

PROJECT

MEASURING OF VOLTAGE AND CURRENT IN A SOLAR PANEL

Introduction:

Generally we check the current and voltage value in a solar panel using multimeter by changing the probe each time. To simplify this process with help of Arduino and INA219 current sensor we can able to measure both current and voltage at the same time. The INA219 sensor is one of the highly accurate sensors that can measure DC current in mA units. It is capable of measuring current as well as voltage, allowing for the calculation of power. The maximum measurable current is 3.2A, and the voltage range for measurement is 0-26V. Now let us discuss in detail about the experiment.

Components Required:

Hardware:

INA219 sensor

9V battery

Arduino UNO board

LED

220 ohm resistor

LCD display (16x2)

Jumper Wires and breadboard

Solar panel(159x88)

Arduino to PC USB cable

Software :

Arduino IDE

Procedure:

Hardware setup:

Connect the INA219 in a breadboard. Connect the Vin+ of the INA219 sensor to the positive terminal in a solar panel.

Secondly, connect the 220 ohm resistor to the positive terminal of the LED to control the current flow and negative terminal to the negative pin of the solar panel.

Now connect the Vcc in INA219 to 5V to Arduino, ground pin in INA219 to ground pin in Arduino, SCL in INA219 to A5 in arduino and SDA in INA219 to A4 in arduino.

Again connect the Vcc in INA219 to Vcc in LCD Display, Ground PIN IN INA219 to ground pin LCD display, SCL in LCD display to LCD in INA219, SDA in INA219 to SDA in LCD display.

Finally upload the code in the arduino IDE via USB cable.

Software Setup:

Open the Arduino IDE and select the board “Arduino UNO” and port number as “COM4”.

Install the library “INA219_WE.h”, “WIRE.h” and “ LiquidCrystal_I2C” from the library manager and upload the code in new sketch.

Code:

```
#include <Wire.h>
#include <INA219_WE.h>
#include <LiquidCrystal_I2C.h>
#define I2C_ADDRESS 0x40
```

```
INA219_WE ina219(I2C_ADDRESS);
```

```
LiquidCrystal_I2C lcd(0x27,16,2); // set the LCD address to 0x27 for a 16 chars
and 2 line display
```

```
void setup() {
  lcd.init();
  lcd.backlight();
  lcd.clear();
  Serial.begin(9600);
  Wire.begin();
  if(!ina219.init()){
    Serial.println("INA219 not connected!");
    lcd.print("INA219");
    lcd.setCursor(0,1);
    lcd.print(" not connected!");
  }
  lcd.clear();
  lcd.print("Voltage:");
  lcd.setCursor(0,1);
  lcd.print("Current:");
```

```

Serial.println ("INA219 Current Sensor with solar panel");
}

void loop() {
  float shuntVoltage_mV = 0.0;
  float loadVoltage_V = 0.0;
  float busVoltage_V = 0.0;
  float current_mA = 0.0;
  float power_mW = 0.0;
  bool ina219_overflow = false;

  shuntVoltage_mV = ina219.getShuntVoltage_mV();
  busVoltage_V = ina219.getBusVoltage_V();
  current_mA = ina219.getCurrent_mA();
  power_mW = ina219.getBusPower();
  loadVoltage_V = busVoltage_V + (shuntVoltage_mV/1000);
  ina219_overflow = ina219.getOverflow();

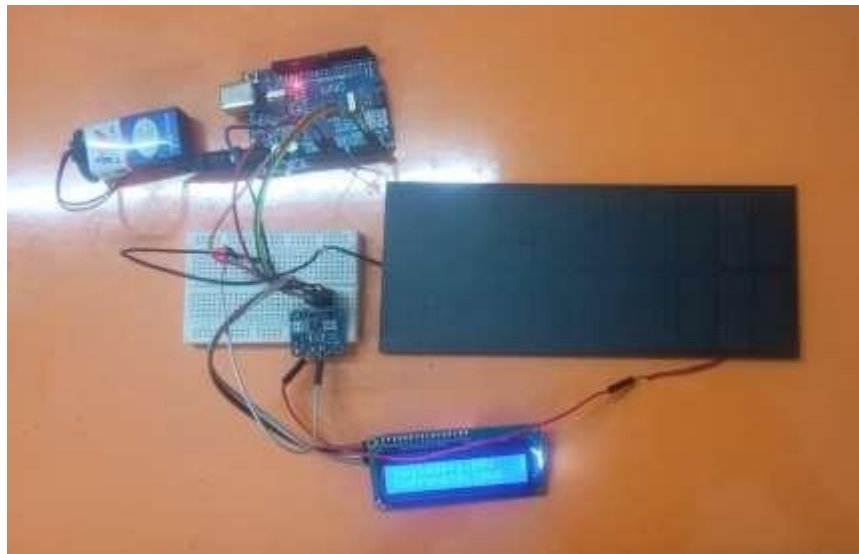
  Serial.print("Shunt Voltage [mV]: "); Serial.println(shuntVoltage_mV);
  Serial.print("Bus Voltage [V]: "); Serial.println(busVoltage_V);
  Serial.print("Load Voltage [V]: "); Serial.println(loadVoltage_V);
  Serial.print("Current[mA]: "); Serial.println(current_mA);
  Serial.print("Bus Power [mW]: "); Serial.println(power_mW);

  lcd.setCursor(8,0);
  lcd.print(loadVoltage_V);
  lcd.print("V    ");
  lcd.setCursor(8,1);

