A

PROJECT REPORT
ON

SOLAR POWER MONITORING
USING
ARDUINO AND LCD

Submitted By:
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Aim:

This project focuses on developing a solar power monitoring system using an Arduino microcontroller and an LCD display. The system aims to monitor the output of a solar panel, including parameters such as voltage, current, and power generation, and display this information in real-time.

Objectives:

- To measure the voltage and current output from a solar panel.
- To calculate the power generated by the solar panel.
- To display the measured values on an LCD screen.
- To log the data for future analysis.

Components Required:

1.**Arduino Board**

- Description: The Arduino is an open-source microcontroller platform that allows users to create interactive electronic projects. The most commonly used board is the Arduino Uno.
- Functionality: It serves as the central processing unit for the project, executing the code to read sensor data, perform calculations, and control the LCD display. It has multiple analog and digital input/output pins for connecting various components.

2.LCD Display (16x2)

- Description: A 16x2 LCD (Liquid Crystal Display) can display 16 characters per line and has 2 lines. It is commonly used in embedded systems for displaying information.

- Functionality: In this project, the LCD is used to display real-time measurements of voltage, current, and power generated by the solar panel. The I2C interface simplifies the connection and control of the LCD.

3.INA219 Current Sensor

- Description: The INA219 is a high-side current sensor that can measure both voltage and current. It communicates with the Arduino via the I2C protocol.
- Functionality: It measures the voltage drop across a shunt resistor to calculate the current flowing through the circuit. It also measures the bus voltage (the voltage across the load) and can calculate power based on these measurements. The INA219 is particularly useful for monitoring solar power systems due to its accuracy and ease of use.

4.Solar Panel

- Description: A solar panel is a device that converts sunlight into electrical energy using photovoltaic cells.
- Functionality: In this project, the solar panel generates DC voltage and current when exposed to sunlight. The output from the solar panel is monitored to assess its performance and efficiency.

5.Shunt Resistor

- Description: A shunt resistor is a precision resistor used to measure current by creating a small voltage drop proportional to the current flowing through it.
- Functionality: The INA219 uses a shunt resistor to measure the voltage drop across it, which is then used to calculate the current flowing through the circuit. The value of the shunt resistor is typically low (e.g., 0.1Ω) to minimize power loss.

6.Breadboard and Jumper Wires

- Description: A breadboard is a reusable platform for prototyping electronic circuits without soldering. Jumper wires are used to make connections between components.
- Functionality: The breadboard allows for easy assembly and modification of the circuit. Jumper wires connect the various components, such as the Arduino, INA219, and LCD, facilitating communication and power distribution.

7.Power Supply

- Description: A power supply provides the necessary voltage and current to power the Arduino and other components in the circuit.
- Functionality: The Arduino can be powered via USB or an external battery. The solar panel itself can also serve as a power source for the system, depending on the design.

connections

Arduino to LCD Display:

- **VCC**(LCD) to **5V**(Arduino)
- **GND**(LCD) to**GND(**Arduino)
- **SDA**(LCD) to**A4(**Arduino Uno)
- **SCL**(LCD) to**A5**(Arduino Uno)

Arduino to INA219 Current Sensor:

