*Research Article*

# Energy Measurement of Solar Through Cloud Source Using Arduino

**S. SreeSouthry[1], Dr.K. Suriyakrishnaan[2], D.P. Sangeetha[3], Dr. Vinayagapriya.S[4], Vishnudevi.S [5], Karthikeyan.R[6]**

[1]Assistant Professor, Department of ECE, Sona College of Technology, Salem, Tamil Nadu, India.

[2]Assistant Professor, Department of ECE, Sona College of Technology, Salem, Tamil Nadu, India.

[3]Assistant Professor, Department of ECE, Sona College of Technology, Salem, Tamil Nadu, India

[4]Associate Professor, Department of ECE, St. Joseph's College of Engineering, Chennai, Tamil Nadu, India

[5]UG Student, Electronics and Communication Engineering, Sona College of Technology, Salem, Tamil Nadu, India.

[6]UG Student, Electronics and Communication Engineering, Sona College of Technology, Salem, Tamil Nadu, India.

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**Abstract-** This project's aim is to use Arduino Board technology to create measurements of solar energy. Temperature, light, voltage, and current and the four parameters are measured in this analysis. The temperature sensor is used to measure temperature.The intensity of light is calculated using a LDR sensor. Since thevoltage provided by the solar panel is too high to be used as a receiver for the Arduino, a voltage divider was used to determinethe voltage. Finally, acs712 module was used to calculate the current, which can detect the current generated by the solar panel.

These parameters were shown on the LCD screen as theArduino's input and output values. The values are all displayed on the LCD panel and mobile phone through the cloud. Arduino's goal is to convert the parameter's analog input to a digital outputand display it on an LCD, as well as on a smartphone. Aside fromthat, this project often involves a plan that ensure the device caseis easy.

## I. INTRODUCTION

Carbon emissions and therefore the burning of fossil fuels, like coal, have caused many countries to seem for energy sources so as to scale back their reliance on fossil fuels. Solar energy is one of the most promising sources ofenergy currently getting used to assist meet the growing global demand for electricity. The conversion of sunlight into electricity is known as solar power; sunlight can be obtained directly through photovoltaics or indirectlythrough the use of solar power concentrations.

As the cost of solar energy has decreased, the number ofgrid-connected solar photovoltaic systems has increased tomillions, and Solar power plants with hundreds of megawatts of capacity are being built on a regular basis. Solar photovoltaic is becoming an affordable, technology that is low-carbon for extracting solar energy is a clean source of energy. Arindam Bose et al. present their findings in this article. A solar system with two stepper motor sets, a light sensor, and a concave mirror has a power of al. With the construction of the perpendicular, the aim of this project is to increase the efficiency of power collection by 65 percent.
Al proposed a method for optimizing the generation of solar panel output power in a PV system based on the simulation of two fuzzy controllers. With solar irradiance

= 500Watts / m2 and temperature = 34.4 ° C, the maximum current of the I-V curve from this project is 1.573A and thehighest voltage possible is 20 volts

Full power point monitoring results for 23Watts with 51percent and 11W with 24.52 percent of the output power'snominal value are fuzzy-based. On the other hand, is 35W, or 78 percent of the nominal production potential.

The Analog MPPT has a number of advantages to understand: the analog component with low power consumption, the rapidity, and the ability to convert all types of power. According to the results, 1000W / m2 equals 112.4W with a 13 percent solar panel efficiency. Mohammad H. Mohammed H. In, Moradi demonstrated an increase in the solar panel maximum power point monitoring reliability. Aria Solar's PV panel is 60 watts, 25degrees Celsius, 1000 watts per square meter, with a current of 2.5 amps and a voltage of 23.1 volts. Calculatingthe setpoint and fine turning loops is the suggested algorithm.

The sun's light is concentrated to a single point using a lens or mirror and a tracking device is known as solar energy concentration. Heat is also generated by the sun's light and when we placed our focus on a single stage. This is the point will be subjected to solar heat output. This project is focused on solar energy measurements.

