REPORT ON IOT-PROJECT

PROJECT NAME: SUN TRACKING SOLAR SYSTEM WITH VOLTAGE DETECTION THROUGH ESP32

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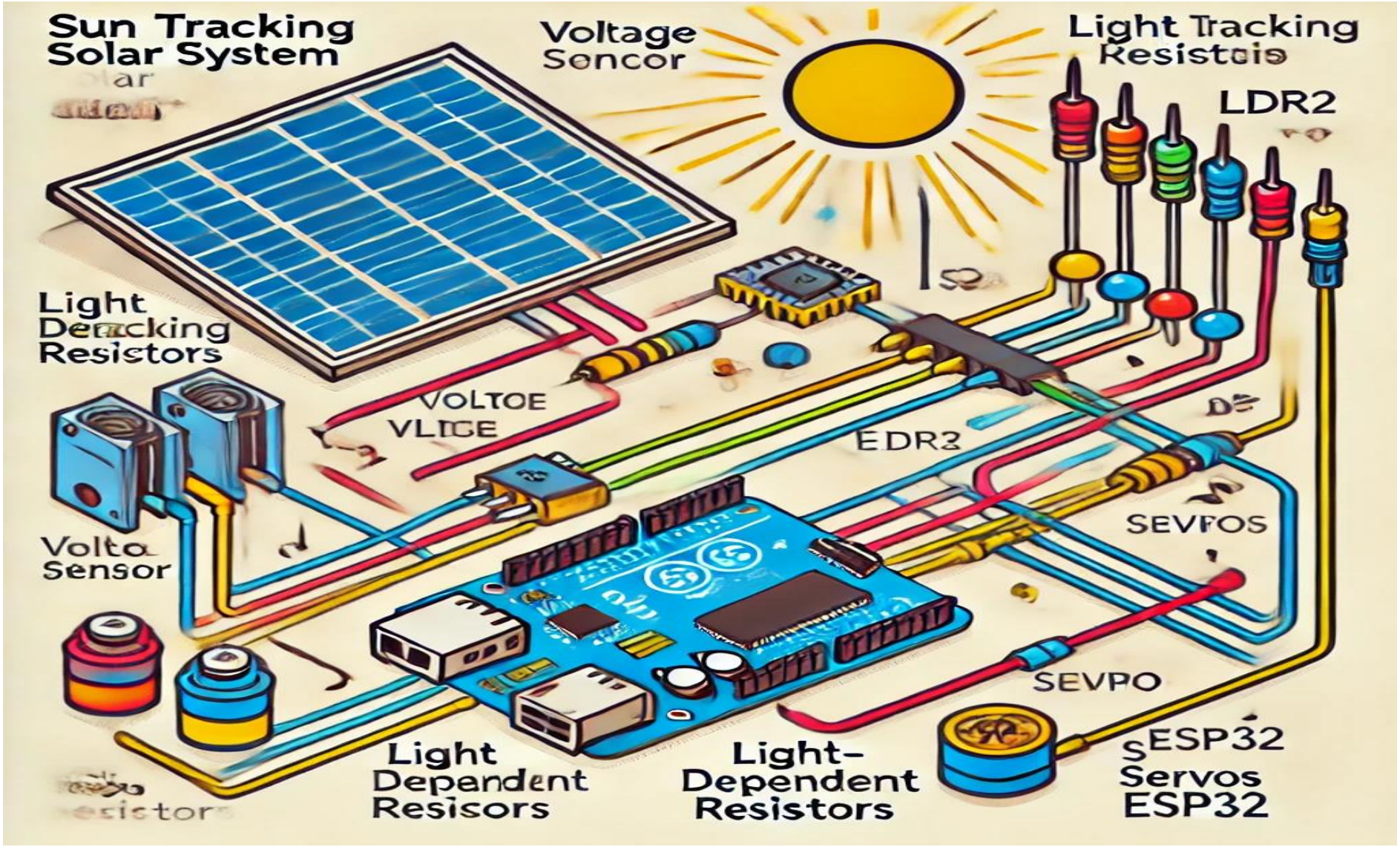
Project Aim:

The aim of this project is to design a solar tracking system that maximizes the efficiency of solar energy collection by adjusting the position of the solar panel to face the sun. The system also integrates voltage detection to monitor and optimize the performance of the solar panel in real-time. The project uses an ESP32 microcontroller for system control and monitoring.

Tools & Components Required

- **ESP32**: Microcontroller for controlling the system and transmitting data.
- **LDR (Light Dependent Resistor)**: To detect the intensity of sunlight from different directions.
- **Servo Motors**: To adjust the angle of the solar panel based on the LDR data.
- **Solar Panel**: The energy source that is aligned based on the sun's position.
- **Voltage Sensor**: To monitor the voltage output from the solar panel.
- **DC-to-DC converter (optional)**: To stabilize and regulate voltage output.
- **Jumper Wires**: For connecting various components.
- **Breadboard or PCB**: To connect and mount components.
- **Power Supply (Battery or External Source)**: To power the ESP32 and servo motors.
- **Resistors**: For proper current control and LDR voltage division.

Block Diagram :



Procedure:

- **Step 1: Setup the Hardware**
- **Connect the LDRs**: Position four LDRs around the solar panel to detect light intensity from different directions. These will provide analog inputs to the ESP32.
- **Connect the Servo Motors**: Attach two servo motors to control the solar panel's movement along the X and Y axes. Connect the servos to PWM pins on the ESP32.
- **Connect the Voltage Sensor**: Attach the voltage sensor to the solar panel's output and connect it to the ESP32 to monitor voltage readings.
- **Power Supply**: Use a battery or external source to power the ESP32 and servo motors.

Step 2: Programming the ESP32

Code: Implement the logic for reading the LDR values, controlling the servo motors based on light intensity, and monitoring the voltage output from the solar panel.

Step 3: Testing and Calibration

Test the system under different sunlight conditions. Adjust the sensitivity of the LDRs if necessary to optimize the tracking and voltage detection.

Step 4: Data Logging and Monitoring

Optionally, implement Wi Fi on the ESP32 for remote monitoring of solar panel performance and voltage data.

Code for ESP32 :

```
• #include <Servo .h >
 const int ldr1 = 34, ldr2 = 35, ldr3 = 32, ldr4 = 33; // LDR pins
• Servo  servo X, servo Y;
• int pos X = 90, pos Y = 90;
void setup() {
•   servo X .attach(14);
•   servoY.attach(27);
•   Serial.begin(115200);}
• void loop() {
•   int valTop = analogRead(ldr1), valBottom = analogRead(ldr2);
•   int valLeft = analogRead(ldr3), valRight = analogRead(ldr4);
•   pos X = (va lLeft > valRight) ? min(180, posX + 1) : max(0, pos X - 1);
•   posY = (valTop > valBottom) ? min(180, posY + 1) : max(0, posY - 1);servoX.write(posX);
•   servoY.write(posY);
•   float voltage = analogRead(36) * 3.3 / 4095;
•   Serial.println("Voltage: " + String(voltage));
 delay(1000);}
```

Conclusion:

- The Sun Tracking Solar System with Voltage Detection using ESP32 is an efficient way to maximize solar energy collection. By constantly adjusting the solar panel to face the sun, the system ensures optimal exposure, increasing energy output. The integration of voltage detection allows real-time monitoring of solar panel performance, making it a valuable system for renewable energy solutions.
- This project combines IoT, automation, and renewable energy to create a practical application that can be scaled for larger systems.