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REVIEW ON AUTOMATIC RAIN WATER HARVESTING

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ABSTRACT

The purpose of this article is to examine several kinds of long-term water collecting techniques from air fogs and dew. We report on the water collection performance of different fog collectors from across the globe in this article. In addition, we look at the technical elements of fog collector feasibility studies. The increases in efficiency Bioinspired technology is often used in modern fog collecting technologies. Fog Global fog incidence clearly limits harvesting technologies. Dew water harvester, on the other hand, is it's ubiquitous, but it needs a cooled condensing surface to work. The collecting of dew water is discussed in this review. Rainy water harvesting utilizing a radiative cooling surface, solar regenerated desiccant systems, and active condensation technology are the three types of systems. All of these methods have one common goal.is the creation of an atmospheric water collector capable of producing water regardless of humidity, geographical position, cheap cost, and supplies that may be found locally.

KEYWORDS: *ARM7 (Advanced Reduced Instruction Set Computer), LCD (Liquid Crystal Display), ROM (Read-only Memory), Rain.*

INTRODUCTION

About ⅔ of the earth surface is covered with water. However, the amount of usable water is very small. The growing population and growing industries and agricultural practices needs lots of water. The huge consumption of water is causing reduction of available water. We need to think about various ways to save and conserve water resources. One of the very important inventive measures for conservation of water is rain water harvesting. Basically water comes on the surface with rain, however it gets collected in the rivers which ultimately flows into the ocean. Which means that the usable water is lost in the ocean[1]. We can catch the rainwater and prevent it from flowing into the ocean, this is rainwater harvesting.

There are mainly two methods for rainwater harvesting:

- Rooftop rainwater harvesting: during raining rain water gets collected on the rooftop. It can be transferred to a storage tank through a pipe. Often water contains soil particles and other impurities in such case water should be filtered to remove these impurities. Water stored in this storage tank can be used to fulfill our water needs. Instead of storage tank water can also be transferred to a pit in the ground from where it saves into the soil. The saved water gets added to ground water and so the level of water increases. In both ways we can prevent water from flowing away[2].
- Roadside drains: Rainwater falling on the road gets collected in the drains. The drains can be modified so that the water entering in them get seeped into the soil or this water can be collected in a storage structure as well[3].

The classification of atmospheric water collecting methods is shown in Figure 1. Harvesting water from fog, or visible cloud water droplets or ice crystals floating in the air at or near the Earth's surface, is the first type. It usually happens as a result of more moisture in the air or a drop in the ambient air temperature[4]. Methods may be classified into two categories: conventional and contemporary. Water vapor collection is the second kind of collecting. While fog may be seen with the naked eye, water vapor is created by the evaporation of liquid water or the sublimation of ice. Dew water is produced when water vapor condenses on a surface that has been cooled below the dew point temperature of atmospheric water vapor. While fog water collecting systems are more conventional in nature, utilizing a mesh-like structure, dew water harvesting techniques use a variety of technologies. Early experiments used passive systems with radiative condensers, but due to their poor efficiency, researchers used solar-regenerated desiccant techniques to improve moisture sorption and desorption. However, this has not shown to be adequate on its own[5]. Dew water harvesting research also includes integration with active cooling condenser technology, which includes the use of traditional vapor compression air conditioning systems and, more recently, thermoelectric coolers. Due to the high efficiency of active cooling condenser systems, readers will be provided with a selection of commercially available water harvesting technologies incorporating active cooling condenser systems at the conclusion of this article.

