Method To Develop A Water Condensation System Supported On Thermoelectric Cooler

[1]Prabhas Singh, [1]Amit Gupta
Department of Electronics and Communication, RD Engineering College Ghaziabad, India
Amitgupta12@gmail.com

Abstract— It is challenging to obtain water resources for irrigation or other uses in many nations, including India, due to the lack of rainfall, especially in the arid regions like deserts etc. Due to a lack of rainfall, the issue of water scarcity is also seen throughout the world. However, we can condense the airborne water vapour in areas that are very humid, such as those near the sea. The method for creating a thermoelectric cooler-supported water condensation system is described in this study. The system consists of air circulator, heat exchanger, and cooling devices. The air Water Generator is the technology that can directly transform air moisture into useful and even drinkable water. This gadget turns water vapour molecules into water droplets by using the latent heat concept. Although it has been introduced a little before, India and some other nations do not use it very frequently. In our technological age, when we are all relying on renewable resources, it has a lot of applications. This essay also discusses the outcomes of the experiment and the functionality of the system.

Keywords –Thermoelectric cooler, Atmospheric moisture

I. INTRODUCTION

In many nations, including India, obtaining water resources for agriculture or other uses is challenging, particularly in arid regions. Finding various techniques for the generation of pure water becomes more useful to inspire many academics to study on related themes because of the lack of pure water in many locations throughout the world, particularly in the countries of the Arabic Gulf. Water is essential to life in all its facets. Water is a necessary component of life, yet it is difficult to purify, expensive to transport, and cannot be substituted. Nearly 45 crore people live in water-deficit zones across 129 nations.

Nearly 70% of fresh water is utilised for irrigation of agricultural fields, causing water conflicts between urban and rural areas. If this trend continues, by 2032, nearly half of the world's population will be experiencing a water shortage. Water wars are expected to occur in the twenty-first century. It has been noted that other parts of the world are experiencing water scarcity due to a lack of rainfall. However, we can condense the airborne water vapour in areas that are very humid, such as those near the sea. The method for creating a water condensation system based on a thermoelectric cooler is presented in this research. The system consists of cooling elements, heat exchange unit and air circulation unit.

The Atmosphere is contains large amount of water in the form of moisture, vapour etc. Within those amounts almost 30% of water is wasted. This amount of water can be used if we are able to extract the water that present in the air in the form of moisture. This Atmospheric moisture convertsdirectly into usable and even drinkable water this is called Atmospheric Water Generator.

This project willhelps to extend the applications of suchdevices further in the future. From previous knowledge, we got to know that the temperature require to condense water is understand as temperature .In this project we are using a of a thermoelectric Peltier (TEC) couple, which is employed to make the environment of water condensing temperature or dew point or otherwise we can also use conventional compressor and evaporator system could to condense water by simply exchanging the heat of transformation of coolant inside the evaporator. After condensing ,the condensed water will be collected to used for drinking, irrigation and various other applications.

II.LITERATURESURVEY

Many products of similar technology are available in the market. But after going through the product develop page of various companies, it was found that the device are very bulky and heavy. The water generated by this gadget are not portable. Since they used a compressor but it consumes heavy electricity and these are not eco-friendly which produces lot of noise and requires maintenance. Hence to make it portable we are using same technology with different device called peltier device

Anbarasu and Pavithra in 2011, title of the paper is "Vapour Compression Refrigeration System Generating
Fresh Water from Humidity in the Air" .This paper infers thatdehumidifying unit using vapour compression refrigeration system will be more effective than the Peltier system but it lacks in the sense that it is not portable and it generates a lot of sound. And also this system is morecostlier than any.

Niewenhuis et.al., 2012, title of the paper is "Water generator water from air using liquid desiccant method" , here in this paper we observed that even though this dehumidification by liquid desiccant method is new and it possess a lot of potential theoretically but when the researchers made a prototype and put it for testing ,it was found that the result was not satisfactory. The device could produce only 72.1 mL of water per kW-hr. Along with Niewenhuis many have tried to use the same liquid desiccant method for dehumidification. After they built the prototype and put it into testing it was found that water created from the gadget was very dismal. Hence from this paper we got to know that not to use this method of dehumidification for our prototype.

