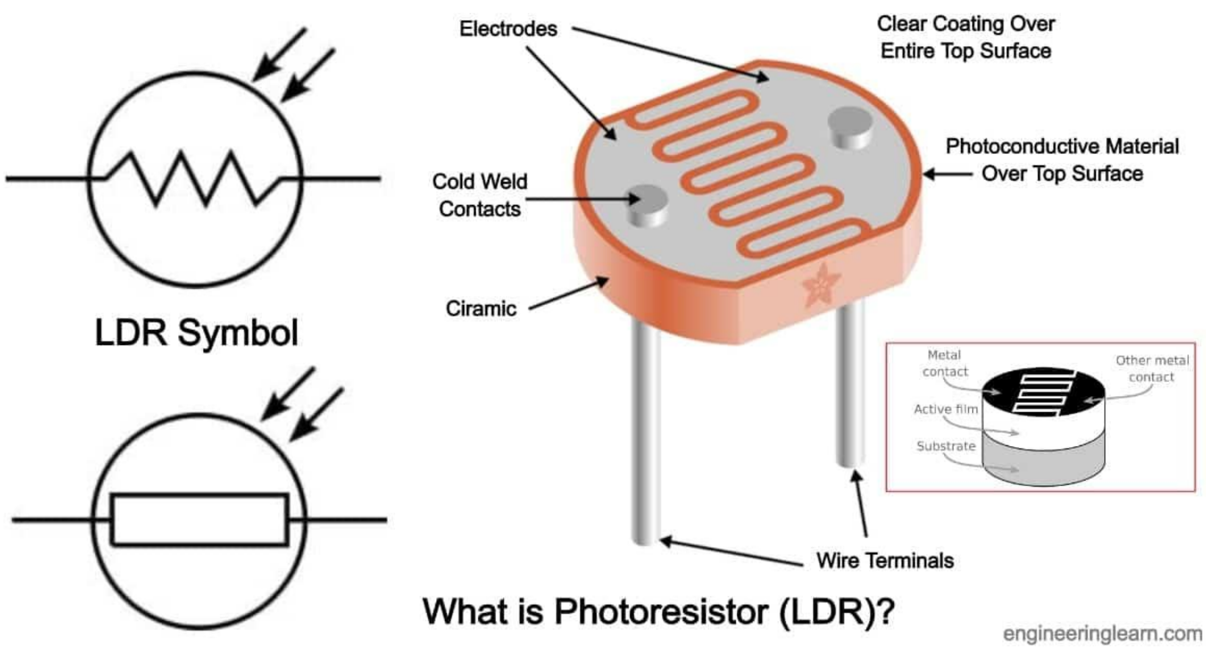
Solar Tracker System

Introduction

A solar tracker is a device that orients solar panels toward the sun to maximize energy absorption. This project is based on an Arduino-controlled dual-axis solar tracking system using servo motors and light sensors.

What is an LDR and How Does It Work?

LDR stands for **Light Dependent Resistor**. It is a type of resistor whose resistance decreases with an increase in the intensity of light falling on it.



Working Principle:

- In darkness or low light, the resistance of an LDR is very high (in the range of megaohms).
- In bright light, its resistance drops significantly (to a few hundred ohms).
- This change in resistance affects the voltage across the LDR, which can be read as an analog input by a microcontroller (like Arduino).
- In the solar tracker, LDRs help detect the direction from which light is strongest.

By placing multiple LDRs in different directions, the system can compare light intensities and determine the best direction to face for maximum sunlight.

Components Used

- Arduino board
- 2 servo motors
- 4 LDRs (Light Dependent Resistors)
- 4 resistors
- 2 potentiometers
- Breadboard and jumper wires

Circuit Connections

- LDRs are connected to analog input pins A0, A1, A2, and A3.
- Potentiometers are connected to analog input pins A4 and A5.
- Servo motors are connected to digital pins 9 and 10.
- 5V and GND pins from the Arduino are connected to the breadboard for power distribution.

Functionality

The LDRs are used to detect the intensity of light from different directions. These values are read by the Arduino, which calculates the difference in light intensity between pairs of LDRs.

Based on the calculated differences and predefined tolerance levels, the Arduino sends control signals to the servo motors. The servo motors then adjust the orientation of the solar panel both horizontally and vertically to face the direction of maximum sunlight.

This continuous adjustment allows the system to keep the solar panel aligned with the sun throughout the day, improving the overall efficiency of solar energy collection.

Behavior of the Simulation

In the simulation, changes in light intensity detected by the LDRs cause the servo motors to rotate, adjusting the panel's position. The servo response can be observed as the light levels vary.

Additional improvements can include connecting an LDR to monitor servo positions or integrating feedback mechanisms for more precise control.

Conclusion

This solar tracker project demonstrates a practical method of improving solar panel efficiency using basic electronic components and an Arduino. The use of LDRs and servo motors enables real-time tracking of sunlight, making the system adaptive and energy-efficient.