Arduino is a microcontroller board. Several sensors will beused in this project to calculate parameters. This project's main components are the solar panel, temperature sensor, the light sensor, the LCD screen, Arduino, the current sensor and voltage divider.

## CIRCUIT SIMULATION

The diagram is divided into blocks. as well as the entire simulation circuit for this project, which was created with Proteus 8 Professional. The parameters are monitor on the LCD panel. This simulation circuit includes the following components. Solar panel generates about 12 volts of electricity. The circuit contains an LDR sensor that detectslight intensity. The temperature sensor then detected temperature changes.

The Arduino Uno is used as the main controller in this project, and it needs electricity. This controller needs a 5Vpower supply.

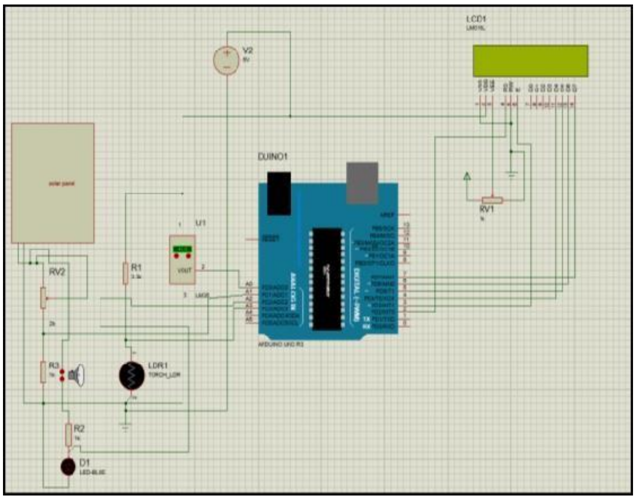

**Fig.1. SIMULATION CIRCUIT**

## BLOCK DIAGRAM

The energy collected from the solar panel is collected using Arduino in this process. We must follow the sun's path and rotate the solar panel. The strategy is to use Arduino to construct a solar energy optimization. The current, voltage, and temperature are all determined using the LDR. The values will be reflected on the LCD. At the same time, we can display the data using an Android app on our computer. Since our system does not need human supervision, it saves a significant amount of time andresources. It can be placed almost anywhere, from a field toa house.

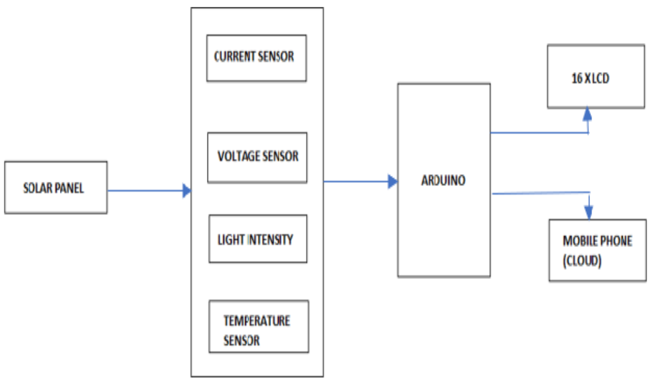


**Fig.2. BLOCK DIAGRAM**

## ANALYSIS AND RESULTS

This segment concentrates on the results of the simulation and the estimation.

### Results of the simulation

Figure 3 depicts the temperature effects. It differsdepending on the sensor condition throughout the simulation. The output voltage and light intensity simulation results are shown in Table 1.