```

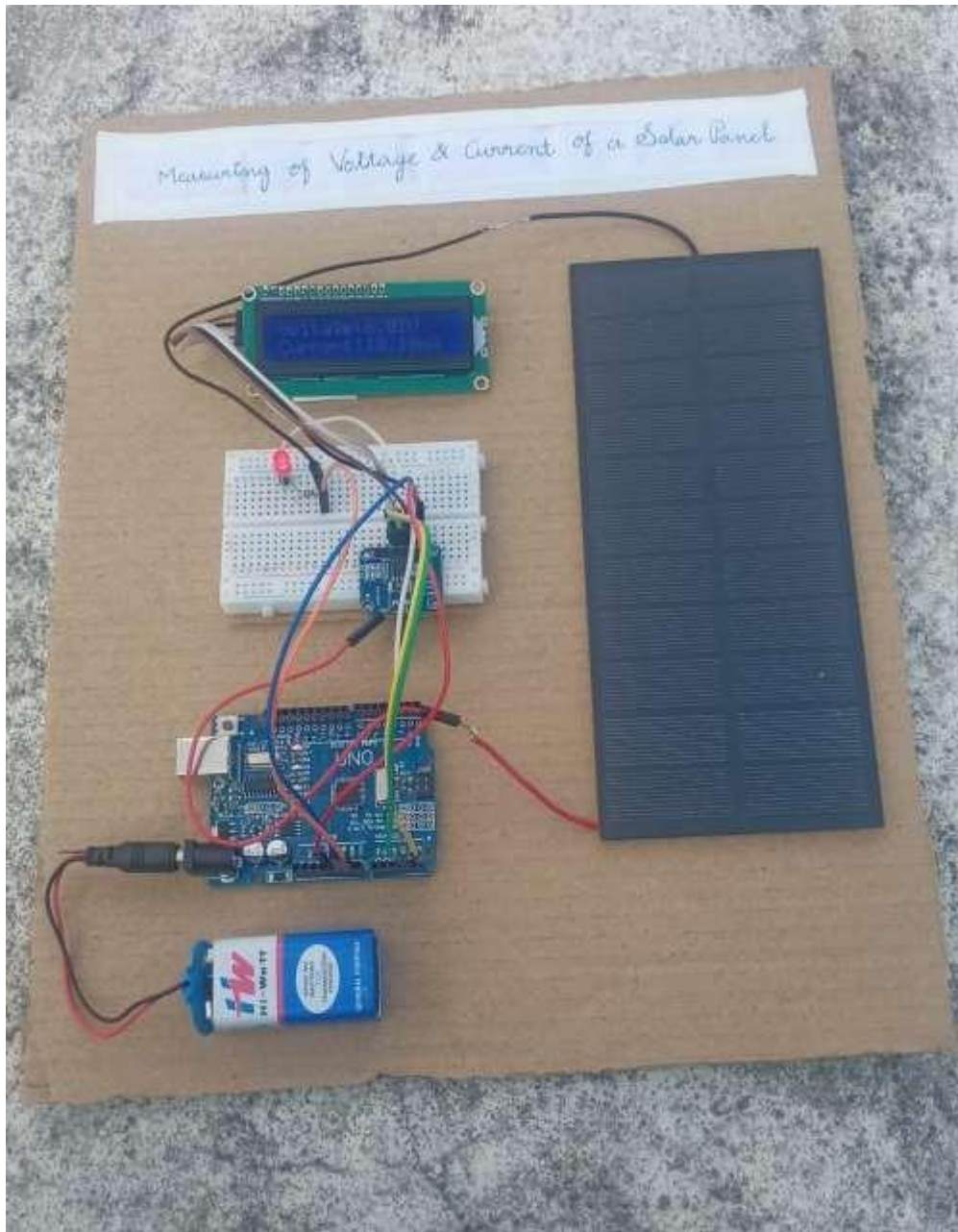
```
lcd.print(current_mA);  
lcd.print("mA    ");  
if(!ina219_overflow){  
    Serial.println("Values OK - no overflow");  
}  
else{  
    Serial.println("Overflow! Choose higher PGAIN");  
}  
Serial.println();  
  
delay(1000);  
}
```

Output Verification:



The voltage and current observed at 11.30 AM

Voltage : 6.01V and Current is 18.10mA



The voltage and current observed at 6.00 PM

Voltage = 1.01V and Current = 0.20mA

