Fabrication of Solar Air Cooler with Heater

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Abstract- *Mechanical Engineering without production and manufacturing process deals with conversion of raw materials inputs to finished products as per required dimensions, specification and efficiently using recent technology. The new developments and requirements inspired us to think of new improvements in air conditioning Engineering field. Nowadays heater as well as cooler is available in market deparately. Hence we decided to take over both applications in a same system. It's a new step ahead in air conditioning Engineering field. Our project fulfilled all our requirements as our thoughts. Heater can be used in winter and cooler in summer.*

Keywords- Solar paned, Waterpump, Blower, Impeller, D.C.motor

I. INTRODUCTION

Human beings give off heat, around an average of 100 kcal per hour per person, due to what is known as 'metabolism'. The temperature mechanism within the human body maintains a body temperature of around 36.9 degree C (98.4degree F). But the skin temperature varies according to the surrounding temperature and relative humidity. To dissipate the heat generated by metabolism in order to maintain the body temperature at the normal level, there must be a flow of heat from the skin to the surrounding air. In such a situation water from the body evaporates at the skin surface dissipating water from the body evaporates at the skin surface dissipating the heat due to metabolism. This helps in maintaining normal body temperature. But if the surrounding air is not only hot but highly humid as well, very little evaporation of water can take place from the skin surface, and so the person feels hot and uncomfortable.

II. REVIEW OF LITERATURE

Zeyad A. Haidar et al (2018),Experimental investigation of evaporative cooling for enhancing photovoltaic panels efficiency, Results in Physics.The evaporation latent heat was utilized to absorb the generated heat from the body of a PV module to reduce its temperature. A simple and effective experimental setup was designed, constructed and tested under outdoor conditions. The back surface of a PV panel was wetted and exposed to surrounding. Water was supplied tothe back of the PV panel from a tank by gravity. A series of experiments under real conditions of Riyadh city showing the effectiveness of the method were conducted and analyzed. More than 20 °C reduction in PV panel temperature and around 14% increment in electrical powergeneration efficiency were achieved compared with a referent PV panel. Uncertainty analysis was performed to assess the accuracy of the results.

Akhilesh Yadav, Rajatkumar Bachan, Dattaprasad Tendolkar, Sankesh Torashkar (2018),"Design & Fabrication of 360 Cooler Cum Heater " As we are in need of heating and cooling simultaneously in many of the rural area in India. This paper helps us to understand the process of evaporative cooling. In this they have created a 360o simple evaporative air cooler in which cooling is achieved by direct contact between the water particles and air stream. In which the minimum outdoor temperature required for successful 360o evaporative cooling is about 35o C and even lower than that. The 360o evaporative cooler depends on the outdoor temperature as well as relative humidity, dry bulb temperature and low wet bulb temperature. This can't be used where relative humidity is high. This system doesn't dehumidify the air but on contrary further humidify air.

V. Priyanka et al (2017),Design of Solar PV Panel Cooling System with Data Logger, International Journal of Advanced Research in Management, Architecture, Technology and Engineering,Vol. 3,Issue 2.The major problems in solar panel is increase in the panel temperature which leads to decrease in efficiency. For every one degree rise in temperature above the normal operating temperature there will be 2.2 mV reduction in the output voltage. Cooling the panel is the only way to overcome this problem of temperature rise. This project deals with the designing of solar PV panel cooling system. Design comprises of natural fibres wetted with water is placed on the back side of the panel. The fibre placed panel is compared with the normal panel using data logger circuit and arduino .This comparison process helps to identify efficient panel.

Filip Grubisic-Cabo et al (2016),Photovoltaic panels: A review of the cooling techniques, TRANSACTIONS OF FAMENA XL, issue 1.The efficiency drops with the rise in temperature, with a magnitude of

approximately 0.5 %/°C. Several cooling techniques have been tried, mostly based on active water and air cooling, as these are the simplest techniques. Other cooling techniques include conductive cooling, phasechange material cooling, etc. Increase in electrical efficiency depends on cooling techniques, type and size of the module, geographical position and the season of the year, and usually corresponds with a rise of 3-5 % in overall efficiency.

III. EXPERIMENTAL SETUP

SOLAR PANEL:

A solar panel works on the principle of photo-voltaic principle, the photo-voltaic solar energyconversion is one of the most attractive non-conventional energy sources of proven reliability from the micro to the Mega watt level.

BATTERIES:

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photovoltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

BLOWER

The fan (impeller) rotates inside the shell. The shell is so designed that the air is rushed out forcely. The blower consists of two main parts. They are

- D.C motor
- Impeller Blades(Fan)

D.C MOTOR

The D.C motor is used to control the direction of hot air flow. In our project the hot air is distributed in all direction with the same rate by using D.C motor tilting mechanism. The D.C motor is directly coupled with Impeller blades. The water pump is used to circulate the water to the blower. The cool air is rushed out forcely. The battery is connected to the D.C motor, so that D.C motor runs directly.

IMPELLER:

Impeller consists of more number of blades. The number of blade increases the cold air rushed out forcely. The impeller blades are slightly bended, so that the cold air forcely transmitted to the outside.

WATER PUMP:

Water pump is used to circulate the water. In our project, the 12 Volt D.C water pump is used. The battery is connected to the D.C water pump, so that D.C water pump runs directly.

Fig:1 Solar Panel

Fig:2 Solar Air Cooler with Heater

IV. AIM AND OBJECTIVES OF PROJECT

To develop a simple, cheap and Velocity of Flow = 1m/s – 3m/s (based portable cooling and heating system on

blower capacity)whichdoes not require much maintenance and can be easily carried wherever necessary.

To find out the system applicability, depending on climate which helps heating in winter and cooling in summer.

To minimize investments in the system costs so it can be cost effective. To reduce the energy requirement and also use renewable resources to run the system as maximum energy gets into dehumidifying the air. To reduce the use of refrigerants that are harmful and non-eco-friendly. These refrigerants can contribute to global warming and also result in the depletion of ozone layer.

V. CALCULATION

5.1 Air Cooler

Atmospheric temperature (Air) = 32°C

Heat exchanged air outlet form cooler = 28°C

Heat Transfer Rate Q= mCpΔt

Mass of Air = Mass of Flow Rate

m = ρAc

Density of Air = 1.16 kg/m3 Assuming , m = 0.25 kg/s

Q = 0.25 x 1.005 x (305 – 301)

Q = 1.005 KJ/s or kw

5.2. Air Heater

Atmospheric Air Temperature T1 = 32°C

Temperature After Heat Exchanged T2 = 38°C

Heat Exchanged Q = mCpΔt

Assume , m = 0.25 kg/s

Q = 0.25 x 1.005 x (311 - 305)

= 1.5075 KJ/s

VI. CONCLUSION

By completing this project we have achieved a clear knowledge of comfort cooling system for human by using non-conventional energy. This project would be fruitful in both domestic& industrial backgrounds.We also know about non-conventional energy sources and utilization.

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