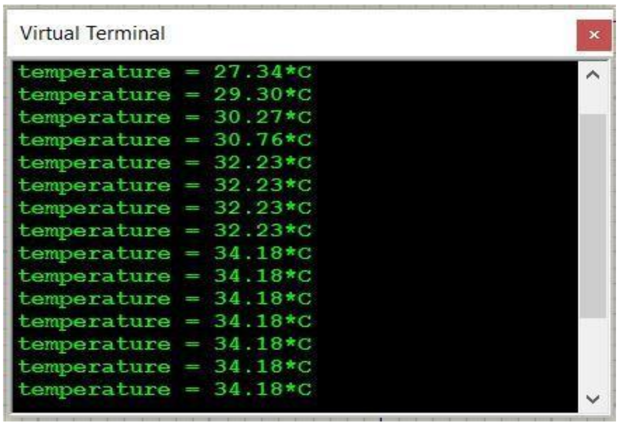


**Fig.3.THE TEMPERATURE OF VIRTUAL TERMINALOUTPUT**

**Table.1. LDR SIMULATION RESULT**

| LDR (Lux) | LDR intensity | Output Voltage (V) |
|---|---|---|
| 0.2 | 12.5 | 0.0538 |
| 10 | 372.4 | 1.8174 |
| 20 | 520.3 | 2.5379 |
| 30 | 607.1 | 2.9655 |
| 40 | 667.4 | 3.2545 |

**Measurement Results**

This section is divided into three sections:

- light intensity.
- voltage versus light intensity.
- output power.

**Results of Light Intensity**

The light intensity was measured for three days, as shown in Figure 4, with the solar panel placed at sunrise. According to the findings, at 2:00 p.m., the light intensity peaked at 980 Lux., and at 5.00 p.m., the minimum level was 700 Lux. The outcomes indicate that, at 11:00 a.m., the maximum light level was 970 Lux and at 5:00 p.m., thelowest light level was 350 Lux.

Figure 6 shows the amount of light averaged over threedays with the solar panel set in the sunrise spot. At 12.00pm, the maximum light intensity was 950 Lux., and the at 5.00pm, the lowest light intensity was 830 Lux.

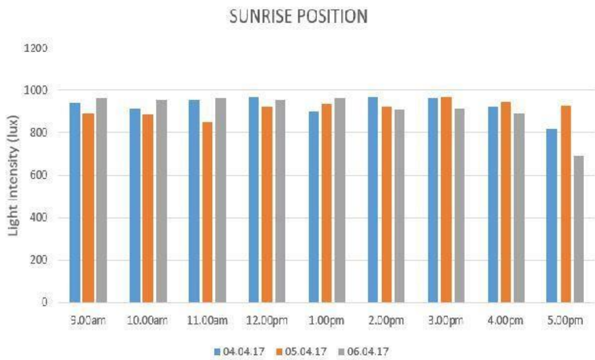

**Fig. 4. LIGHT INTENSITY RESULT FOR SUNRISE POSITION**

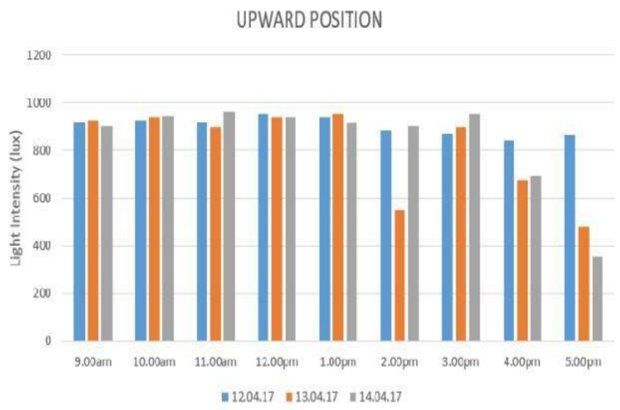


**Fig. 5. LIGHT INTENSITY RESULT FOR UPWARD POSITION**

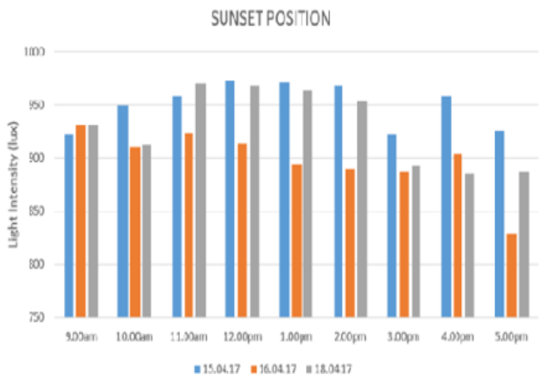


**Fig.6. LIGHT INTENSITY RESULT FOR SUNSETPOSITION**

Table 2 shows light strength at its highest and lowest points measured based on the location of the solar panel

