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Experiment of Natural Cooling System Using Well Water

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Abstract: Technology would make life more convenient, easier, and meaningful for humans. Many innovative inventions and solutions are created by combining technologies from many sectors. Natural cooling system-related systems undergo significant development on a regular basis as they become an increasingly important element of our lives. Many facilities are required in a structure with a big number of tenants. Furthermore, a cooling system is a crucial system for a building, but modern cooling systems consume more energy and produce more pollution. As a result, a natural cooling system employing well water can be used to control this. Meanwhile, the concept behind this cooling system is to drill a well near the structure and use the well water to cool it down using a simple mechanical system. Most notably, a conceptual design house is used to depict the cooling system.

Keywords: Natural Cooling System, Well Water, Conceptual Design House

1. Introduction

In the age of globalisation, the trends of all countries in the world moving to the most famous and renowned countries throughout the world are developing. One of the main reasons why people believe in making them is because of the time path that technology exhibits today. We now have cooling systems such as air conditioning in every building, which is the primary source of global warming. The topic of global warming has been a major concern in recent years. The cooling system's demand has risen quickly in recent years and will almost probably continue to rise in the next decades. Although the current cooling system has done an excellent job of meeting the demand, for the purpose of global warming, this chemical-based cooling system must be reduced. Not only that, but it can also deal with the effects of climate change and economic growth. As a result, the cooling system's efficiency is required to meet the criterion. Meanwhile, if the cooling system management for the house and building

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fails, it may bring harm to people. As a result, the natural cooling system using well water can be considered one of the next most cost-effective practices in the building cooling system implementation plan.

The method, which will be used in the structure because of its prospective advantages and uses, could become very popular from the research on the natural cooling system strategy. The relative efficacy of the natural cooling system clearly depends on the native environment, but the natural cooling system is the best suited to all the problems of our global warming in such a way [2].

2. Materials and Methods

The main focus of this research is to investigate the cooling system performance. The conceptual design is made in a small ratio and act as a prototype that represent the real natural cooling system using well water. The methods a clearly elaborated below with the help of diagrams [3].

2.1 Material and Sample

. There are few materials have been used to construct the conceptual design such as plywood, wood, zinc roof, screws, submersible pump, water tube, PVC materials. The materials are selected based on the ability to absorb heat to test the cooling system in the experiment show in figure 1. All these materials are available in hardware shops with a reasonable price.

