IMPROVING THE EFFICIENCY OF SOLAR PANEL

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Abstract— An operating temperature is governing parameter of solar panel. As temperature of solar panel is increased then efficiency of solar panel decreases. The different solar panels stations do not work effectively once the temperature exceeds 45°C. In our project we are looking forward to optimize their efficiency in absorbing sun radiations. The methodology that will be used is using water for cooling them down, to increase the temperature inside the panel and therefore to work at its maximum efficiency. The challenge in this project is to solve the problem with minimum water used to cool down panel.

Keywords- Solar Panel, Arduino microcontroller, LM35 Sensor .

1 Introduction

As the world is facing the problem of energy deficit, global warming and detoriation of environment and energy sources, there is need for an alternative energy resource for power generation other than use of fossil fuels, water and wind. Fossil fuel get depleted in next few decades, hydro power plants are depends on annual rainfall and wind power is also depends on climate changes. Solar energy is one of the comparable candidate for alternate energy source. But temperature is main parameter in this , As temperature of solar panel is increased then efficiency of solar panel decreases. The different solar panels stations do not work effectively once the temperature exceeds 45°C.

A typical PV module has an ideal conversion efficiency in the range of 15%. The remaining energy is converted into heat and this heat increases the operating temperature of PV system which affects the electrical power production of PV modules and this can also cause the structural damage of PV modules leads to shorting its life span and lowering conversion efficiency.

The temperature increase of 1K corresponds to the reduction of the photoelectric conversion efficiency by 0.2%-0.5%. Various studies have been conducted in order to improve the PV conversion efficiency, among these cooling provides a good solution for the low efficiency problem. Both water and air are suitable as the cooling fluid to cool the PV module in order to avoid the drop of electrical efficiency.

1.1Problem Statement

Photovoltaic solar cell generates electricity by receiving solar irradiance. The electrical efficiency of photovoltaic (PV) cell is adversely affected by the significant increase of cell operating temperature during absorption of solar radiation. This undesirable effect can be partially avoided by fixing a water absorption sponge on the back side of the photovoltaic panel and maintain wet condition by circulation of drop by drop water through sponge.

As temperature of solar panel is increased then efficiency of solar panel decreases. Ideal conversion efficiency is in the range of 15%. The remaining energy is converted into heat and this heat increases the operating temperature of PV system which affects the electrical power production of PV modules and this can also cause the structural damage of PV modules leads to shorting its life span and lowering conversion efficiency.

1.2Objective

The objective of the present work is to reduce the temperature of the solar cell in order to increase its electrical conversion efficiency.

Get the temperature reading directly on LCD screen and automatic cooling will start.

1.3Scope of work

Solar panel system is very common in each part of contry. It is used in many big renewable energy projects and has huge benefits in power supplying. However the main problematic is the efficiency of this system.Main problem of reducing efficiecy is solved by water cooling method. This has high scope in hot areras and also due to use of renewable energy.

2 Materials and Methods

1. Solar Panel = 20watt, 18 volt
2. Small submersible water pump
3. Tube
4. Arduino microcontroller
5. LM35 Sensor
6. LCD

2.1 Material

1 Aurdino Microcontroller

(FIG1- Aurdino Microcontroller)

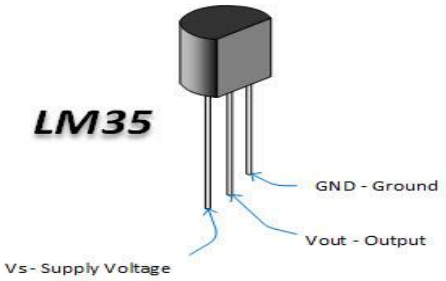
The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards.

2 SOLAR PANEL

(Fig2- Solar panel)

Solar panels absorb sunlight as a source of energy to generate electricity or heat. A solar panel with 20WATT 18 VOLTS USED.

LM35 SENSOR



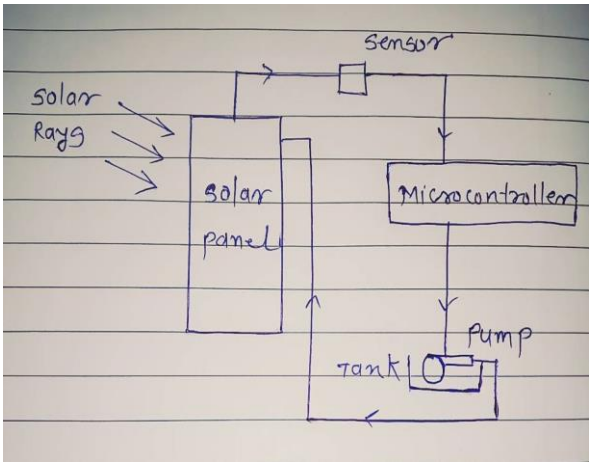
(Fig3- LM35 SENSOR)

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearlyproportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level.

