined towards the use of renewable resources. The idea of the generation of electric energy from solar energy using photovoltaic panels has increasing importance. But the frequent change in the positions of the sun with respect to Earth is responsible for the loss of huge amounts of energy. Thus, it is necessary that the panel should continuously track the positions of the sun and thus it gives rise to the idea of sun-tracking solar panel systems. Sun-tracking solar panels will increase the panel's efficiency as it will be able to adjust its orientation with respect to the sun's position. This paper presents the entire process of designing such panels, the working, and other aspects of the system. The tracking system designed using Arduino Nano uses LDR sensors to detect the intensity of sunlight. The servo motor is used for rotating the panel. Thus , once set in the east direction, the single-axis panels change its orientation towards the west direction depending upon the sun's position.

Index Terms - Panels, Trackers, Sunlight, Intensity, Arduino, LDR sensors, Servo Motor.

I. INTRODUCTION

Renewable energy resources provide about 28% of electricity generation across the world. The demand for power generation will ·keep increasing in the coming years. However, resources like coal, oil, and gases, that is the non-renewable ones are exhausting. The solar energy is one of the most powerful resources for the generation of power. In the last decades, most of the residential areas installed solar systems. Thus, to utilize the efficiency of solar energy, the idea solar tracking system is proposed. The solar energy produced, largely depends upon the placement and orientation of the panel. The enhance the output obtained, the panel must be perpendicular to the sun throughout the day. As in the existing system. Sun tracking solar panel is a project which aims at designing a model in which the solar panel is self-orienting with respect to the positions of the sun in the sky. The innovation in this phenomenon is that, it generates more amount of power from solar energy than fixed systems in a lesser area. In fixed systems, to produce more power the panels of larger areas are required to be installed, but in this case, more amount of energy is generated while keeping the area of the panel the same. Thus, this method is most cost-effective as well as contributes to the proper utilization of energy.

II. LITERATURE REVIEW

[1] In the past, research was made to solve the issue of loss of energy by solar panels. This paper suggests that the efficiency of solar power systems can be increased by incorporating a tracking system. Various types of tracking systems are possible. This paper is an overview of designing a single-axis sun tracker using a microcontroller. The study evinces that such tracking systems increase the yield of energy by a huge amount. Using microcontrollers manipulates the execution of the system with more efficiency.
[2] This paper addresses the factors that affect the efficiency of solar cells such as temperature, maximum power point tracking, and energy conversion efficiency. Solar cells are more efficient in various applications if all these factors are optimized. Thus, to utilize these factors a tracking system based on the function of a DC motor controlled by light sensors is fabricated.
[3] The tracking system is designed using a microcontroller as well as a servo motor. The system can be programmed to rotate at different angles and also the sensitivity of the system can be encouraged by the use of Light Depending Resistors that is LDR sensors. This gives greater flexibility over existing systems. The paper explores how the single-axis algorithm could be extended to the dual-axis as well.
[4] This paper proposes a financial assessment of the economic benefits of tracking systems over traditional systems. The financial survey was undertaken based on Texas's energy market rate and sun trackers' average price and operative expenses. The overall improvement in the final outcome was about 82%. Thus, the trackers proved to be economically more beneficial.
[5] This paper aims to the comparison between tracking panels and fixed panel PV systems with the same rate powers in one year. The setup was installed in Florida. The Factors such as the annual power production by each array and the amount of CO_2 emission

reduction suggested that the tracker system should be adopted and more research should be carried out in this aspect.

[6] The paper relates to the architecture of a simple dual-axis tracking system using Arduino and a stepper motor. It gives the algorithm of the relation between the working of a motor based on the signals received from LDR which are responsible for the moment of the solar panel.

[7] This paper approaches a photovoltaic panel system using an Arduino-based application as monitoring media. The Android application monitors the temperature changes and conveys the necessary angle inputs. The node MCU is the communication bridge for the microcontroller. The system is commanded by open loop control system. Servo motors are attached to bike wheels which move solar panels to follow the sun's positions. Thus, the output from the mobile application which serves as input for the servo motor and the position of the panel is adjusted.