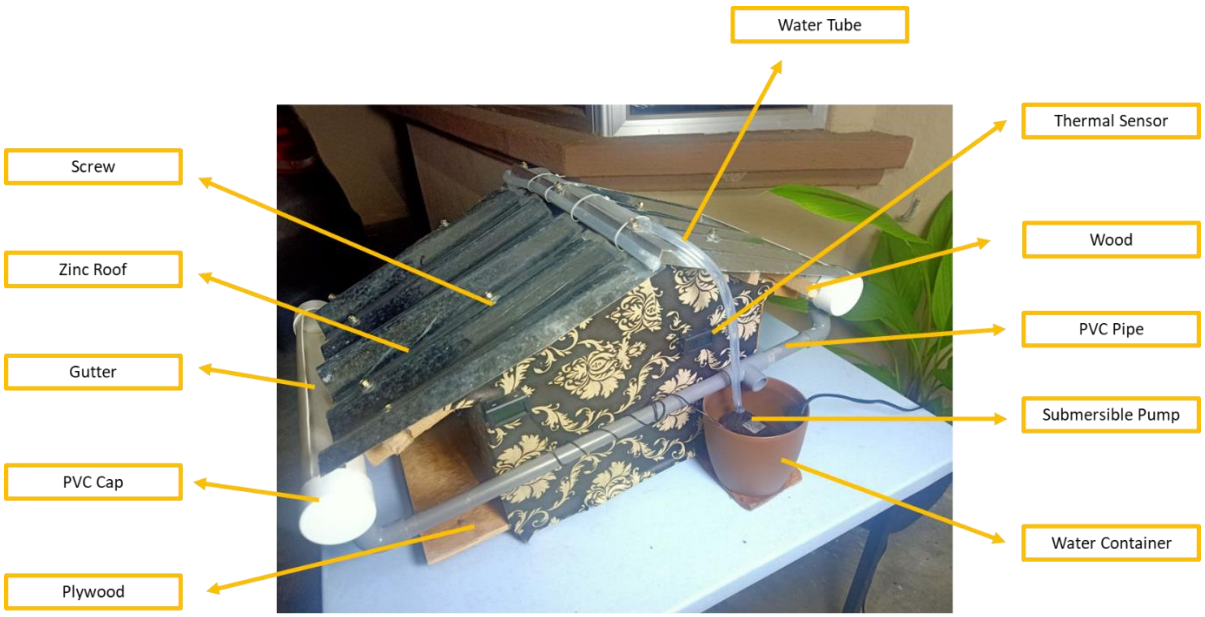

Figure 1: Material used

2.2 Experimental Methods

First of all, the water tank is filled with water and extra water is prepared to add when the pump is on. Besides that, extension wire is necessary to carry out the experiment. Not only that, a submersible pump with 220-240V, 600L/H and 1M H.MAX is used to converts rotary energy into kinetic energy and then into pressure energy to push water to the roof surface. Initial temperature was taken from the water tank and the house after the conceptual design is exposed to atmosphere/surrounding for 15 minutes to obtain the equilibrium temperature. The water tank is filled with water and the power supply is switched on to generate the pump. The submersible pump will suck out the water from the water tank to the roof through a small colourless tube. Next, the water will flow to the zinc roof through small tube. Then, the water will flow to the gutter from the zinc roof. The water from the gutter will then flow through the piping system and back to the water

tank. The process will be repeated for 15 minutes. After 15 minutes the temperature will be taken and recorded to a table. The procedure of cooling system will be tested on four different parts of the day [4]. The conceptual design show in figure 2.

Figure 2: Conceptual design

2.3 Formula to calculate

2.3.1 Average

The sum of a set of numbers is divided by the total number of values in the set to get the average. We utilise averages because they're a great method to summarise a lot of information. Instead of having to sift through hundreds or thousands of pieces of information, we now have a single number that summarises everything. While averages have some drawbacks, such as outliers causing an erroneous average, they are useful for quickly comparing data. The statistics average termed Mean is a concept we used to hear in statistics and mathematicians [5].

Average is a highly significant concept in statistics if you want to get the centre value from a set of data, you may use the average function. An average is a statistical concept that can be defined as a single number taken as typical of the given list. Many researchers utilise averages when conducting research, but technical analysts use averages the most since they must compute the average price of the stock in which they are conducting research, hence averages are more important in their area. An average is a number that falls in the middle of a set of data. The formula for average show in equation 1.

Formula to calculate average,

$$\text{Average} = \frac{\text{Total sum of all numbers}}{\text{Number of Item In The Set}} \qquad \text{Eq.1}$$

2.3.2 Pressure

The force applied perpendicular to the surface of the object per area over which the force is spread is known as pressure. Water pressure, on the other hand, is a word used to describe the force of water flowing through a channel or pipe. It is also possible to calculate the decrease of water pressure [6]. As a result, the force applied over a given area is also the pressure in a liquid. The gauge pressure is the pressure in relation to the surrounding atmosphere. Pressure is expressed using a variety of units. Some of it comes from a force per unit area unit. Pascal is the SI unit of pressure (Pa). The formula for pressure shows in equation 2.

Formula to calculate pressure,

$$p = \rho gh \qquad \text{Eq.2}$$

Where,

P = water pressure in Pa

ρ = density of water in kg.m-3

g = gravitational force in 9.81 m.s-2

h = height in m

3. Results and Discussion

In the results of the experiment and profoundly discuss the effect of the cooling system on the conceptual design house. The results from four part of the day is tabulated into a table together with the average calculation. Furthermore, the result of input and output temperature of the water and house is shown in a bar chart separately.