**Table 2: MAXIMUM AND MINIMUM LIGHTINTENSITY**

| Position | Sunrise | Upward | Sunset |
|---|---|---|---|
| **The maximum** | 980 Lux at 2.00 pm | 970 Lux at 11.00am | 950 Lux at 12.00pm |
| **The bare minimum (LUX)** | 700 Lux at 5.00 pm | 350 Lux at 5.00 pm | 830 Lux at 5.00 pm |

**Results of Voltage versus Light Intensity**

Figure 7 shows for the solar panel in the sunrise spot, the voltage versus light intensity is plotted. The highest recorded voltage was 14.75V with a light intensity of 945 Lux at 11.00 a.m., and the least recorded voltage was 9.18V with a light intensity of 695 Lux at 5.00 p.m.

The highest recorded voltage was 13.15V at 10 a.m., with a light intensity of 929 Lux, and the lowest recorded voltage was 6.32V at 357 Lux at 5.00 p.m. Figure 9 showsthis. the solar panel's output voltage vs. light intensity in the sunset location at 1.00 p.m., the highest recorded voltage was 12.57 volts with a light intensity of 964 lux, and at 9.00 a.m., the lowest recorded voltage was 11.19 volts with a luminosity of 931 lux.

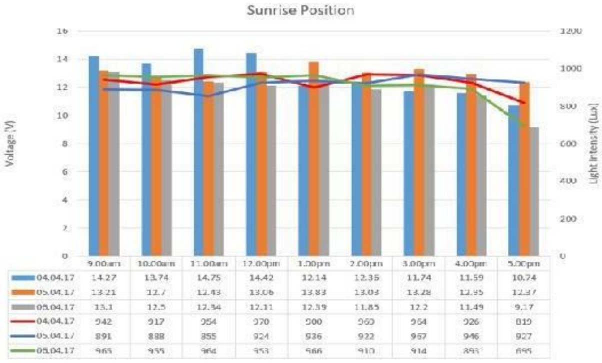


**Fig. 7. VOLTAGE VERSUS LIGHT INTENSITY FORSUNRISE POSITION.**

Table 3 shows voltage and light intensity at maximum and minimum for each location. The luminous strength hasa higher value when the voltage value is higher. Thecurrent intensity of light would affect the voltage producedby the solar panel.


**Fig.8. FOR SUNSET POSITION, VOLTAGE VERSUSLIGHT INTENSITY**

**Table. 3. EACH POSITION'S MAXIMUM ANDMINIMUM VALUES.**

| Position | Sunrise | Upward | Sunset |
|---|---|---|---|
| **Maximum** | With 954 LUX at 14.75 volts (11 a.m.) | With 929 LUX at 13.11 volts (10.00am) | With 964 LUX at 12.57 volts (1.00pm) |
| **Minimum** | With 695 LUX at 9.17 volts (5.00pm) | With 357 LUX at 6.3 volts (5.00am) | With 931 LUX at 14.75 volts (11.00am) |

**Results of Output Power**

Figure 9 depicts the impact of the solar panel's output power in the sunrise location. At 4:00 p.m., the maximum power output was 2.4Watts. At 5:00 p.m., the minimum output was 0.34 W. At 12 p.m., the maximum power output was 1.7 watts. At 5.00pm, the minimum output was 0. 38W.Figure 10 depicts the impact of output power in the sunset position with the solar panel. At 5.00 p.m., the highest power output was 1.63 watts, and at 9.00 a.m., thelowest power output was 1.21 watts.

