IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 03, 2022

DESIGN AND PERFORMANCE ANALYSIS OF WATER GENERATOR FROM ATMOSPHERIC AIR

Sundeep Siddula[1]
Dept. of Electrical and Electronics Engineering, Vignana Bharathi Institute of Technology, Hyderabad
sundeep.siddula@gmail.com

Abstract— In present generation more than half of the population in the world lives in towns and cities. Urban areas are expected to absorb the increase in population growth for the next three decades.By 2050 it is estimated that there is a vast increase in world's population (in billions),and the vast majority of this surplus will be living in slums with inadequate or non-existent water, health or sanitation systems. Today more than 156 million urban dwellers live without immediate access to water. The production of this amount of water in various locations within a slum has the capability to solve the water scarcity problems by producing clean, filtered, free, accessible water in order to eliminate health and sanitation issues. This project in this paper will address the use of this technology while at the same time using it to solve nutrition problems in the same slums by serving also as a water resource for urban farms which are designed to produce fruits, vegetables and mushrooms in the same structure that houses the atmospheric water generator. This water generator is produced within the slum, cutting transportation and packaging costs. The idea is to serve large numbers of people through a process of urban acupuncture producing services that require less maintenance and the possibility of creating local jobs and in helping and solving the water and food crisis in slums in the developing world.

Keywords: TEC modules, cooling fans, heat sink, LM35 temperature sensor, PLC16F676 microcontroller and LCD display.

I. INTRODUCTION

This paper explains about the atmospheric water generator with the concept of peltier effect. In many countries it is difficult to get water resources for drinking, irrigation and other purposes, especially in the area of dry regions. The water scarcity problem observed in other places of the world due to the lack of rainfall.

This paper presents the method to develop a water condensation system by the thermo electric coolers. This system contains cooling elements, cooling fans and heat sink. By attaching large heat sink to the TEC module of hot body, the heat can be removed from the hot side, to maintain the temperature between the hot and cold sides.

This atmospheric water generator converts atmospheric moisture into Drinkable water. The thermo electric cooler is the technology which is applied to the application of refrigeration. In this regard the basic concept was proven with help of 2 TEC modules.

In this TEC devices consumes the current of 3 amps at 10v DC. This time thermo electric cooling uses the peltier effect to form a heat flux between the two different type material junctions. Thermo electric heat pump is a device which transfers heat from one side to the other by using electrical energy depending upon current direction. This is instrument, which is also called as peltier device.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 03, 2022

Whatever the temperature of the cold body is sensed by the LM35 temperature sensor. It is energized by the 5v DC supply. Temperature sensor senses the cold body temperature is given to the PLC16F676 microcontroller. It is already inbuilt with ADC converter and one LCD is interfaced with microcontroller which displays the cold body temperature. This microcontroller unit requires 5v DC supply.

The meaning of Peltier cooler is, an effect whereby heat is given out when an electric current passes across a junction between two materials, this process known as Peltier effect. This device is named after a French scientist whose name is Charles Peltier.

The main function of Peltier cooler is, when current flows through its junction, heat will be removed and cooling will be occurred. When the device is energized, immediately the cooling body gets cooled, this side of the device will be exposed to feel the cooling affect.

The hot side of the device must be coupled with proper heat sink by which heat generated by the hot body must be used and it should be radiated in to air for which bulky aluminium heat sink is required. Here in addition of using bulk heat sink, cooling fans are also used to maintain the temperature. Means the hot body side of the TEC module temperature must be maintained properly, otherwise cooling affect will be decreased.

Due to the poor quality of the heat sink mechanism and poor quality of the TEG module, cooling affect may not be continued for long time, in our trail run we found that the system offers cooling affect for a period of 2 to 3 days continuously, therefore it is concluded by using high quality devices, the affect can be continued by 24/7.

II. PELTIER EFFECT

When the two dissimilar conductors are joined to gather then electricity is passes through them at one junction will be losses heat and other will gains the heat this phenomenon is known as peltier effect. This is just like thermo couples at one junction cooler then the other one is hotter. This is also known as Thermoelectric effect. The thermo electric cooler (TEC) works on this principle.

Thermoelectric effect is process of conversation of DC voltage to the temperature difference. This peltier effect was discovered by the jean charles peltier in 1834. Due to change in the continues current. in junctions leads to temperature difference between those junctions.

Two unique semiconductors, one n-type and one p-type, are used because they need to have different electron densities. semiconductors are placed thermally in parallel to each other and electrically in series and then joined with a thermally conducting plate on each side. When a voltage is applied to the free ends of the two semiconductors there is a flow of DC current across the junction of the semiconductors causing a temperature difference.

The side with the cooling plate absorbs heat which is then moved to the other side of the device where the heat sink is. Thermoelectric Coolers, also abbreviated to TECs are typically connected side by side and sandwiched between two ceramic plates. The cooling ability of the

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 03, 2022

total unit is then proportional to the number of TECs in it.