Kabeela et.al. 2014, title of the paper is "Solar-based atmospheric water generator utilisation of a water recovery",during this paper they used the tactic of dehumidification unit using Peltier device, it had been found that the device is extremely portable and environment friendly. It consists of straightforward design with high capabilities. This sort of device are often implemented in extreme situations like during floods or in desert and rural areas. This device has greater advantages because it works sort of a renewable source of atmosphere water and doesn't need an important power source. Applying this techniue during a highly humid region almost 1 Litre of condensed water during the day time. Hence due to these many advantages we decided to use the Peltier device which is more portable and eco friendly.

Agbossou, A., Q. Zhang, G. Sebald, and D. Guyomar. 2010. title of the paper is "Solar Micro-Energy Harvesting

Based on Thermoelectric and heat of transformation Effects. Part I: Theoretical Analysis.". during this paper they used a way of harvesting ambient renewable micro energy by using both TE and heat of transformation effects. A prototype was designed for work unit made from phase-change material as well as a TEG.

After browsing all the available options and referring from several papers, we are decided to use a Peltier device which is portable and eco-friendly to create the Atmospheric Water Generator. Using the tactic of dehumidification are going to be costlier and not portable, hence we are generating water from air using Peltier device at coffee cost and efficient in terms of amount of water collected and portability.
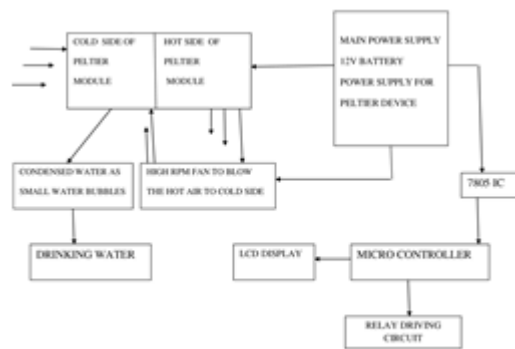

Fig 1: diagram

III. METHODOLOGY

The ability of air to contain water vapour changes depending on the air's temperature and humidity; the warmer the air, the more water vapour it can hold. We are employing a Peltier gadget in this instance, which has both a hot and a cold side. In order to lower the temperature of the air and help it cool down, free air is first passed over the peltier element's cold side. As a result, water vapour begins to condense as the air cools. The hotter side of the peltier device is then passed through with this air, which lowers the temperature there. The peltier device begins to operate once it is attached to a power source, and it must continue to operate otherwise the temperature at the recent.

The water droplets obtained after condensation are often collected using any reservoir then passes through the filter. The microcontroller operates effectively at 5V but the most power supply will produce fluctuated output voltage to avoid that weareconnecting 7805 voltage regulator IC microcontroller. Similarly pH sensor operates at 9V so we are connecting 7809 transformer to provide constant 9V to the pHsensor.

In LCD display we are getting to display the pH value, humidity percentage and temperature value., The aim of relay driving circuits, we are setting humidity threshold intensityl we are setting humidity threshold level the device will Automatically shutdown

and when the humidity percentage goes above the humidity intensity the device will automatically activate.

- **Hardware Components**

A. Power Supply

Fig 2: Power Supply

Power supply providing electricity to the module and other components.

B. Conductor with fan

Fig 3: conductor with fan

Heat sink is another one which is typically made from aluminium is in touch with the recent side of a thermoelectric module.
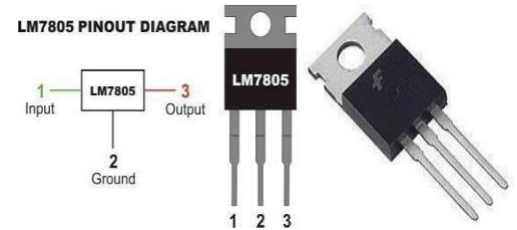
C. Peltier cooler

F. Voltage regulators

Fig 4: Peltier cooler

The design is more convenient for water collection and so simple such the device are often carried anywhere. This gadget is extremely helpful for explorers, mountaineers, fisherman etc. At the present climate as heating increases   and therefore the water resources over the planet diminishes, so this equipment is extremely helpful to mankind. The concept of this techniue also can be used as a far better

alternative in refrigeration against conventional systems

D. DC Pump

Fig 5: DC PUMP

They are circulating humid water from the copper coil.