3.1: Results

3.1.1 Table of temperature (morning)

The table 1 below shows the average temperature (℃) that is calculated in the morning of the experiment.

Table 1: Input and output of house and water temperature

Conceptual Design	Temperature (℃)	Sample			Average	Percentage
		S1	S2	S3		
House	Input	29.1	29.0	28.9	29.0	0.021%
	Output	28.3	28.5	28.4	28.4	
Water Temperature	Input	26.9	26.5	26.4	26.6	0.026%
	Output	27.0	27.5	27.3	27.3	

3.1.2 Table of temperature (afternoon)

The table 2 below shows the average temperature (℃) that is calculated in the afternoon of the experiment.

Table 2: Input and output of house and water temperature

Conceptual Design	Temperature (℃)	Sample			Average	Percentage
		S1	S2	S3		
House	Input	35.8	35.7	35.6	35.7	0.092%
	Output	33.5	32.1	31.6	32.4	
Water Temperature	Input	27.8	27.7	27.5	27.7	0.011%
	Output	28.0	28.0	28.0	28.0	

3.1.3 Table of temperature (evening)

The table 3 below shows the average temperature (℃) that is calculated in the evening of the experiment.

Table 3: Input and output of house and water temperature

Conceptual Design	Temperature (℃)	Sample			Average	Percentage
		S1	S2	S3		
House	Input	31.0	31.1	31.2	31.1	0.061%
	Output	29.5	29.1	29.0	29.2	
Water Temperature	Input	29.0	29.1	29.2	29.1	0.076%
	Output	27.0	26.9	26.8	26.9	

3.1.4 Table of temperature (night)

The table 4 below shows the average temperature (℃) that is calculated in the night of the experiment.

Table 4: Input and output of house and water temperature

Conceptual Design	Temperature (℃)	Sample			Average	Percentage
		S1	S2	S3		
House	Input	27.2	27.1	26.9	27.1	0.033%
	Output	26.5	26.0	26.2	26.2	
Water Temperature	Input	25.9	26.0	25.8	25.9	0.023%
	Output	25.4	25.3	25.2	25.3	

3.3: Graph

3.3.1: Morning

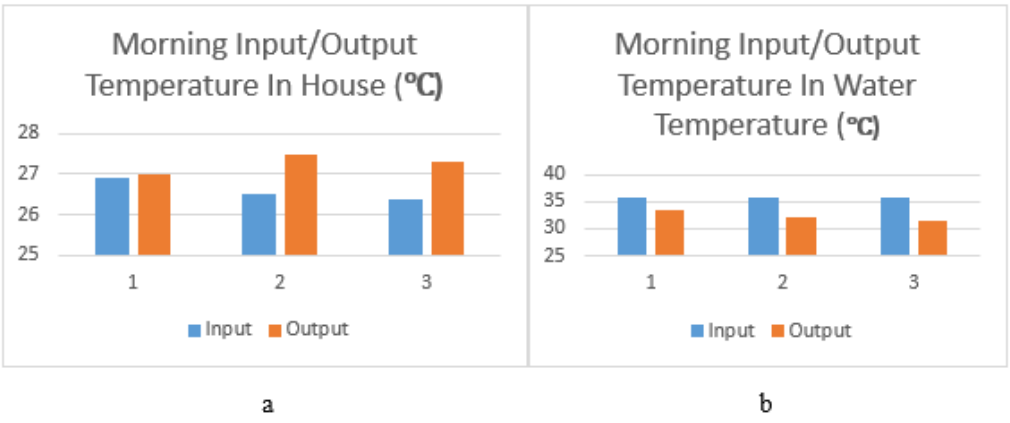

Figure 3: Morning temperature result; house (a) and water temperature (b)

