# Thermoelectric Cooler-Supported Water Condensation System Development Method

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**Abstract**
The scarcity of rainfall in many countries, including India, makes it difficult to get water resources for irrigation or other applications, particularly in arid regions like deserts, etc.The problem of water scarcity is also present throughout the world as a result of insufficient rainfall. However, in really humid places, such those close to the sea, we can condense the water vapor in the air. This paper describes the process of developing a water condensation system supported by a thermoelectric cooler. The heat exchanger, air circulator, and cooling components make up the system. The device that can directly convert atmospheric moisture into usable, even drinkable water is called the air Water Generator. 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

## INTRODUCTION

In numerous countries, including India, getting water assets for agribusiness or different purposes is testing, especially in parched areas. Finding different strategies for the age of unadulterated water turns out to be more helpful to motivate numerous scholastics to concentrate on related subjects in light of the absence of unadulterated water in numerous areas all through the world, especially in the nations of the Arabic Bay. Water is crucial for life in the entirety of its aspects. Water is an essential part of life, yet it is hard to decontaminate, costly to ship, and can't be subbed. Almost 45 crore individuals live in water-deficiency zones across 129 countries.

Almost 70% of new water is used for water system of agrarian fields, causing water clashes among metropolitan and rustic regions. In the event that this pattern proceeds, by 2032, almost 50% of the total populace will encounter a water deficiency. Water wars are likely to break out in the 21st century. It has been noticed that different regions of the planet are encountering water shortage because of an absence of precipitation. Notwithstanding, we can consolidate the airborne water fume in regions that are extremely muggy, like those close to the ocean. The strategy for making a water buildup framework in light of a thermoelectric cooler is introduced in this examination. There are cooling elements, a heat exchanger, and an air circulation unit in the system.

The Air is contains enormous measure of water as dampness, fume and so forth. Inside those sums practically 30% of water is squandered. If we are able to extract the water that is present in the air in the form of moisture, then this quantity of water can be utilized. This Environmental dampness converts directly into usable and, surprisingly, drinkable water this is called Barometrical Water Generator.

This venture will helps to expand the utilizations of such devices further from here on out. From past information, we got to realize that the temperature expect to consolidate water is comprehend as temperature .In this undertaking we are utilizing an of a thermoelectric Peltier (Sleuth) couple, which is utilized to make the climate of water gathering temperature or dew point or if not we can likewise utilize customary blower and evaporator framework could to consolidate water by just trading the intensity of change of coolant inside the evaporator. Subsequent to consolidating ,the dense water will be gathered to utilized for drinking, water system and different applications.

## LITERATURE SURVEY

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

**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 we are connecting 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**
**Power Supply**



**Fig 2:** Power Supply

Power supply providing electricity to the module and other components.
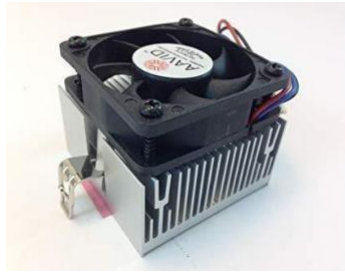
**Conductor with fan**

**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.
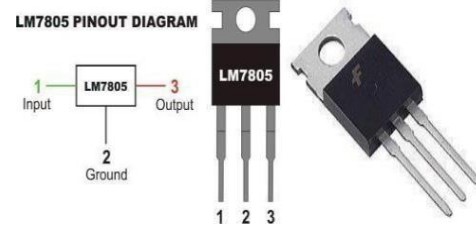
C.  Peltier cooler



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 increase 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

**DC Pump**



**Fig 5:** DC PUMP

They are circulating humid water from the copper coil.

**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.
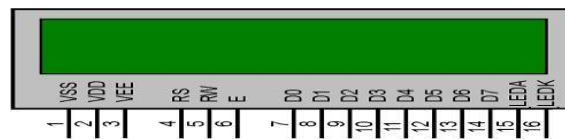
**LCD Display**



**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.
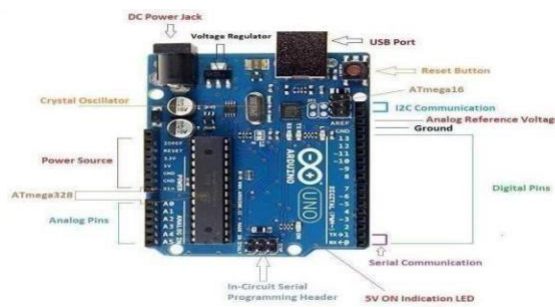
**Copper Coil**



**Fig 9:**  Copper Coil

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

**Arduino Uno**



**Fig 10:** Arduino UNO

Arduino Uno is a microcontroller board developed by 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.

**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.

**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.

**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.

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