[8] The tracking systems designed using microcontrollers are efficient as they provide systematic working of the system. The LDR sensors used with appropriate arrangement provide the signals to the servo motor and thus the panel rotates with the desired angle according to the position perpendicular to the sun rays.

[9] The paper performs a techno-economic-environmental analysis of maximum power generation by the solar tracking system. The panels were installed in the residential areas. The results reflected that, by using tracking systems the number of plants needed was reduced. The single-axis tracking system resulted in greater cost-efficiency with 0.243 $/kWh cost of energy with an average of 25% increase in the output power. Although the dual-axis tracker increased power generation by 33%, it was less cost-effective.

[10] The paper directs to the design of a dual-axis solar tracker. The panel adjusts its orientation by moving simultaneously in two directions. It is a closed-loop system using the Wheatstone bridge circuit that works with light-dependent resistors (LDRs).

III. METHODOLOGY

3.1 Component used:

3.1.1 Hardware Requirements:

Solar Panel, LDR sensors, Arduino nano, LEDs, Servo Motor SG90, Cell 9V Resistor, Connecting-wires, Zero PCB, Foam Board

3.1.2 Software Requirements:

Arduino IDE for Program, Protius 8 for Circuit design.

3.2 Block Diagram:

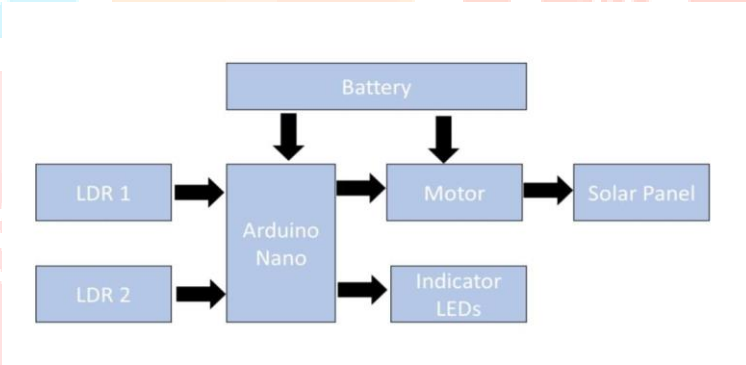
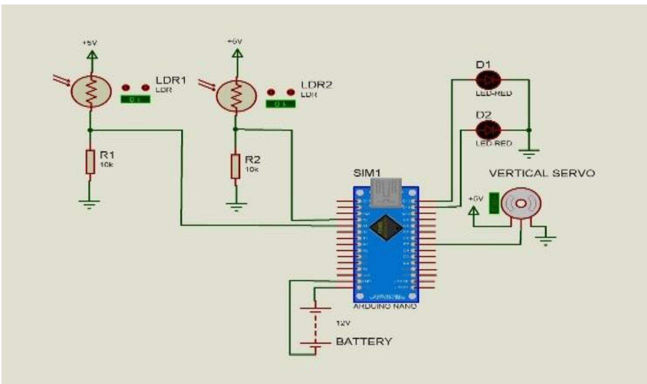


Fig. 1 Block diagram representing the flow of work of the project.

3.3 Working:



Above is the circuit diagram of the working of the project. The construction of a prototype for a solar tracking system is along the horizontal axis. The circuit design of the solar tracking system uses an Arduino nano board & servo motor to control the position of the solar panel. Light-dependent resistors are used to track the position of the sun and to start the operation. This system is controlled with an SG90 servo motor. The single–axis solar tracking system is implemented here. Whenever the sunlight is incident on the LDR sensors the signals are sent to the servo motor through the microcontroller. Thus, the LDR rotates in a direction perpendicular to the initial one. Two such LDRs arranged two on the side of the panel. Due to the partition between two LDRs, each of them is isolated from the other. When the intensity of light falling on the LDR sensor increases the resistance is decreased.