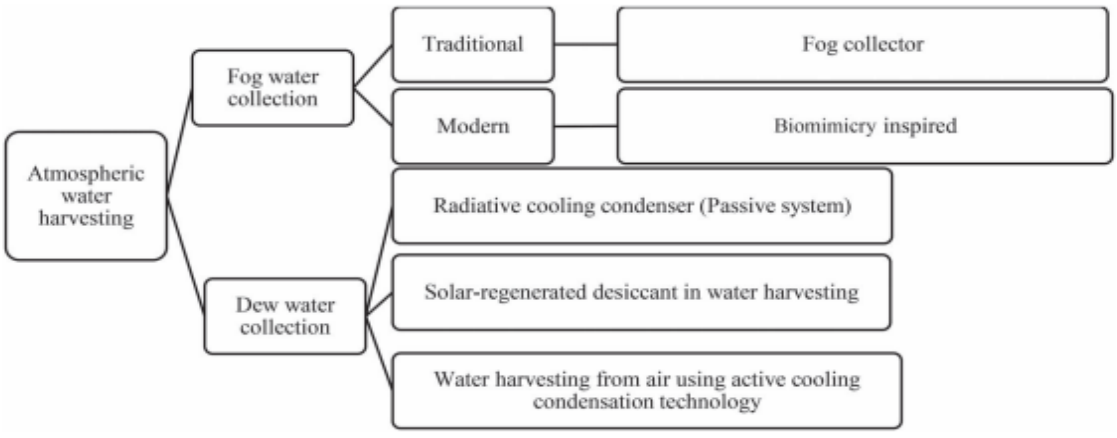

Figure 1. Illustrate the categories of atmospheric water harvesting techniques

Apart from the above methods Aqua space rainwater harvesting is one of the larger rainwater harvesting systems which can be constructed using a sub-surface rainwater exchange system[6]. This system is a revolutionary design that combines a recirculating decorative water feature with a sub-surface rain water harvesting storage system. The clean, filtered water that is stored in the sub-surface can be stored for irrigation or to maintain the water level in the decorative water feature[7]. To make this Aqua space rainwater more effective an LPC2148 controller which is an ARM7 based microcontroller with high performance of 32-bit RISC microcontroller with thumb extensions 512KB on-chip flash ROM with in-system programming and in-application programming, 32KB+8KB of data memory is used along with a raindrop sensor, LCD and an alarm, wherein the raindrop sensor will sense the rain water moisture, LCD is attached to the sensor to display whether the droplets is rain drop or not. An alarm to alert the presence of rain. Once the presence of rain is detected an input is sent to the controller and the controller makes the motor to open the valve of the pump. Then the water passes through the pump and we can further proceed to the harvesting process[7].

