S. B. JAIN INSTITUTE OF TECHNOLOGY, MANAGEMENT AND RESEARCH, NAGPUR
(An Autonomous Institute Affiliated to R.T.M. Nagpur Univeristy, Nagpur)
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING
(NBA Accredited)
Emerge as a center for quality education in Electronics and Telecommunication Engineering, so as to create competent professionals

Session 2025-26 (ODD)

Teacher Assessment Examination (TAE)-I: Project Based Learning

Course Name & Code: MDM-III: Embedded for IoT (N-MDMIT501T)

Year/Semester: III/V

Name of Students: Ashwini Khushal Barapatre		
USN: CS23118	**Class Roll No. 34**	
Problem Statement: To develop automatic solar tracking system using Arduino.	**Due Date of Submission**	**Actual Date of Submission**
Stage-I: Problem Statement	15/09/2025	
Stage-II: Design and Implementation	06/10/2025	

Evaluation Stages	**Stage-I**	**Stage-II**	**Total Marks**
Marks Obtained			
Max. Marks	**02**	**03**	**05**

Name & Signature of Course Incharge
(Dr. Parag Puranik)

PBL Report

Problem Statement: To develop automatic solar tracking system using Arduino.	
Stage-I: Problem Statement	
Introduction	A device called an Automatic Solar Tracker is made to automatically move a solar panel so that it is always facing the sun. A solar tracker tracks the sun's path throughout the day to optimize energy capture and efficiency, in contrast to fixed solar panels that stay at a single angle. The tracker rotates the panel in accordance with the position of the sun using sensors, motors, and microcontrollers. Smart energy management and real-time performance analysis are made possible by the remote monitoring and control of solar trackers. **Importance of Automatic Solar Tracker** • Increases solar panel efficiency by 30–40% compared to stationary systems. • Enables maximum utilization of renewable solar energy. • Eliminates manual adjustment, saving time and effort. • Contributes to sustainable power generation and environmental protection by promoting clean energy. **Why It Is Used** • To capture maximum sunlight from sunrise to sunset. • To generate more electrical energy using the same panel area. • To improve system performance and ensure consistent power output. • Commonly used in solar farms, residential systems, and research applications. **Need of Automatic Solar Tracker** • Solar panels work best when sunlight strikes them perpendicularly. • Since the Sun moves from east to west, manually adjusting panels is time-consuming and inefficient. • An automatic tracking system continuously optimizes energy collection, making solar power more reliable and cost-effective. • It supports the global shift toward clean and renewable energy sources.

<table>
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<td>List of Components Used</td>
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<u>Hardware:</u>

Arduino UNO Board
➢ The microcontroller is used to read sensor inputs and control the servo motor.
Servo Motor
➢ Used to rotate or move based on sensor inputs.
LDR (Light Dependent Resistors)
➢ 2 pieces – LDR1 and LDR2 are used to sense light intensity.
Resistors
➢ 2 pieces – Likely 10kΩ resistors, used in series with LDRs to form voltage dividers.
Connecting Wires
➢ For making connections between Arduino, sensors, and servo motor.
Power Supply
➢ Provided through Arduino via USB to power the circuit.

<u>Software:</u>

Arduino IDE
➢ Main platform to write, compile, and upload the code to the Arduino board.
Servo Library (<Servo.h>)
➢ Built-in Arduino library to control servo motor movement easily.

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<td>Implementation Phases/ Flowchart</td>
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Phase 1: Component Setup & Connections

Place all components (Arduino UNO, 2 LDRs, 2 resistors, and servo motor) on a breadboard for easy wiring.
Connect LDR sensors to Arduino:

Each LDR is connected in series with a 10kΩ resistor (forming a voltage divider).
Left LDR output → Arduino Analog Pin A0
Right LDR output → Arduino Analog Pin A1
Connect one side of each LDR to 5V, and the resistor side to GND.

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3. Connect Servo Motor to Arduino:
    - Signal (Orange/Yellow) → Digital Pin 9
    - VCC (Red) → 5V
    - GND (Brown/Black) → GND
4. Power Supply:
    - Arduino is powered via USB cable (5V) or external adapter.
    - Ensure common ground between all components.
5. Double-check wiring:
    - LDRs are connected correctly in voltage divider configuration.
    - Servo signal pin is secure and not loose.
    - All GND connections are common.

Phase 2: Software Development

1. Open Arduino IDE on your computer.
2. Connect Arduino UNO via USB cable.
3. Install required library:
    - Go to Sketch → Include Library → Servo.
4. Write or upload the Arduino code that:
    - Initializes servo and analog pins.
    - Reads light intensity from both LDRs.
    - Compares LDR values to determine light direction.
    - Rotates servo accordingly toward the brighter side.
5. Upload the code to Arduino UNO.
6. Observe servo movement: it turns toward the LDR receiving more light.