2.2 METHODOLOGY

A solar panel with 20WATT 18 VOLTS USED. The experimental setup also consists of water pump , copper tubes , microcontroller ,LM35 sensor and LCD.

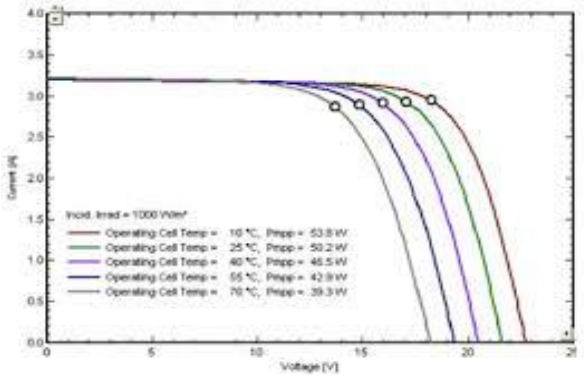
As during working , temperature of solar panel increases it will get detected by LM35 sensor . The output is then given to



(Fig-4 Block diagram of Set-Up)

Arduino micro-controller, then it will drive water pump depending on Threshold temperature.A new temperature is shown on LCD.

Effect of Temperature on Photovoltaic Cell Efficiency



(Fig-5 Effect of Temperature on Photovoltaic Cell Efficiency)

As the temperature increases voltage of panel is decreases with higher rate and that of current of panel increases with smaller rate.

That is output power of solar panel decreases with increase in temperature.

Calculation

EFFICIENCY = OUTPUT POWER/INPUT POWER
=Vmax.Imax /(A.I)

Vmax= maximum Voltage of solar panel(Volts)

Imax =maximum current of solar panel(Amp.)

A =area of solar panel(m^2)

I=Intensity of radiation(W/m^2)

Vmax = Vm@std + ΔVm

Imax = Im@std + ΔIm

At standard temperature (25°c)
αi=0.045%/°K
αv=-0.34%/°K
αi=Temperature coe. Of Imax
αv =Temperature coe. Of Vmax

αi= ((Change in I/ I@std.)×100)/(ΔT)
αv =((Change in V/V@std.)×100)/(ΔT)

Percentage of increase in current is lesser than percentage of decrease in voltage.

Therefor output power decreases and efficiency decreases.

Conclusion

As the temperature increases voltage of panel is decreases with higher rate and that of current of panel increases with smaller rate.

It is need to maintain temperature of solar panel below particular value because the temperature above 25c affects the performance and efficiency.

Reference

1) V.Jafari fesharaki Majid Dehghani, J.Jafari Fesharaki, Humed Tarasoli, "The effect of tempratue of photovoltaic cell efficiency",first international conference on emerging trend in energy conservation-ETEC Tehran ,Tehran,Iran.
2) Anna Machniewics,Dominika knera,Dariusz Heim, "Effect of transition temprature on eficiency of PV/PCM",Sixth international building physics conference IBPC 2015 energy procedia 78(2015)1684-1689.
3) K.A. Moharram M.S. Abd –Elhaldy, H.a. Kandil, H. EI-Sherif,"Enhancing the performance of PV PANELS by water cooling",Ain Shams Engineering Journal(2013)4,869-877.
4) Catain George Popovici, Sebastian Veleriu Hudisteanu, Theodor Dorin Mateescu, Nelucristian Chereches, "Efficiency improvement of photovoltaic panels by usimg air cooled heat simks",sustainable solution for enrgy and enviroment, EENVIR_YRC 2015,Bucharest, Romana, energy procedia 85(2016)425-432.
5) B.Koteswararao, K. Radha krishna, P.Vijay, N.Raja surya, "Experimental Analysis of solar panel efficiency with different modes of cooling", e-ISSN : 0975-4024 B.Koteswararao et al. / International Journal of Engineering and Technology (IJET).
6) Yogesh S Bijjargi, Kale S.S and Shaikh K.A, "Cooling techniques for photovoltaic module for improving its conversion efficiency: a review", International Journal of Mechanical Engineering and Technology (IJMET) Volume 7, Issue 4, July–Aug 2016, pp.22–28, Article ID: IJMET_07_04_003.