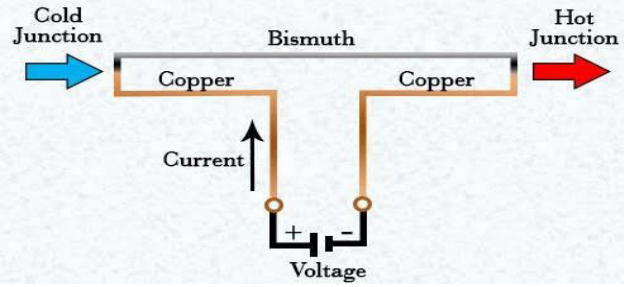

Fig. 1. Peltier effect

III. THERMO ELECTRIC COOLER

In this paper the major component. This TEC modules. This Thermo electric cooler (TEC) module has two sides. Whenever the electric current passes through this module due to the peltier effect one side will becomes hotter and other will be cooler, At cooler side the water molecules are formed because of condensation.

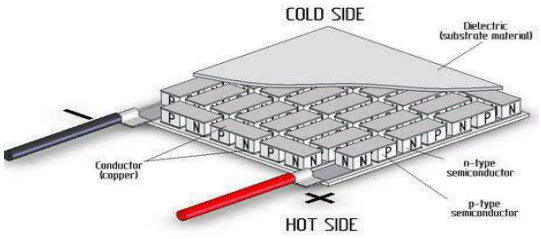

Fig. 2. Thermo electric cooler module

IV. WORKING PRINCIPLE OF AN ATMOSPHERIC WATER GENERATOR

This paper works on the principle of peltier effect. Whenever the current passes through peltier cooler or thermoelectric cooler at one side of the TEC module gets cooler and other gets hotter, To dissipate this heat a fan (heat sink) is attached to hotter side of TEC module. Coming to cooler side to measure the temperature of cooler body a LM35 temperature sensor is connected, this sensor output was given to microprocessor (PIC16F676) which is inbuilt with ADC. This microprocessor output was given to LCD (16×2) unit, as the sensor senses the temperature and displayed in LCD with the help of microprocessor.

At cooler side of TEC module the water molecules are formed because of Condensation, it was just like whenever a items from refrigerator was kept outside we observe water molecules around that item this phenomenon is called condensation. It mainly consists of two circuits.

V. TEC MODULE CIRCUIT

This is main circuit, in this first the input of 230V AC supply was step down to 12V by stepdown transformer, Then this 12V AC was converted in to 12DC with the help of rectifier, this 12DC consist of ripples so to eliminate the ripples it passes through filter capacitors. Finally this pure DC was given to TEC module then it will be cooed one side and other will hotter, at cooled side water molecules are formed. As the number of TEC module circuit are increase the output water quantity was also increases. In this project we are using 2 TEC modules the circuit diagram was shown below.

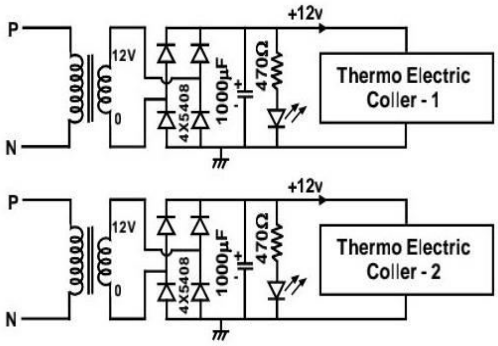

Fig. 3. Circuit diagram of TEC modules

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 03, 2022

VII. TEMPERATURE MONITORING CIRCUIT

In this circuit the temperature of cooler side was monitor continuously by the LM35 temperature sensor. The input to this sensor was 5V which is supplied by stepdown transformer(230/5v) this 5v was rectified and given to sensor. This sensor senses the temperature and give that information to the microprocessor, as this microprocessor (PIC 16F676) process the data and displayed in the LCD display panel. This circuit helps to know at what temperature the water molecules are forming at cooler side of TEC module.

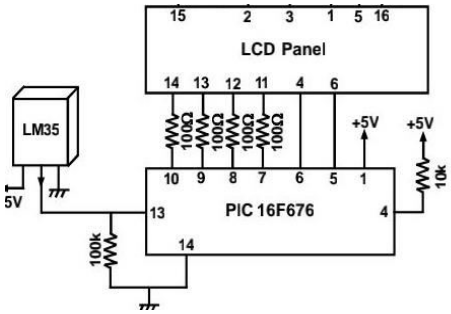

Fig. 4. Temperature Monitoring circuit

Fig.5. Hardware implementation of atmospheric water generator

Hardware model of atmospheric water generator shown in fig.5.