Phase 3: Testing & Calibration

1. Use a flashlight or lamp and shine it near each LDR.
2. Verify the servo moves in the correct direction.
3. Adjust thresholds (+50 difference) or servo speed (delay(15)) if movement is too sensitive or jerky.
4. Ensure both LDRs are equally sensitive and aligned properly.

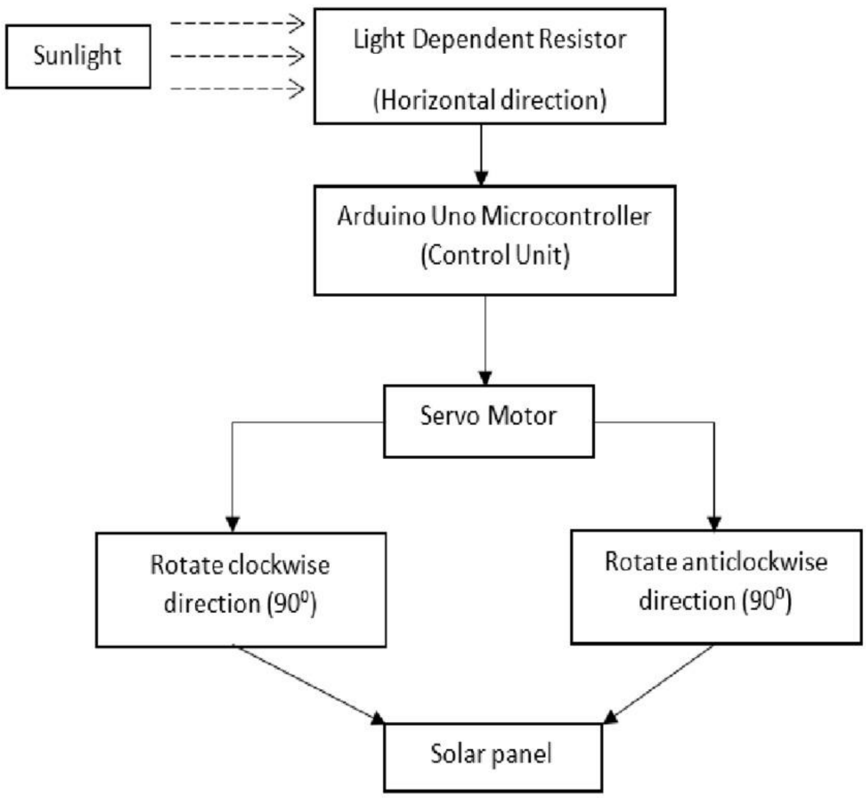
Phase 4: Final Integration

1. Mount LDRs on a small rotating platform connected to the servo shaft.
2. Secure wiring and place components neatly on a base.
3. Demonstrate light tracking in real-time.
4. Connect to a solar panel if used in a real-world application.