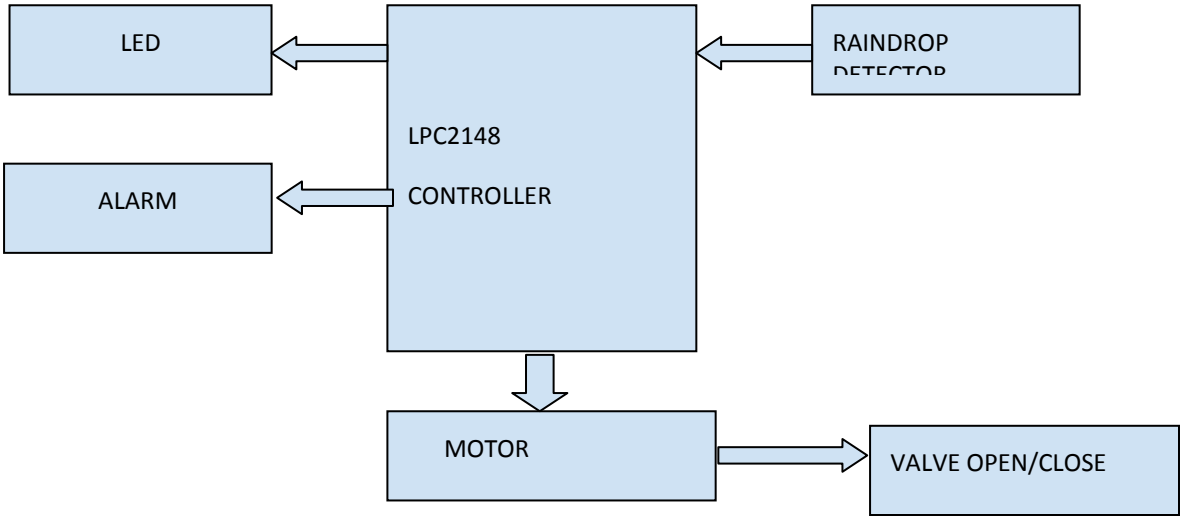

Figure 4: This figure shows the block diagram of rainwater detection and storage process wherein a LPC2148 controls the entire process of rainwater detection system. Once the detector detects the rainwater the motor opens the valve to store the water for further use[8].

This are the component used in my research paper to complete the Aqua space rainwater harvesting system using ARM7 comptroller:

1. Lpc2148
2. Raindrop sensor
3. Led
4. Alarm

Harvesting dew water

When fog droplets collide and intercept with the collecting surfaces in fog water harvesting, water is collected. However, the worldwide fog occurrence, which is highly reliant on geographical and metrological variables or circumstances, is the primary limiting factor in

collecting water from fog droplets. Only a small number of locations have climatic circumstances that allow moist air to spontaneously cool below its saturation temperature, resulting in fog[9]. As a result, fog is believed to be even less accessible than saltwater as an alternate supply of freshwater on a worldwide scale. Because water vapor is widespread in the atmosphere, freshwater may be collected at a variety of places if it is condensed by cooling. Nonetheless, the condensation process is more thermodynamically complex than fog harvesting, since it includes a large amount of heat release. Dew water is made up of water droplets that form when water vapor condenses on a surface at a temperature below the dew point temperature.

Dew water collecting methods are classified into three categories in this paper:

1. Passive (radiative) cooling condenser,
2. Desiccant renewed by the sun and
3. Active cooling condensation technique for water collection from the air.

Projects from the last 30 years to the present

Fog harvesting is prevalent in dry and semi-arid regions near the coast, where clouds develop over the water and are driven towards the mainland by the prevailing winds. When the clouds collide with the surface of the hills near the sea, they turn into fog. Various fog collection installations exist in various locations, including the Namib Desert in Africa, for both research and real-world uses[10]. The desert is well-known for its ability to gather water through fog collecting. A fascinating study was conducted to determine the quality of Namibian fog water. Three Topnaar communities in the Namib Desert were researched for fourteen SFCs. Klipneus community has the highest water collection. In terms of water quality, the first washing of SFCs produces murky, brackish water containing NaCl following a no-fog period. The water was deemed unfit for human consumption on a case-by-case basis. Despite this, the water recovered after the first washing was determined to be quite clean and low in salt concentration. In the 1980s, fifty fog catchers were used in a study experiment in Chile's Coquimbo area.

The design of fog catchers

The prevailing wind exerts pressure on the mesh in LFCs, which subsequently exerts stresses on the supporting structures, weakening or breaking the foundation. Meanwhile, UV light and other external conditions may harm the mesh and other components of LFCs. The failure of LFCs in severe weather is mostly due to a lack of a logical or designed design approach. This seems to explain the fog collector maintenance problem that the locals are having. Robust materials for fog collectors were developed utilizing stronger stainless steel mesh, coupled with poly material, to meet various environmental circumstances, such as for extremely windy locations.

Studies on the efficacy and practicality of fog collectors

A fog water collectors would serve as a wind-driven fog barrier. However, the fog water collector does not disturb a part of the fog. Despite the fact that the fog collector collides with the fog, it is unable to catch all of the liquid water present in the fog.

There seem to be losses as a result of:

1. Fog circling the fog water collector.
2. Fog flowing through the mesh apertures.
3. Droplets bouncing back into the wind.

Fog interception effectiveness refers to the percentage of fog collected by the fog water collector. The caught water droplet mixed, moved to the bottom portion of the fog collector, and was delivered to the water tank through the water gutter. However, there is the possibility of re-entrainment at the water gutter, where water may return to the air flow or some water from the mesh slack, wrinkles, and folds may enter the gutter and be collected at the water tank.

