



# Measurement of different parameters of PV cell

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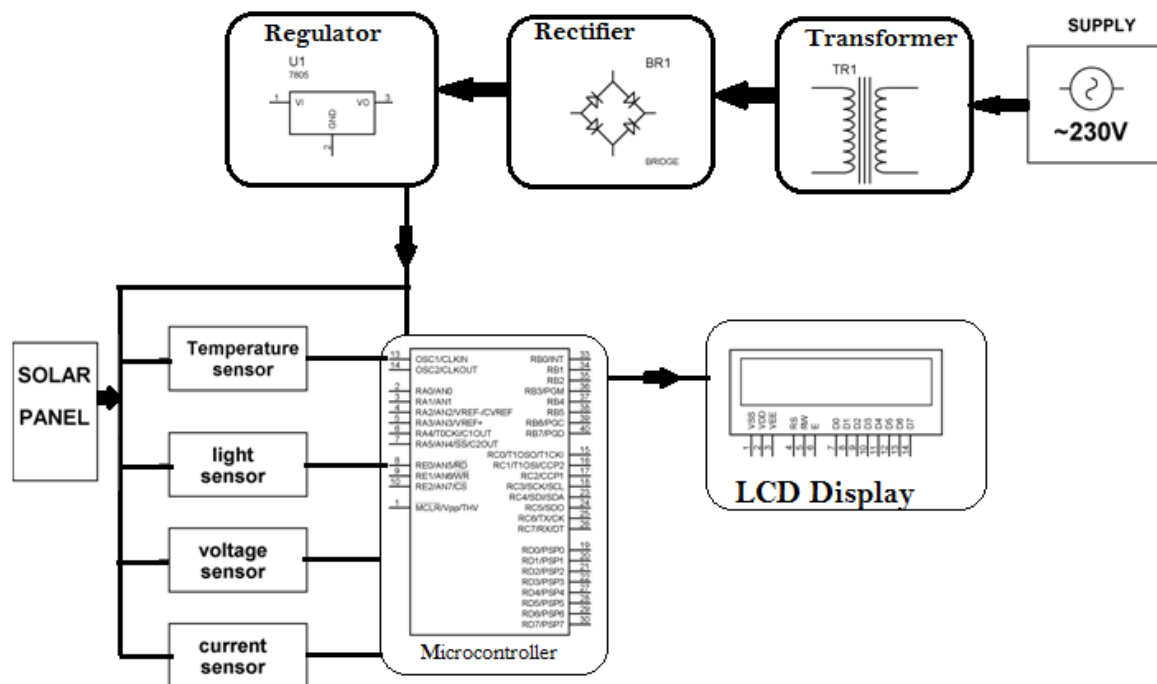
## ABSTRACT

The aim of this proposed work is to measure solar cell parameters through multiple sensors. In this project, a solar panel is used that keeps monitoring the sunlight. Here different parameters of the solar panel like light intensity, voltage, current and the temperature are monitored.

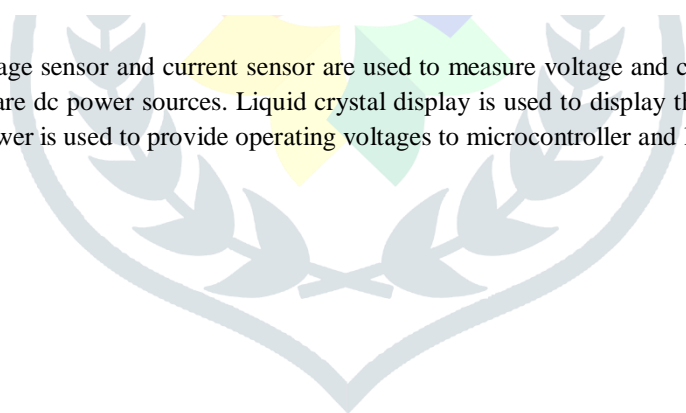
## INTRODUCTION

The solar-energy market is one of the most rapidly expanding renewable energy markets in all over the world. Presently we have seen a significant increase in requests for remote monitoring and control equipment for solar-energy applications. Whether you are assessing a site's potential for solar power generation, monitoring performance of existing solar installations, or advanced solar monitoring, reliable and accurate measurements are crucial. They aid in decision making, product development, system maintenance and in many other ways. Common meteorological measurements including wind speed, wind direction, relative humidity, barometric pressure and precipitation, all have their use in solar applications. Of course, solar-radiation measurements are especially important and sensors are available for measuring all aspects of solar radiation. The main objective of this project is to design a solar energy measurement system for measuring solar cell parameters such as voltage, current, temperature and light intensity through multiple sensors. The light intensity is monitored using a LDR sensor, voltage by voltage divider principle, current by series resistor and temperature by temperature sensor. All these data are displayed on a 16X2 LCD interfaced to PIC microcontroller. In this work, a solar panel is used to keep a track on monitoring the sunlight. In this system, number of sensors is connected to the microcontroller with an 8-channel in-built ADC device for monitoring the parameter of the solar panel like voltage, current, temperature and light intensity. A 16x2 LCD display is connected to the microcontroller for displaying the information. The solar panel is fed to the microcontroller through a potential divider to measure voltage – a small load through which current is measured. The temperature and light intensity is monitored through corresponding sensors. All these parameters are displayed on the 16x2 LCD interfaced to the PIC microcontroller.