3.3.2: Afternoon

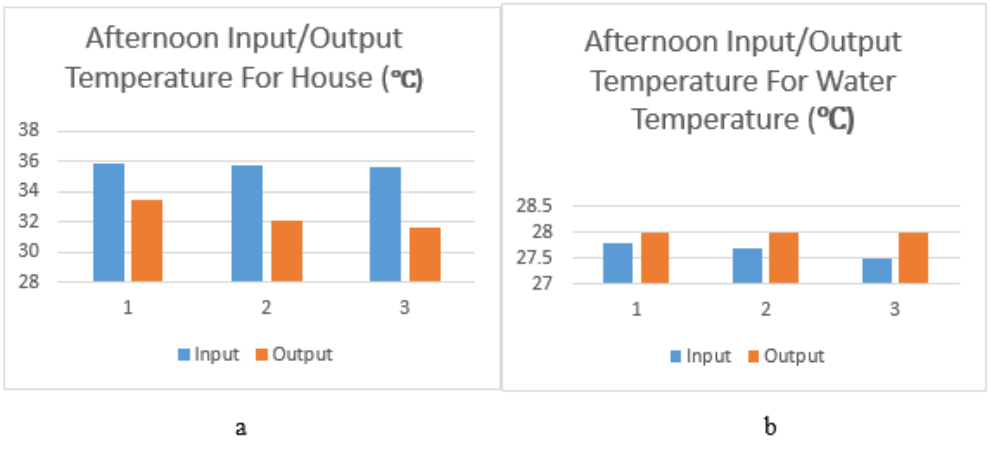

Figure 4: Afternoon temperature result; house (a) and water temperature (b)

3.3.3 Evening

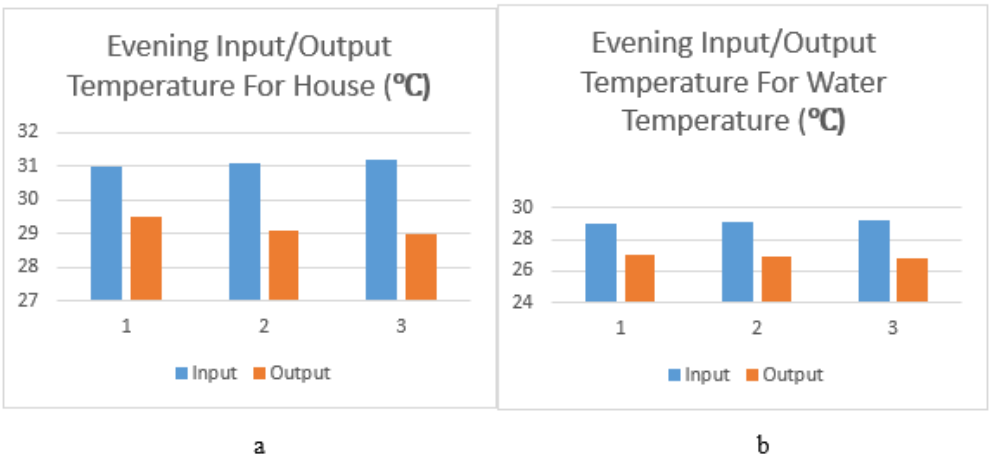

Figure 5: Evening temperature result; house (a) and water temperature (b)