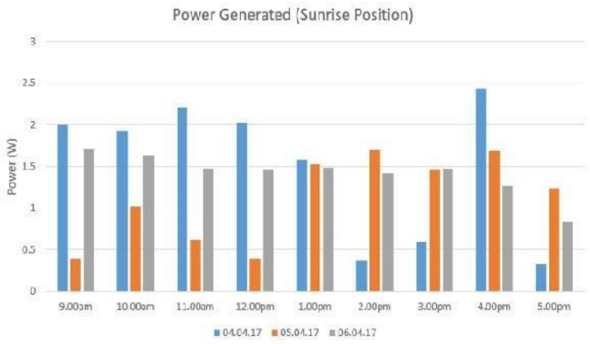


**Fig. 9. POWER FROM THE SUNRISE POSITION.**

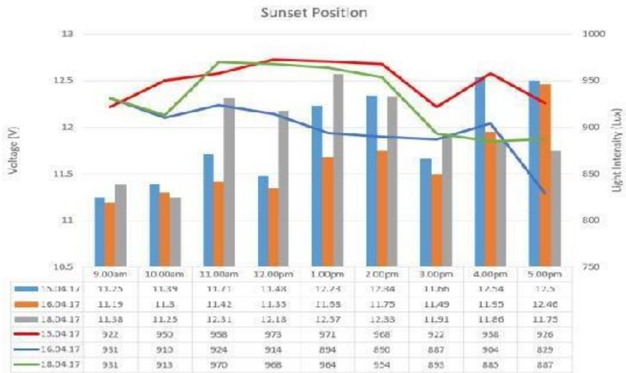


**Fig. 10.THE SUNSET POSITION PROVIDES POWER.**

The highest and lowest power levels outputs of the solarsystem are shown in Table 4 based on the position. At the sunrise location, the maximum generated power is 2.4 Watts., although the smallest amount of power produced is0.45W. In the upward location, the maximum produced power is 1.7W. The lowest level power produced is 0.38Watts.

At the sunset location, the highest-level produced power is 1.63W. The smallest amount of power produced is 1.21W.

**The Project Prototype**

Figure 11 depicts a solar energy calculation prototype made with an Arduino UNO. The best solar panelenergy position was the highest-voltage sunrise spot, was registered at 11.00 a.m. at 14.75V. The temperature was 34.32 degrees Celsius, and the brightness of the light was 954 lux.

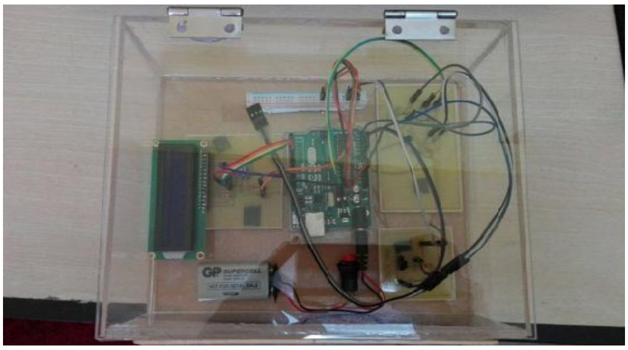

**Fig. 11. SOLAR ENERGY MEASUREMENT PROTOTYPE**

**Table.4. OUTPUT POWER FOR OPTIMAL ANDMINIMAL**

| Position | Sunrise | Upward | Sunset |
|---|---|---|---|
| **Maximum (WATTS)** | 2.4 watts at 4.00pm | 1.7 watts at 12.00pm | 1.63 watts at 5.00pm |
| **Minimum (WATTS)** | 0.4 watts at 5.00pm | 0.38 watts at 5.00pm | 1.21 watts at 9.00am |

**CONCLUSION**

Finally, the project's goal is to measure solar panel parameters. The temperature sensor was used to detect changes in ambient temperature, the LDR sensor was used to measure light intensity, and the voltage divider device was used to minimize the solar panel's maximum output interms of voltage acceptable for the solar panel. The Powersupply for Arduino was used with the new sensor module, followed by the new parameter. Following that, electricityis effectively energised in order to assess the best location and now is the time for solar energy. At 11:01 a.m., the sunrise location with the maximum voltage value, 14.75V,was observed. The best location for a solar panel to efficiently generate energy, according to the measurement part results. The temperature was 34.32 C and the light intensity was 954 lux at the time. Finally, designing a portable system for calculating solar energy allows for the light weight of the device's casing and the electrical component's neat arrangement inside the casing.

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