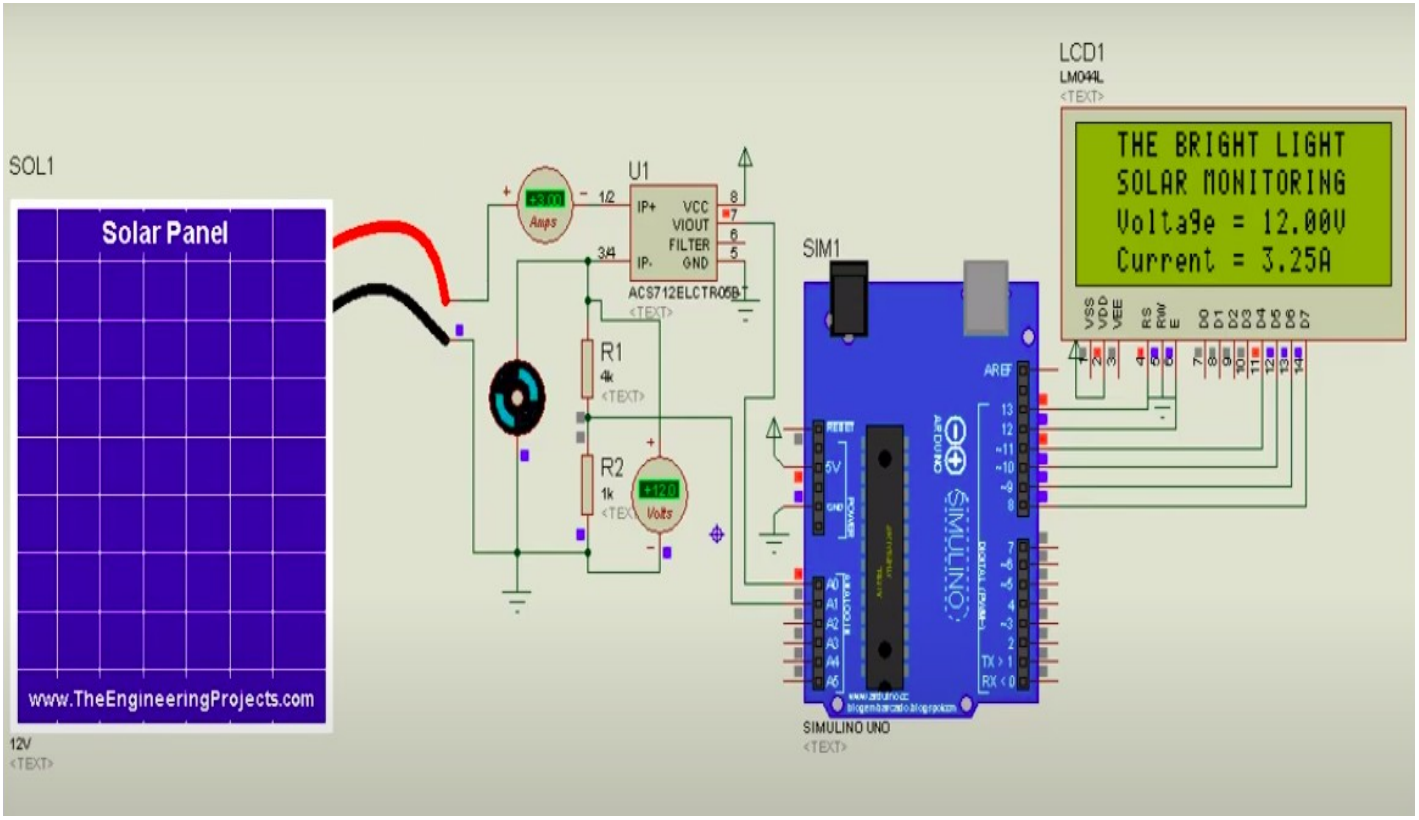
- **VCC**(INA219) to**5V**(Arduino)
- **GND**(INA219) to**GND**(Arduino)
- **SDA**(INA219) to**A4**(Arduino Uno)
- **SCL**(INA219) to**A5**(Arduino Uno)

Program:

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

#include <Adafruit_INA219.h>


LiquidCrystal_I2C lcd(0x27, 16, 2); // Set the LCD address

Adafruit_INA219 ina219;


void setup() {

  lcd.begin();

  lcd.backlight();

  ina219.begin();

}


void loop() {

  float voltage = ina219.getBusVoltage_V();

  float current = ina219.getCurrent_mA() / 1000; // Convert mA to A

  float power = voltage * current;


  lcd.setCursor(0, 0);

  lcd.print("V: "); lcd.print(voltage); lcd.print(" V");


  lcd.setCursor(0, 1);
```

```
  lcd.print("I: "); lcd.print(current); lcd.print(" A");


  delay(1000); // Update every second
}
```

CIRCUIT DIAGRAM:



Future scope:

Enhanced Data Logging and Analysis

Advanced Sensor Integration

IoT Integration:

Alerts and Notifications:

Conclusion:

The solar power monitoring project utilizing Arduino and an LCD display successfully demonstrates a practical approach to tracking solar energy generation. By employing the INA219 sensor to measure voltage and current, the system provides real-time data that allows users to monitor the performance of their solar panels effectively.

Ultimately, this solar power monitoring system represents a valuable tool for promoting renewable energy awareness and efficiency. As interest in sustainable energy solutions grows, this project can inspire further innovation and adoption of solar technology, contributing to a more sustainable future.