3.3.4: Night

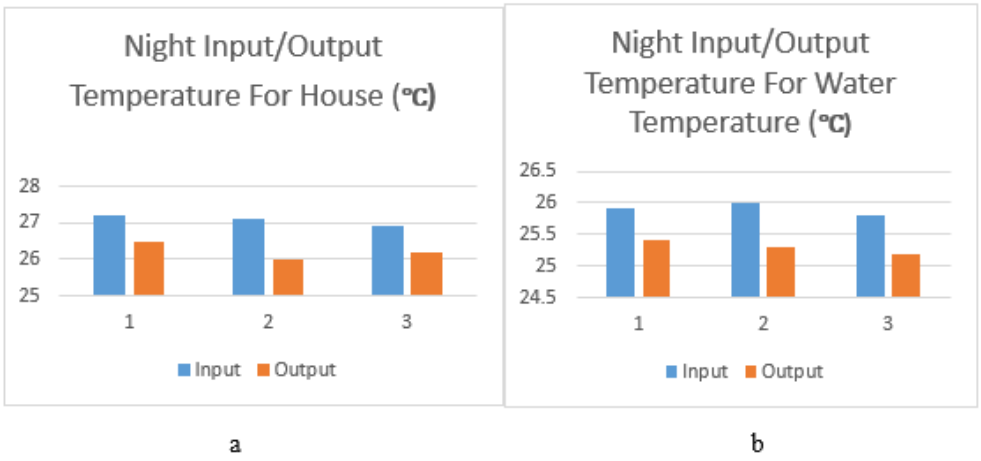

Figure 6: Evening temperature result; house (a) and water temperature (b)

4.3: Discussion

From the results that is obtained in this experiment, the water temperature in the house is quite high in the morning where the average temperature is 29.0℃. This is due to the light sunlight during the daytime. The water shows the highest temperature reading in the afternoon because the the sun is at its highest point at approximately noon. The sun's highest point is when it gives the Earth the most direct sunlight, also called solar noon. The sun's radiation is the strongest at this point. So, the average temperature of the house in the afternoon is 35.7℃.

As for evening, the temperature slightly decreases because the radiation of the sunlight decreases which only show an average temperature of 31.1℃. Lastly, the water temperature is low during the night because there is no sunlight during the nigh time and the surrounding is slightly cooler. This can be shown by the average temperature that is measured which is 27.1℃. In short, when the input temperature increases, the ratio of output temperature also increases when it is tested after 15 minutes. In order to calculate the pressure of water, the formula of water pressure is used which is $p = \rho gh$ where p is pressure, ρ for density of water which is 100, g for gravitational field strength which is fixed that is 9.81 and h for depth of water.

From the calculation that is derived, we can get to know that the pressure of water is 2.9 kilopascal. Besides that, from the results that is taken we can get to know whether the cooling system is effective or not. The changes that occurs in the water temperature can be shown in the form of graph from the results taken. The house is set up using different types of materials that has its own function and characteristics. The materials are wood, zinc roof, thermal sensor, PVC connectors, PVC pipe, plywood, submersible pump and water storage pot. The conceptual design of the house is covered with black colour sheet as it is a good absorber of heat. Black colour is always known fot the best heat absorption.

Zinc roof is used as the top layer to cover the house as zinc is a good reflector of heat radiation and can last longer. Zinc has a higher durability, resistant to corrosion, self-healing and also has lower maintenance cost. So, zinc is the best material that can be used to build up this house. Plywood is long, robust and stronger to build this conceptual design. Submersible pump is fixed to pump water in a building from a basement. PVC pipes and PVC connectors are made up of metal piping which can be obtained with a low cost, high strength, and can be fixed easily.

4.1: Conclusion

According to modern technology, the design of the approach provided in this study is adequate. The temperature of the conceptual design house was kept at a comfortable level by using simple water and a well-designed cooling system. Despite the fact that the experiment was conducted in a small ratio in open space, it yielded a satisfactory result in terms of temperature to cool down the conceptual design. The bar chart clearly depicts the temperature difference between the input and output. As a result, the conceptual design for the natural cooling system using well water has been effectively designed, indicating that the study's goal has been met. Because of its simple and effective design, this cooling system can be used anywhere. Furthermore, because the water is recycled throughout the system, it is safe and prevents water waste. Most importantly, the system is simple to install and maintain, as well as providing long-term internal comfort for the residents. There are a few suggestions for this project's future work. First and foremost, the system can be improved by adding a solar panel, which delivers significant savings on monthly expenses and also prevents energy waste. Aside from that, the system can be improved by connecting the switch wirelessly to a master control panel, which allows the switch to be monitored and operated from one location. Finally, when the house's appropriate temperature is reached, an automatic power cancellation on the submersible pump is applied.

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