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# Microcontroller Based Solar Inverter and Monitoring the System Using IOT

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**A B S T R A C T**

This paper gives an idea about the combination of solar inverter and monitoring system using IOT. Now a day's technology is advancing, cost of renewable energy equipment's is decreasing which has resulted in a massive increase in solar photovoltaic installations, As we know the photovoltaic panel is installed at rooftop, remote capital area and in desserts and monitoring such installations it may be difficult, so this project provide proper systems for remote monitoring of these installations using IOT. We use WIFI module and a microcontroller to send the data to the internet, which can then be accessed anywhere on the globe. So we use arduino ATMEGA328 which is connected with voltage sensor, current sensor and temperature sensor and also connects with the Wi-Fi module as a connection to the Smartphone to display the measurements of current, voltage and power of solar panel and ambient temperatures through the Blynk app.

**Keyword:** solar energy, solar panel, inverter, IOT.

## 1. INTRODUCTION

Electricity is one of the prime requirements for the human kind, but most of electricity generation is done by natural gas, coal, and nuclear energy due to this global warming and severe weather conditions have compelled many nations to look for alternative sources to reduce pollution. So to natural sources are the best solutions for this condition, in this project we make use of solar energy which is clean, abundant and an easily harnessed form energy it is becoming more and more popular with advancement in technology and decreasing cost. Solar power is a conversion of sunlight into electricity, sunlight was collecting either directly by using photovoltaic or indirectly using concentrated of solar energy. Photovoltaic was initially use as a power source for a small and medium-size applications from the calculator powered by a single solar cell to a remote homes powered by an off-grid rooftop photovoltaic's system. As the cost of solar electricity has fallen, the number of grid-connected solar photovoltaic's systems has grown into the millions and utility scale solar power stations with hundreds of megawatts are being built. Solar photovoltaic is becoming inexpensive, low-carbon technology to harness renewable energy from the sun. To harness the solar power generation, it is indeed necessary to pay serious attention to its maintenance as well as application. For proper maintenance and for monitoring the solar energy we make use of IOT in this project, The IOT based solar energy monitoring system is proposed to collect and analyzes the solar energy parameters to predict the performance for ensuring stable power generation. Internet of things or IOT is a revolution in the world of electronics, the idea is to connect all sensors and devices on a common network so that user can access the data and control the devices from anywhere around the globe with an internet connection. In this project the generated output will be store in Battery bank, Inverter section implemented for convert DC to AC for output load.

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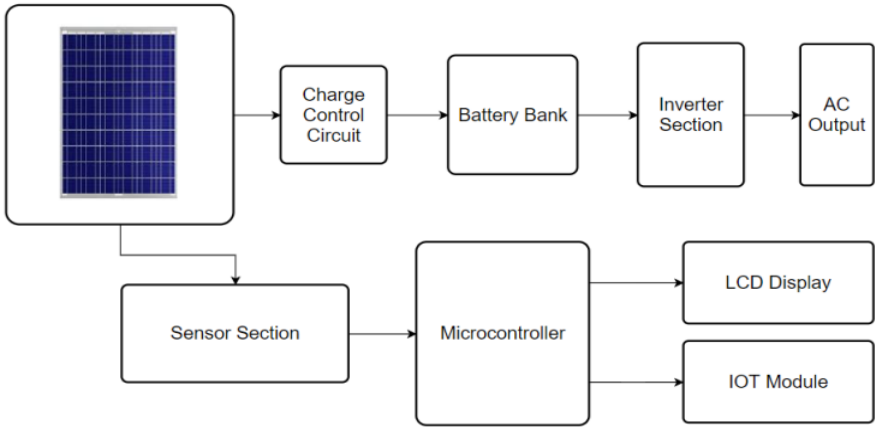
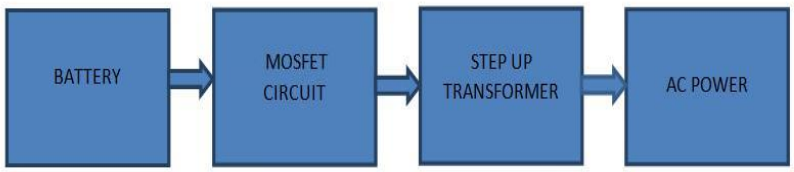
## 2. OBJECTIVE

