**GreenSense Power Supply System - Documentation**

**Overview**

This document explains the power supply architecture used in the GreenSense plant monitoring system. It describes how the ESP32S board is powered using a rechargeable 18650 Li-ion battery, charged via a TP4056B module and dual 4V 100mA solar panels. It also includes smart power tracking using voltage dividers to monitor both battery and solar panel voltages.

**Components Used**

* ESP32S Development Board
* TP4056B Li-Ion Charging Module with Protection (OUT+, OUT-, B+, B-, IN+, IN-)
* 18650 Li-Ion Cell (3.7V)
* 2x 4V 100mA Solar Panels (connected in parallel)
* Resistors (2x 100kΩ for each voltage divider)

**Circuit Connections**

**A. TP4056 Connections**

| **TP4056 Pin** | **Connected To** |
| --- | --- |
| B+ | 18650 Positive Terminal |
| B- | 18650 Negative Terminal |
| OUT+ | ESP32 VIN or 5V pin |
| OUT- | ESP32 GND |
| IN+ | Solar Panel Positive (parallel) |
| IN- | Solar Panel Negative (parallel) |

**B. Voltage Divider for Battery Monitoring**

* Tap from TP4056 **B+**
* R1 = 100kΩ to B+
* R2 = 100kΩ to GND
* Middle of divider to ESP32 GPIO 34 (ADC1\_CH6)

**C. Voltage Divider for Solar Panel Monitoring**

* Tap from TP4056 **IN+**
* R1 = 100kΩ to IN+
* R2 = 100kΩ to GND
* Middle of divider to ESP32 GPIO 35 (ADC1\_CH7)

**ESP32 Code Snippet**

#define BATTERY\_ADC 34

#define SOLAR\_ADC 35

float readVoltage(int pin) {

int adc = analogRead(pin);

float v = adc \* (3.3 / 4095.0); // ADC to voltage

return v \* 2.0; // Adjust for divider

}

void setup() {

Serial.begin(115200);

analogReadResolution(12);

}

void loop() {

float batteryVoltage = readVoltage(BATTERY\_ADC);

float solarVoltage = readVoltage(SOLAR\_ADC);

Serial.print("Battery Voltage: ");

Serial.print(batteryVoltage);

Serial.println(" V");

Serial.print("Solar Panel Voltage: ");

Serial.print(solarVoltage);

Serial.println(" V");

delay(2000);

}

**Optional Smart Power Tracking Ideas**

1. **Low Battery Warning**
   * If batteryVoltage < 3.3V → Alert via LED/Blynk
2. **Daylight Detection (Solar Active)**
   * If solarVoltage > 3.5V → Assume sunlight present
3. **Data Transmission Optimization**
   * Only send sensor data when solarVoltage is high to save battery
4. **Power Saving Modes**
   * Enter deep sleep if battery is too low and no solar charging is available
5. **Long-Term Logging**
   * Store battery/solar readings on an SD card or cloud for performance analysis

**Notes**

* A Schottky diode (e.g., 1N5819) between the solar panel and IN+ is recommended to prevent backflow discharge at night.
* Ensure ESP32 board has onboard 5V-to-3.3V regulator if powered from OUT+.

This power supply design ensures reliable off-grid operation of the GreenSense system using sustainable solar energy while protecting the battery and tracking power metrics smartly.