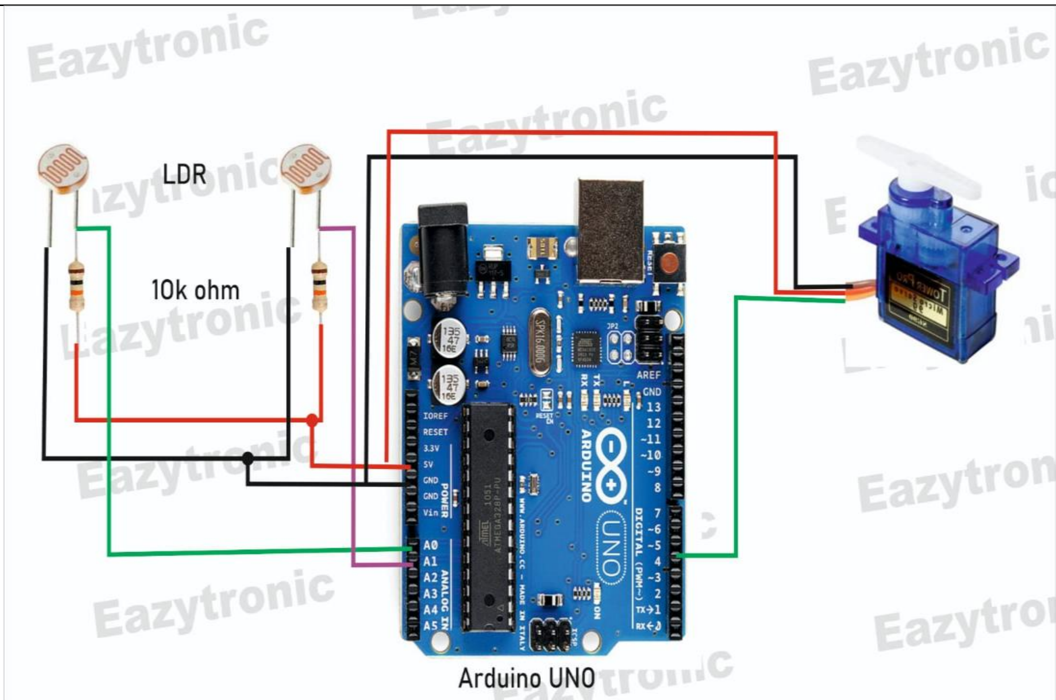
Phase 5: Result & Application

- The servo automatically turns toward the direction with maximum light intensity.
- Applications:
  - Solar tracking systems
  - Light-following robots
  - Smart lighting systems
  - Energy-efficient solar devices

Flowchart:



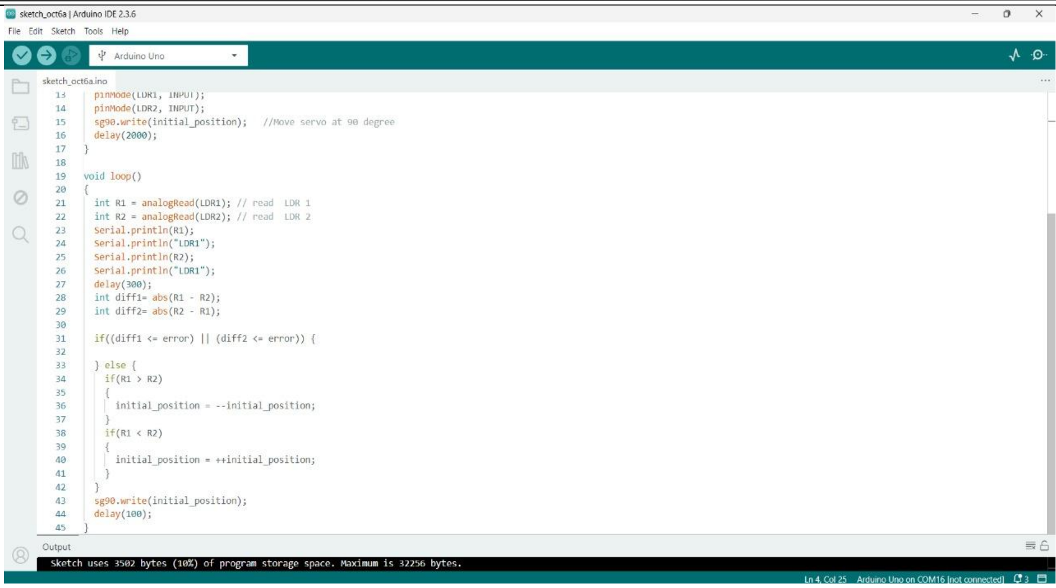
Stage-II: Design & Implementation

Interfacing Diagram (Simulation Diagram)	
Photograph of Hardware Model Developed	

	
Code/Program	#include <Servo.h> //including the library of servo motor Servo sg90; int initial_position = 90; int LDR1 = A0; //connect The LDR1 on Pin A0 int LDR2 = A1; //Connect The LDR2 on pin A1 int error = 5; int servopin=4; //You can change servo just makesure its on arduino's PWM pin void setup() { sg90.attach(servopin); pinMode(LDR1, INPUT); pinMode(LDR2, INPUT); sg90.write(initial_position); //Move servo at 90 degree delay(2000);

	`` } void loop() { int R1 = analogRead(LDR1); // read LDR 1 int R2 = analogRead(LDR2); // read LDR 2 Serial.println(R1); Serial.println("LDR1"); Serial.println(R2); Serial.println("LDR1"); delay(300); int diff1= abs(R1 - R2); int diff2= abs(R2 - R1); if((diff1 <= error) || (diff2 <= error)) { } else { if(R1 > R2) { initial_position = --initial_position; } if(R1 < R2) { initial_position = ++initial_position; } } sg90.write(initial_position); delay(100); } ```

Output



Conclusion

The Automatic Solar Tracker project successfully demonstrates how solar panels can be made more efficient through automation. By using Arduino UNO, LDR sensors, and a servo motor, the system can detect the Sun's position and automatically adjust the panel's angle to face the brightest direction. This ensures maximum light absorption and improved energy generation compared to a fixed solar setup.

Through proper hardware connections, coding, and calibration, the tracker operates smoothly and reacts accurately to changes in sunlight. The project highlights the importance of combining electronics and renewable energy technologies for sustainable solutions. It can be effectively applied in solar power systems, smart energy devices, and environment-friendly applications, making it a practical and impactful innovation for future energy needs.

Remarks (if any):

Name & Signature of Course Incharge
(Dr. Parag Puranik)