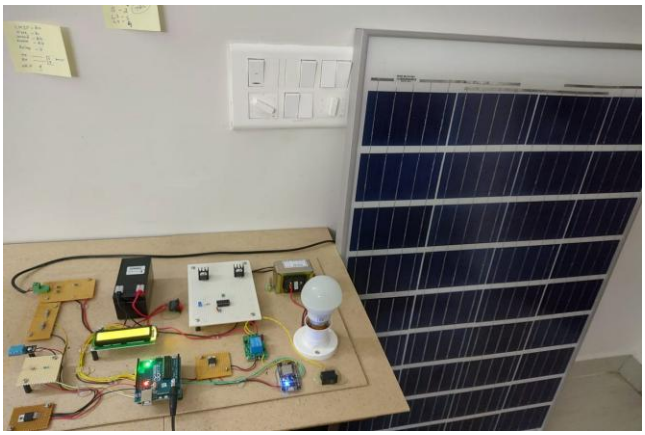
This project is aimed at the development of a cost-effective parameter measuring system for a solar photovoltaic panel using Arduino microprocessor board. The systems measure parameters, including voltage, humidity, light intensity, temperature and for output load inverter section. The hardware circuit designed to link different sensors with the Arduino board and the measured data were in turn were document into IOT application. The measured parameters show that the output energy generation from solar photovoltaic panel largely depends on the solar irradiance and temperature.

## 3. BLOCK DIAGRAM




**BLOCK DIAGRAM OF INVERTER**



## 4. METHODOLOGY

- The project architecture consists of two parts. The first being power electronics, designing of a prototype of solar inverter.
- The second part being wireless communication, sending the observed data wirelessly over internet.
- Different type of sensor is interfaced with solar panel output and microcontroller. This sensor will take information from panel and will pass to microcontroller.
- The solar inverter is designed using MOSFET'S whose DC input as well as AC output. The MOSFET'S are driven by using a CD4047 MOSFET'S driver IC.
- The solar inverter is monitored using data acquisition device. The DAQ consists of an Arduino atmega328, WI-FI module (ESP8266), sensors platform.
- User will able to see this data from anywhere of world location using this system.

## 5. CALCULATION

➢ **The formula to calculate relative humidity is:**

RH = $\left(\frac{pw}{ps}\right)$ x 100%

RH = Relative Humidity

Pw = density of water vapor

Ps = density of water vapor at saturation

➢ **The formula to calculate temperature is:**

Vout = 10mv/℃ x T

Where:

Vout is LM35 output voltage

T is temperature in℃

Vout=$\left(\frac{Vs * Rs}{R1+R2}\right)$

➢ **The formula for voltage divider is:**

Where:

$V_S$ is the source voltage, measured in volts (V),

$R_1$ is the resistance of the 1st resistor, measured in Ohms (Ω).

$R_2$ is the resistance of the 2nd resistor, measured in Ohms (Ω)

$V_{out}$ is the output voltage, measured in volts (V).

## 6. HARDWARE AND SOFTWARE COMPONENTS

➢ **HARDWARE**

- Temperature sensor (LM35)
- MOSFET (IRF540)
- LED (2x16)
- Humidity sensor (DHT11)
- LDR sensor
- Voltage sensor
- Arduino (Atmega328)
- IOT module node MCU
- Solar panel
- Switch
- PCB board
- Resistance
- Connecting wire
- ESP866 WI-FI

➢ **SOFTWARE**

- Arduino IDE
- Blynk app

## 7. RESULT

- As per the room temperature,


- Waveforms



## 8. AKNOWLEDGEMENT

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## 9. CONCLUSION

The main goal of this project is to develop an equipment to measure the status of solar panels in real time and send the measurement result parameters to IOT cloud. The inverter section included for convert this low power dc to Ac for load application. The testing results of the system monitoring system of solar panel output using Arduino Atmega328 which is connected with sensors and Wi-Fi module successfully displays the values related to solar panel via IOT app. This proposed system has more advantageous because of a combination of monitoring and solar inverter system as a single system. This system helps to generate more energy in Indian climatic condition. This proposed system helps India to become superpower country.

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