

ARDUINO BASED SOLAR PV ENERGY HARVESTING SYSTEM FOR SPACE APPLICATION

Harvesting the Power of the Sun for a Sustainable Space Future

This project presents a low-cost, efficient and intelligent solar PV energy harvesting system using Arduino UNO that monitors and optimises the performance of solar panels for spacecraft and satellite applications.

ABSTRACT

Solar energy is the primary and most reliable power source for satellites and space missions. This system uses a solar panel to harvest solar energy and continuously monitor key parameters - voltage, current and power - using Arduino UNO. The real-time data is displayed on an LCD and transmitted via serial communication for further analysis. The system ensures maximum power utilisation and supports efficient energy management in space applications.

OBJECTIVES

- To design and develop an Arduino based solar PV energy harvesting system
- To measure and monitor voltage, current, and power of the solar panel in real time.
- To transmit data to a computer for visualisation and analysis.
- To demonstrate a compact, reliable and efficient power solution for space applications

HARDWARE COMPONENTS:

- Arduino UNO
- Solar PV Panel (5V)
- Two 10 kΩ Resistors
- One 100 Ω Resistor
- One 10 Ω Resistor
- 16x2 LCD Display



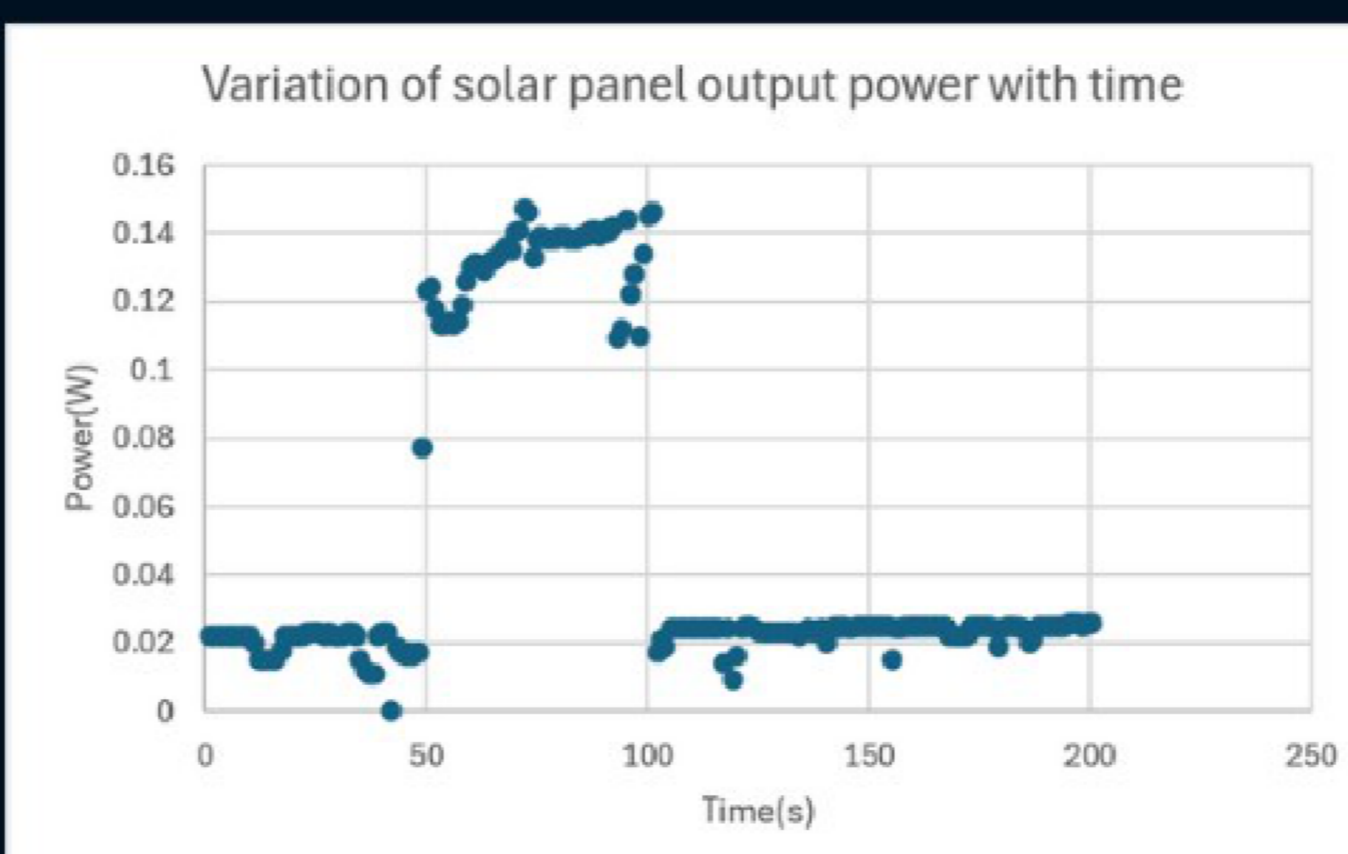
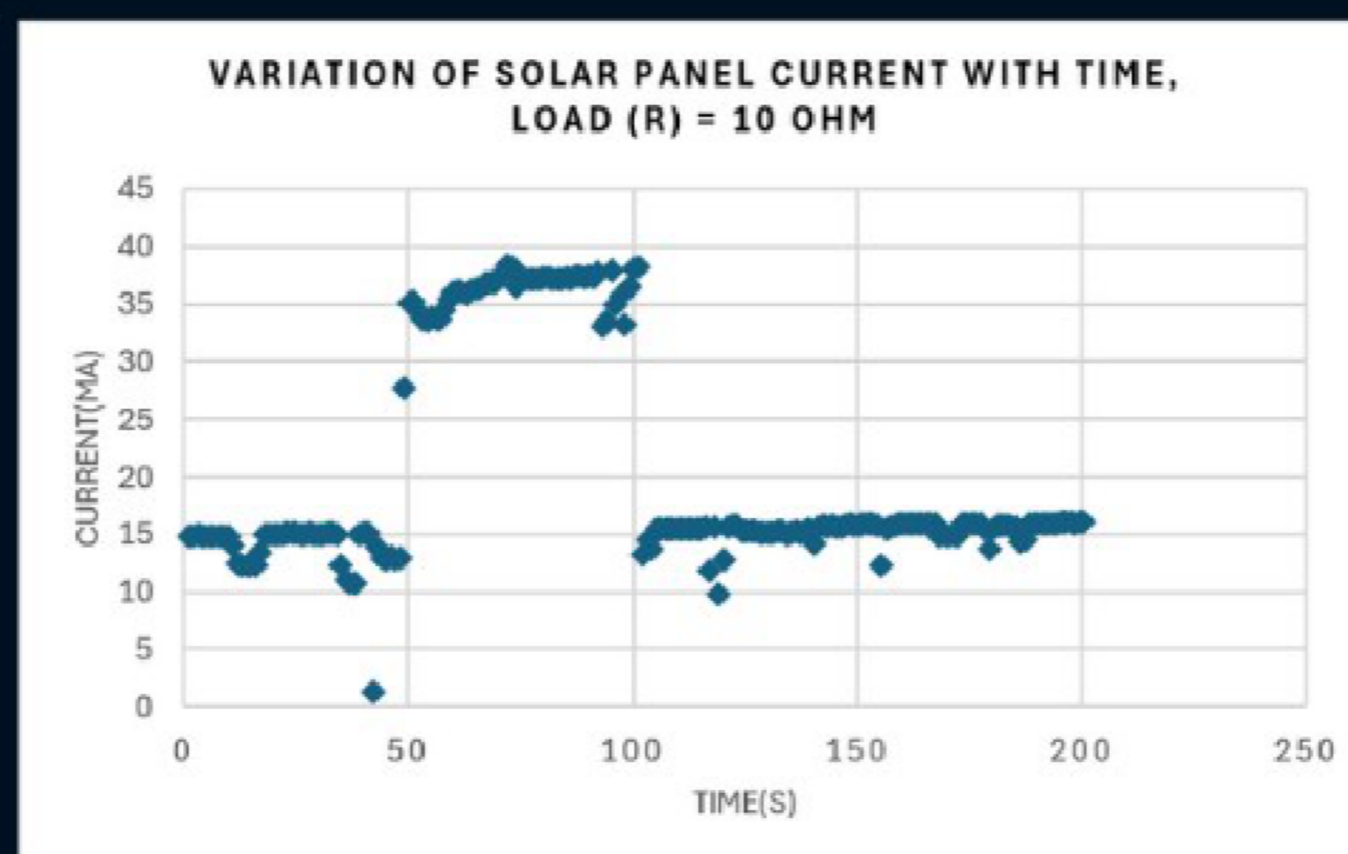
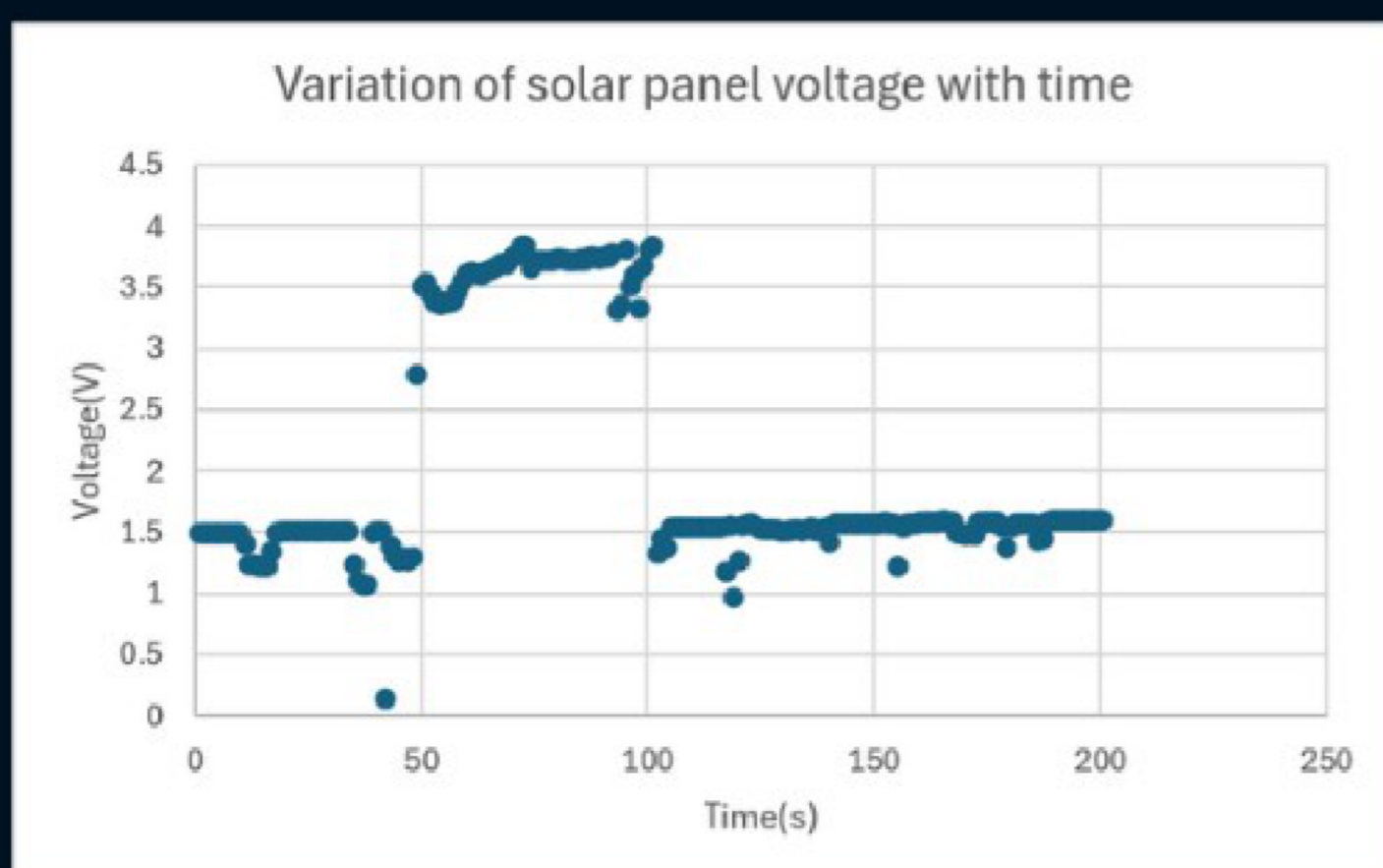
KEY FEATURES:

- Real-time measurement of voltage, current and power
- LCD display for on-board monitoring
- Serial data transmission to PC for data logging
- Low power, lightweight and space-friendly design
- Easy to integrate with satellite and rover systems

TECHNOLOGIES USED:

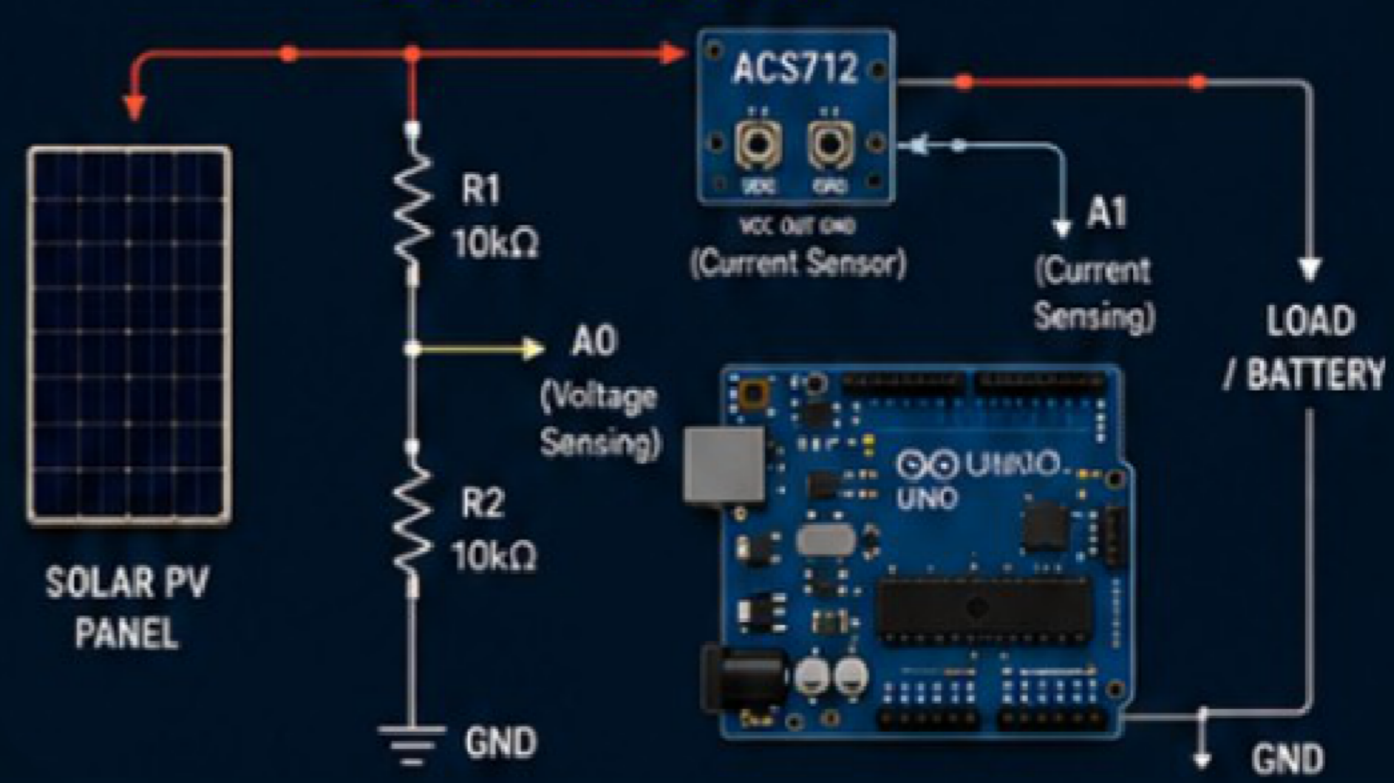
- Arduino IDE (C/C++)
- Embedded Systems
- ACS712 Current Sensor
- Renewable energy
- Serial Communication

REAL TIME MONITORING:

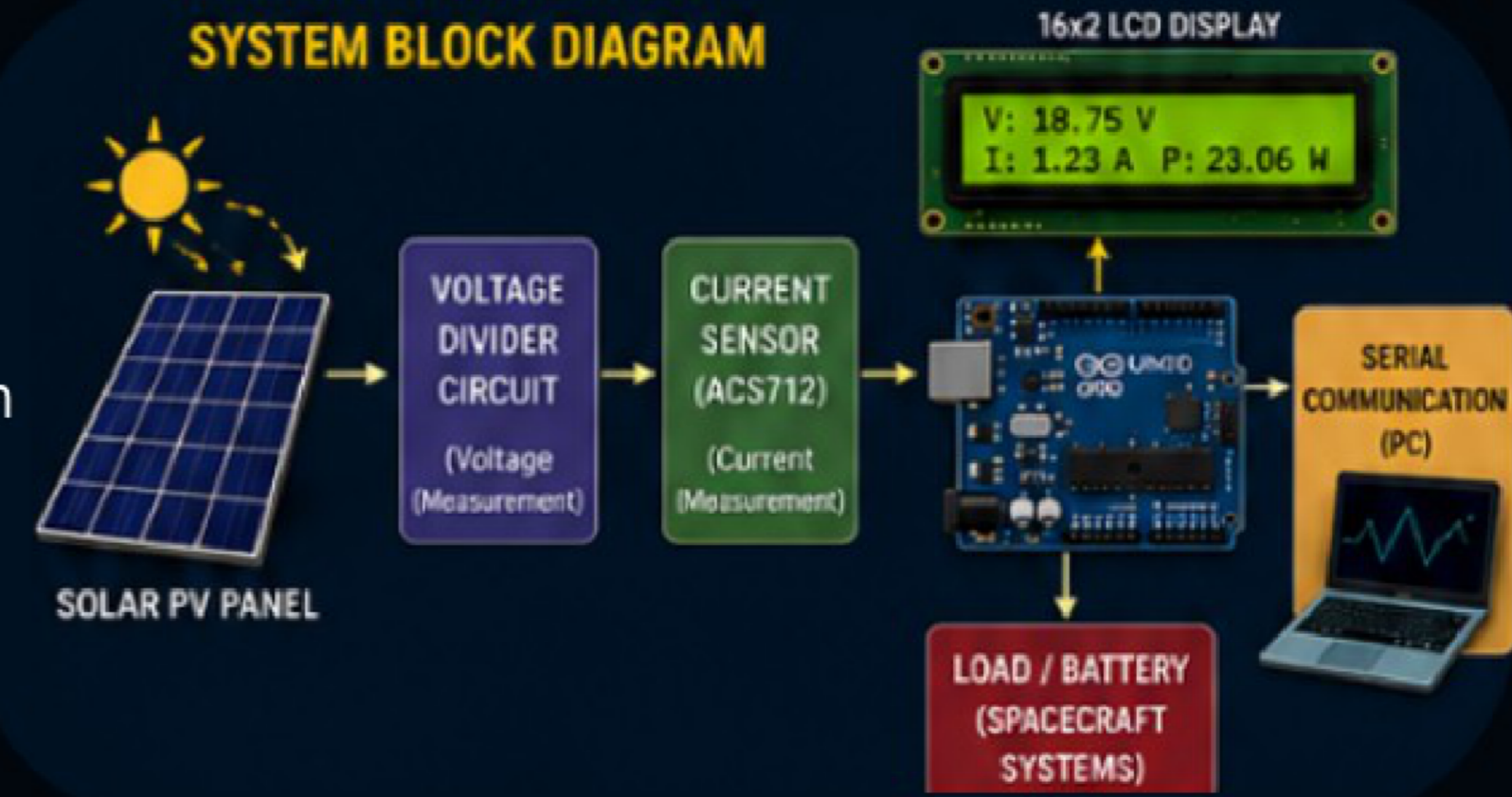


The system continuously monitors and maximises the power output for efficient energy harvesting.

CIRCUIT DIAGRAM



SYSTEM BLOCK DIAGRAM



APPLICATIONS IN SPACE



Power supply for satellites and CubeSats



Energy source for deep space missions



Powering sensors, cameras and communication modules.



Support for long duration and unmanned missions.



HOW IT WORKS:

1. Solar panel converts sunlight into electrical energy.
2. Voltage divider scales the panel voltage and sends it to Arduino.
3. Current sensor measures the output current and sends it to Arduino
4. Arduino calculates power using $P = V \times I$
5. Parameters are displayed on the LCD in real time
6. Data is transmitted to PC via serial port for monitoring and analysis.

ADVANTAGES:

- Reliable and continuous power source in space
- Reduces dependency on batteries
- Improves mission duration
- Supports deep space and long term missions
- Environment friendly and renewable energy

CONCLUSION:

The Arduino based Solar PV Energy Harvesting System is a compact, efficient and reliable solution for power generation and monitoring in space applications. It ensures optimal ultrafiltration of solar energy and enhances the reliability and lifetime of space missions.