Pyramid collector made of glass

- desiccant beds on shelves,
- glass pyramid collector
- A slanted wall covering
- A collecting cone
- A condenser portion affixed to the pyramid's top, shielding it from the sun. As desiccants, sawdust and cloth soaked with CaCl2 were explored.

Overnight, the beds' coverings are left open to allow the desiccant to collect water vapor from the air. During the day, the covers are closed, allowing the beds to be heated by solar radiation, which condenses on the sides and, in particular, at the pyramid apex, where it is collected by a central cone and travels via a tube to an external container as shown in figure 1. The cloth bed system outperformed the sawdust bed system in terms of water yield.

Surface is corrugated

Introduced the use of an integrated desiccant/solar collector to harvest water from humid air, based on the concept of desiccant moisture absorption at night and simultaneous desorption and water vapor condensation during the day. During the evenings, they utilized a tiny air circulation fan to push ambient air into the glass-enclosed solar collection. A thick layer of corrugated fabric was employed as the desiccant bed in the collector as shown in figure 2. During the absorption/desorption process, the usage of a corrugated surface was intended to enhance the heat and mass transfer area.

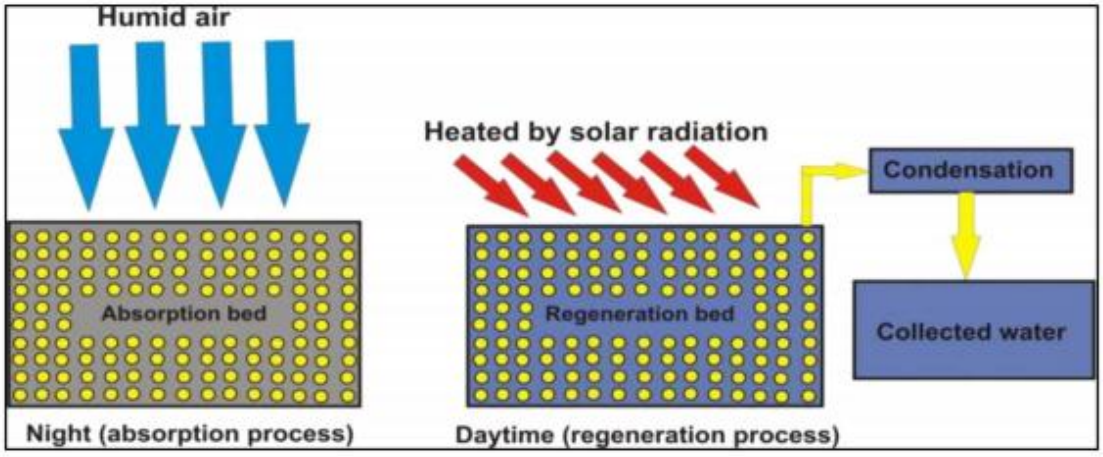

Figure 1: Wet desiccant technique for water production from atmospheric air

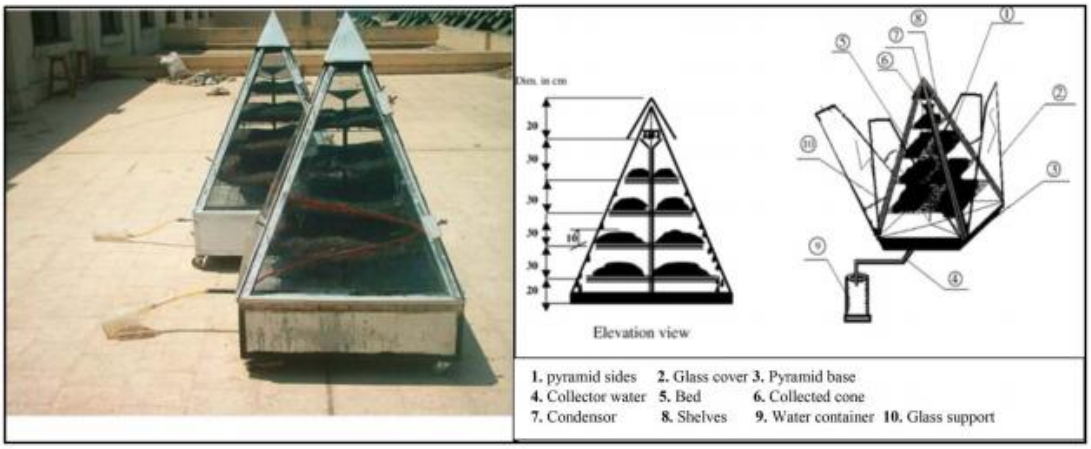

Figure 2: (a) Photograph of the system used. (b) Pyramid with glass covers open at night (right)

In this literature an lpc2148 microcontroller is interfacing with a raindrop sensor which will detect the rain, an LED to display whether the moisture is rain drop or not and an alarm attached to make an alert. The rain water detector is used in the irrigation field, home automation, communication, automobiles etc. The drawback of this literature is it just detects the raindrop not showing the method of harvesting[11]. This paper disclose creates a truly sustainable water feature using all rain water. The underground reservoirs comprise of the aqua box storage units, this are made from recyclable plastic and the modular nature of this unit allows it to put together in such configuration to meet the sight requirements for any size projects. The best thing about this system is we can drive heavy equipment over the top of the system once it is buried under the ground, it is very useful for commercial application. Aquaspace snorkel vault and centipede has a high efficiency pumping system and provides a convenient access point for inspection and maintenance. The rain exchange comes in free packets, easy to use kits and can also be customized for the larger or more unit projects. This entire process helps us to capture, filter and reuse rainwater.

DISCUSSION