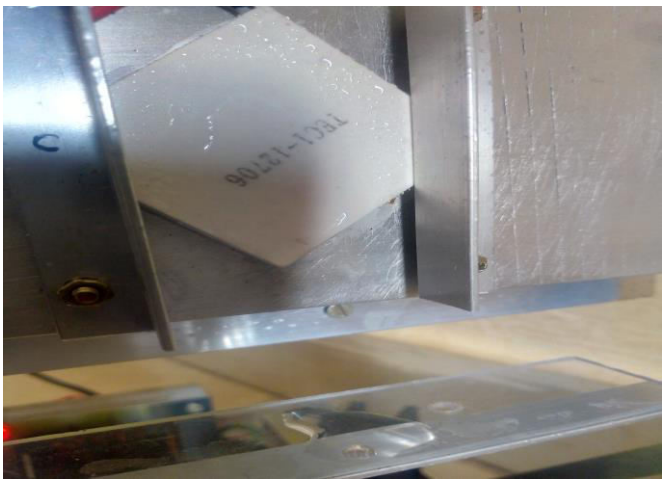

Fig. 6. Formation of water drops

By the hardware implimentation of this atmospheric water generator, water droplets are accumulated over the cold body of the device. That is shown in above fig.6.

Hence by this module pure drinking water generated from air. Temperature of TEC module was displayed in the LCD.

VIII.EQUIPMENT OF ATMOSPHERIC WATER GENERATOR

The equipment which are used in this atmospheric water generator are listed in below table.

Table 1. Equipment details of atmospheric water generator

EQUIPMENT	RATING	QUANTITY
TEC MODULES	12V,3A	2No
TRANSFORMERS	230/12v 230/5v	2No 1No
PIC16F676 MICROPROCESSOR	------	1No
LM35 TEMPERATURE SENSOR	-------	1No
16×2 LCD DISPLAY	-------	1No
RESISTORS	470Ω 100Ω 1kΩ 100kΩ 10kΩ	3No 5No 2No 1No 1No
CAPACITORS	1000µF	5No
DC FANS	12V	2No
DIODES	-----	As per requirements
PCB BOARD	----	1No

V. CONCLUSION

This paper work is constructed by the Model of Atmospheric water generator is successfully designed and tested. Results are found. Since it is prototype module and experiment wise. This system is designed with 2 TEC modules, but for practical time many devices must be used depending upon requirement in fact, large size of TEC modules are necessary to grab the water from air.

A thermo electric cooling system must be coupled with proper heat sink mechanism, these are supposed to attached with hot body of TEC modules so the heat can be generated by the device and absorbed effectively. If proper heat sink is then not used heat will pass through the cold body so that instant and continuous heat sucking device must be used to maintain the continuous cooling effect. In this trail runs water droplets dropping from the cold body of the device.

ACKNOWLEDGEMENTS

One of the authors, Dr.Sundeep.Siddula, is a EEE faculty of Vignana Bharathi Institute of Technology (VBIT), Hyderabad, acknowledges DST for providing computational facilities under its FIST program at VBIT Hyderabad where the computational work has been carried out.

REFERENCES

[1] G. Peters, N. Blackburn, M. Armedion, “Environmental assessment of air to water machines,” in The International Journal of Life Cycle Assessment, 2013.

[2] A. Dash and A. Mohapatra, “Atmospheric water generator: to meet the drinking water requirements of a household in coastal regions of India,” National Institute of Technology, Rourkela, 2015.

[3] J. Taweekun, V. Akvanich, “The experiment and simulation of solid desiccant dehumidification for air-conditioning system in a tropical humid climate,” in Engineering, 2013, Vol. 5, pp. 146-153.

[4] G. Sharan, "Harvesting dew water for human use in coastal area of Gujarat (India)," in IEEE Global Humanitarian Technology Conference: South Asia Satellite (GHTC-SAS), Trivandrum, 2013, pp. 80-84.

[5] Beaudoing, Hiroko and M. Rodell, NASA/GSFC/HSL (2016), GLDAS Noah Land Surface Model L4 monthly 1.0 x 1.0 degree V2.1, Greenbelt, Maryland, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC),

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 03, 2022

Accessed: August 3,2017, 10.5067/LWTYSMP3VM5Z.

[6] T. Anbarasu and S. Pavithra, (2011) "Vapour compression Refrigeration system generating fresh water from humidity in the air," in International Conference on Sustainable Energy and Intelligent Systems, SEISCON 2011, Chennai, pp. 75-79

[7] Tripathi, S. Tushar, S. Pal, S. Lodh, S. Tiwari, R. Desai, "Atmospheric water generator," in International Journal of Enhanced Research in Science, Technology & Engineering, Vol. 5, Issue 4, 2016, pp. 69-72.

[8] Cengel, Y., Cimbala, J., & Turner, R. (2012). Fluid mechanics:Fundamentals and applications (4th ed.). New York, NY: McGraw Hill Higher Education.