The two sensors are again connected with resistors in series. Thus, whenever the position of the sun changes, the intensity of sunlight falling on the LDR arrangement also differs from each other due to the partition. The voltage drop is formed at the junction of the LDR and the resistor. This voltage drop is passed as the input to the microcontroller. The digital signals are sent to the servo motor and thus it rotates at a desired angle and thereby the panel also rotates in the direction of maximum intensity. Thus, it rotates by about 15 degrees per hour. Hence, a delay of 1.5 minutes is required. Because of this algorithm, sunlight radiating from every direction is tracked and the orientation of the panel is achieved.

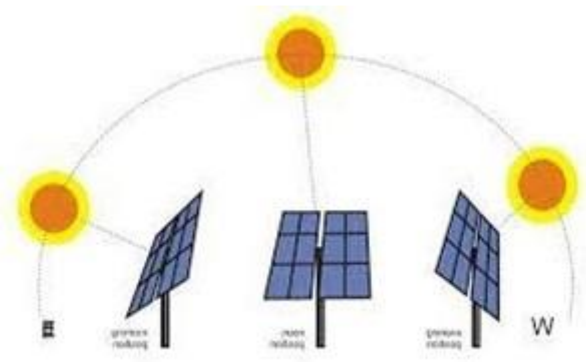


Fig. 3. Working of the prototype

IV. RESULTS AND DISCUSSIONS

Using such kinds of Solar panels will generate power at full efficiency. The panel will be able to attain its orientation according to the position of the sun. As a result, there is linearity in power generation. Automatic operation of panels will increase the accessibility of such methodologies as it reduces manual errors and controlled tracking is possible. This improves performance. Since non-renewable sources are brought into usage this contributes to green energy.

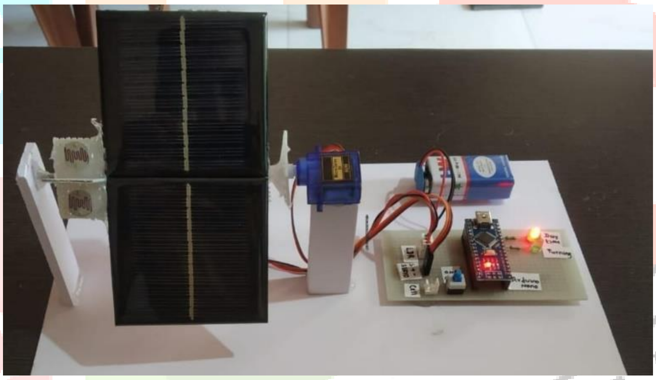


Fig. 4 Model of the project.

V. FUTURE SCOPE

Sun-tracking solar panels have the potential to significantly increase the efficiency of solar energy systems, as they can follow the path of the sun throughout the day to optimize the amount of sunlight they receive. The future scope of sun-tracking solar panels is promising, as more and more research is being conducted to improve their design and functionality, making them more efficient, cost-effective, and easier to use. With the increasing demand for renewable energy sources, sun-tracking solar panels are expected to become more popular in the future, and could play crucial role in fulfilling the energy needs of the world in a sustainable way. Innovation is to be made in the current panel and a dual-axis tracking panel can be designed which will perform in a multidimensional workspace

VI. CONCLUSION

The project helps in enhancing the efficiency of solar panels and thus the maximum amount of energy can be obtained without loss. Similarly, the project shows the working of software for maximizing the output by positioning the panel at maximum intensity. Self-adjusting solar panels are proven useful as we just need to place them in ample sunlight and rest it works efficiently. Hence, the tracking systems demand more research as it proves to be beneficial in agriculture as well as for power generation in industries as well as in residential areas. It is cost-effective as well as environmental-friendly

VII. ACKNOWLEDGEMENT

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