**Block diagram:**



In the block diagram, voltage sensor and current sensor are used to measure voltage and current owing to load from solar panel. As we know, solar panels are dc power sources. Liquid crystal display is used to display the value of current, voltage and power of solar panel. 5 volt dc power is used to provide operating voltages to microcontroller and liquid crystal display



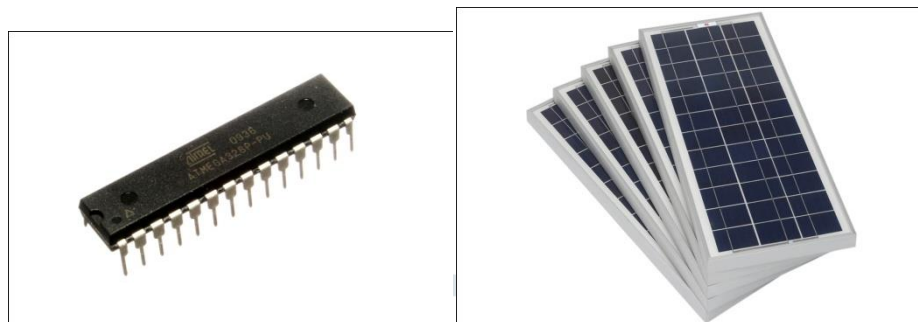
**OBJECTIVE:**

The main objective of this project is to design a solar energy measurement system for measuring solar cell parameters such as Voltage Current Temperature and light intensity through multiple sensors.

**COMPONENTS:**

Microcontroller

solar panel



Led

Lcd



Light dependent resistor

Temperature sensor



## Transformer



## Transformer

A transformer is a device that transfers electric energy from one alternating-current circuit to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage.

## Photo resistor

A photo resistor (also known as a Photocell, or light-dependent resistor, LDR, or photo-conductive cell) is a passive component that decreases resistance with respect to receiving luminosity (light) on the component's sensitive surface.

## Light-emitting diode

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons

## Microcontroller

A microcontroller (MCU for *microcontroller unit*) is a small computer on a single metal-oxide-semiconductor (MOS) integrated circuit (IC) chip. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.

## Solar cell

A photovoltaic (PV) cell, also known as a solar cell, is an electronic component that generates electricity when exposed to photons, or particles of light. This conversion is called the photovoltaic effect, which was discovered in 1839 by French physicist Edmond Becquerel.

## Liquid-crystal display

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in Smartphone's, televisions, computer monitors and instrument panels.

## Temperature sensor

A temperature sensor is a device used to measure temperature. This can be air temperature, liquid temperature or the temperature of solid matter. There are different types of temperature sensors available and they each use different technologies and principles to take the temperature measurement.

### WORKING

The power supply which is =5 v is connected to pin no.11 and 32 of microcontroller and GND is connected to its pin no. 12 and 31. Pin no. 2 of microcontroller is connected to LDR sensor. Pin no. 3 of microcontroller is connected to pin no. 2 of LM35 temperature sensor. Pin no. 4 of microcontroller is connected to voltage sensing circuit; Pin no. 5 of microcontroller is connected to current sensing circuit. Solar power parameter calculator is the device to calculate the intensity, temperature, current and voltage represent them on the LCD screen. We can use LM35 temperature sensor which is calibrated in Celsius over Kelvin because in Kelvin calibrated sensor there is a requirement of subtract a constant voltage from its output to is easy. The temperature sensor LM35 can be used with single power supply. The temperature range for operating is -55 to +150 Celsius. The LM35 sensor is suitable for remote applications. Operating voltage such sensor is varies from 4 to 30 V. When the intensity of light is increases then the resistance of LDR is decreases. This is also known as photoconductor. The LDR(light dependent resistor) is made of a high resistance semiconductor when the falling light on the device is of enough frequency then the photons absorbed by the semiconductor. Thus in resulting free electron conduct electricity thereby resistance is decreases. IV IN4007-The IN4007 is used in rectifier to convert AC to DC

### CONCLUSION

In this project we tried to measure parameters of solar panels such as Voltage, current, power, temperature and intensity of light using ATMEGA328P-PU microcontroller. Digital display can be used to display values of these parameters. PIC microcontroller can be used to measure analog values of these sensed parameters and analog to digital to converter which is in built in PIC microcontroller can be used to measure values of these parameters. There are many ways to sense voltage. But in this proposed work we can easily measure voltage of solar panel using voltage divider. Two capacitors are connect parallel to voltage measurement resistor to avoid voltage fluctuation and avoid harmonics to go into ADC of PIC microcontroller Here we have used differential amplifier to amplify voltage appearing across shunt resistor, because current value may be too high and too low in different timings.

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