E. Relay Module

Fig 6: Relay Module

A Relay is an electrically operated switch. Relays are used where it's necessary to regulate a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

Fig 7: LM7805 & LM7809 voltage regulator

A transformer may be system designed to automatically maintain a continuing voltage level. The 7805 may be a transformer microcircuit.7805 provides +5V regulated power supply.
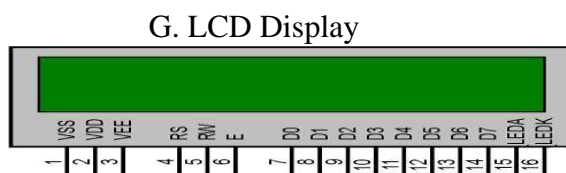
G. LCD Display

Fig 8: LCD display

Aliquid-crystal display (LCD) may be flat-paneldisplay or other electronically modulated device that uses the light-modulating properties of liquid crystals. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.

H. Copper Coil

Fig 9: Copper Coil

In this copper coil we are flowing humid cold water, and small water bubbles freeze on the copper coil.

I.   Arduino Uno

Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328. Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins are often used for PWM output. It allows the designers to regulatel and sense the external electronic devices within the world.

J.   Conductor compound

Fig 11: Conductor compound

Heat sink compound or thermal paste may be very high heat conductive paste that's used between two objects (usually a conductor and a CPU/GPU) to urge better heat conduction. We'd like physical contact to move heat from the recentt side of the Peltier to the warmth sink.

K.   Battery

Fig 12:   Battery

Sunlight isn't always same thanks to cloud, rain and already dark. For that reason, within the system, we've used batteries as copy when there's not enough sunlight.

o**Software Components**

The Arduino integrated development environment (IDE) may be a cross-platform application (for Windows,macOS, Linux) that's written within the programing language Java. It's wont to write and upload programs to Arduino board. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiringproject, which provides many common input and output procedures. We are using embedded C to program the device.

Embedded C programing

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software. Embedded C programming plays a key role in performing specific function by the processor. In day- to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all device working is based on microcontroller that are programmed by embeddedC.

CONCLUSION & FUTUREWORK

The design is more convenient for water collection. The design is so simple such that the device can be carried to anywhere .The equipment is very helpful for explorers, mountaineers, fishermen etc. The concept of this system can also be used as a better alternative in refrigeration against conventional systems. At the current climatic conditions as global warming increases and the water resources over the world diminishes, so this equipment is extremely helpful to mankind**.**

Future Scope

1) For now, in this prototype we have used only two peltier device. In future the prototype may incorporate with multiple number of peltier device to increase the production of water.

2) This idea can likewise be utilized as a superior optionin refrigeration science against traditional frameworks.

3) RO water filter which kills the bacteria and also UV water filter which kills all the pathogens present in the water can be used for large scale implementation for producing such water that meets the standard of WHO

   water guidelines.

4) As this project aims at producing water from atmosphere, small sized scrubber can be used to remove all oxides from the air and made it portable for drinking and other purpose.

5) As this project we can also make portable air conditioner and refrigerator.

ACKNOWLEDGEMENT

REFERENCES

[1] Abualhamayel and Gandhidasan. "A Method of Obtaining Fresh Water from the Humid Atmosphere",1997.

[2] Kabeel. "Application of Sandy Bed Solar Collector System for Water Extraction from Air" International Journal of EnergyResearch,2006.

[3] Ji,Wang, and Li. "New Composite Adsorbent for Solar- Driven Fresh Water Production from the Atmosphere",2007.

[4] Suter, C., P. Tomes, A. Weidenkaff, and A. Steinfeld. "A Solar Cavity-Receiver Packed with an Array of Thermoelectric Converter Modules" SolarEnergy,2011.

[5] Maneewan, S, J. Hirunlabh, J. Khedari, B. Zeghmati, and S. Teekasap. "Heat Gain Reduction by Means of Thermoelectric Roof Solar Collector",2005.

[6] Agbossou, A., Q. Zhang, G. Sebald, and D. Guyomar. "Solar Micro-Energy Harvesting Based on Thermoelectric and Latent Heat Effects. Part I: TheoreticalAnalysis",2010.

[7] Rahbar, N., and J. A. Esfahani. "Experimental Study of a Novel Portable Solar Still by Utilizing the Heat Pipe and Thermoelectric Module", 2012.

[8] Anbarasu T., Pavithra S. "Vapour Compression Refrigeration System Generating Fresh Water from Humidity in the Air",2011. [9] Niewenhuis B., Shepperly C., Beek R.V., Kooten E.V."Water generator water from air using liquid desiccant method",2012.