One of the beautiful and easy technique is used in this project to harvest rainwater i.e. Aqua space rain water harvesting. By this technique we can capture, filter and reuse rainwater. The best thing about Aqua space rainwater storage system is it adds beauty to our home. If each and every home follows this technique, we can give rise to a green environment as green earth is degrading day by day also we will be able to store large amounts of water for our daily use.In this research paper Aqua space rainwater harvesting is successfully done using an ARM7 controller. The process starts with the detection of rainwater, once the rain water is detected an input signal to the LPC2148 controller. Then the controller converts the received input analog signal to digital signal. An output from the controller allows the LED to display the status whether the moisture is rainwater or not. If the detected moisture is rain water, then an alarm gives an alert to the authorized person and the controller sends a signal to the motor to open the valve. The open valve allows the rainwater to flow through the pipe and passes through the filtering process called Aqua space downspout filter.

CONCLUSION

Water is a basic need in everyday life. So saving water and using it in a proper manner is very important. Here is a project by which we can check the rainwater status, so that if the water status is confirmed motor valves get activated and rain water gets harvested. This filter is located at the base of the downspout and has a 300-micron bag located inside of it. It is made for the easy removal and capture of all the leaves, twigs, sediments and seeds that are generated from the roof. From here the water goes through a pipe system into the underground modular reservoir. The revolutionary design of a rain change system combines the modular underground reservoir with a decorated water feature. The benefit of that is we get the sight and sound of the water feature combined with aeration and filtration aspects of the moving water also gives us more usable water. This creates a truly sustainable water feature using all rain water. The underground reservoirs comprise of the aqua lox storage units, this are made from recyclable plastic and the modular nature of this unit allows it to put together in such configuration to meet the sight requirements for any size projects. The best thing about this system is we can drive heavy equipment over the top of the system once it is buried under the ground, it is very useful for commercial application. Aqua space snorkel vault and centipede has a high efficiency pumping system and provides a convenient access point for inspection and maintenance. The rain exchange comes in free packets, easy to use kits and can also be customized for the larger or more unit projects. This entire process helps us to capture, filter and reuse rainwater.

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