Ai 302 Final Project Documentation

Ai 302 IDEA

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Overview :

The project integrates an LDR (Light Dependent Resistor) sensor for precise detection of ambient light intensity and servo motors, controlled by an Arduino microcontroller, to enable automatic adjustment of solar panels for optimal solar energy capture. The system's primary objective is to dynamically orient the solar panel towards the light source, ensuring maximal energy conversion efficiency.

Utilizing LDRs, the system accurately measures ambient light intensity levels, facilitating real-time feedback to the servo motors. These servo motors respond to the received signals by precisely rotating the solar panel either to the right or left, aligning it with the direction of the incoming light. This automated process ensures that the solar panel continuously tracks the sun's position throughout the day, optimizing its exposure and thus enhancing energy harvesting capabilities.

By leveraging the Arduino microcontroller's computational power and interfacing capabilities, the system orchestrates seamless coordination between the LDR sensors and servo motors. This intelligent control mechanism enables the solar panel to autonomously adapt to varying light conditions, maximizing energy output while minimizing manual intervention.

Furthermore, the integration of advanced sensor technology and precision motor control underscores the project's commitment to efficiency, sustainability, and renewable energy utilization. Through its innovative design and functionality, the system exemplifies the intersection of technology and environmental stewardship, offering a scalable solution for harnessing solar energy with unprecedented efficiency and reliability.

<u>Component and their description + Pictures:</u>

components	Description	picture
Arduino Uno	It is a microcontroller board that can be programmed to perform the solar tracker.	
LDR Sensor (x4)	It changes resistance with the change in the ambient light exposure on the surface of the sensor. 5mm LDR Sensor (Light Dependent Resistor) is a type of photocell which finds excellent use in light sensing device application, whether it is automatic outdoor light ON/OFF switch or Indoor automatic light switch. The sensor works best in both Light and dark region.	
Mini Servo Motor (x2)	It is a motor that converts electrical signals into mechanical motion. It adjusts the position of solar panels or mirrors to maximize the amount of light.	
Mini Solar Panel	It can be used in solar trackers to power the tracking mechanism. The tracker adjusts the panel's position throughout the day to follow the sun's path, maximizing energy absorption.	
On/Off Switch	2 pins with SPST ON/ Off Switch	
18650 Battery Holder – 1 Cell 18650 battery cell 3.7v	They both play a crucial role in providing reliable and uninterrupted power to the Arduino and other components in a solar tracker system, ensuring continuous operation even under varying environmental conditions.	

Approach + Algorithms used:

Approach

The method uses light sensing through two digital light-dependent resistors (LDRs) to measure light intensity, generating binary signals. The difference between LDRs is calculated by subtracting digital readings. A servo motor is used to adjust its vertical position based on this variance. If one LDR detects more light, the servo moves towards the brighter source. The speed of movement is regulated by a movement increment variable. Delays between iterations moderate the servo's rate of movement, allowing gradual changes in response to changing light conditions. This dynamically tracks light and fine-tunes its vertical position.

Algorithm

First, set up the system by attaching the vertical servo motor to pin 6 and initializing its position to 180 degrees. Then designate pins 2 and 3 for the digital light-dependent resistors (LDRs). Next, read the digital signals from both LDRs. Calculate the difference between their readings by subtracting the value of ldrPin2 from ldrPin1. Based on this difference, determine the servo movement: if positive, indicating more light on ldrPin1, decrease the servo's position by a set increment to move it forward; if negative, indicating more light on ldrPin2, increase the position to move it backward; and if zero, maintain the current position. Ensure the servo position remains within its defined limits (0 to 180 degrees). Repeat this process in a loop to continuously monitor and adjust the servo position according to the light levels. Introduce a delay at each iteration's end to moderate the servo's movement rate and prevent abrupt position changes.

Output Screenshots:

```
Bottom LDR reading: 0
Top LDR reading: 1
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Bottom LDR reading: 1
Top LDR reading: 0
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