DEVELOPMENT OF AN AIRCONDITIONING SYSTEM WITH INTEGRATED WATER DISPENSER

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Abstract: **The purpose of this study is to design and develop an air conditioning system with and integrated water dispenser. With this study, by combining these two distinct pieces of equipment, there can be a noticeable amount of energy savings compared to the total energy consumption of an air conditioner and a water dispenser. The researchers made a prototype of this device that is able to produce cold and hot drinking water as in a water dispenser at the same time blowing cool air that is regulated by a thermostat as in an air conditioning system. The researchers used the fundamental knowledge of heat transfer in coming up with the design. In the data gathered during testing phase, the researchers are able to reach the temperatures that conventional water dispensers have after a certain amount of time, while being able to decrease electrical energy consumption. Hence, it can be concluded that this study is beneficial to the people that are in hot and humid areas like the Philippines**

Keywords: **air conditioner, water dispenser, heat transfer.**

I. INTRODUCTION

Air conditioning is the process of controlling temperature, humidity, purity, and motion of air in an enclosed area, independent of outside conditions. It gives us humans a means to control the air that is in our environment. Air conditioners are one of the many devices that gives us convenience of changing ambient temperatures and achieve comfort in commercial and industrial buildings, even in our own homes.In the Philippines, air conditioners are in demand given that we are in a tropical and humid country.

With air- conditioners, water dispenser are also used to provide us with the convenience of choosing preferable drinking water temperature for our everyday lives

II. LITERATURE REVIEW

The vapor compression-refrigeration cycle resembles a reverse Rankine cycle. Use is made of the phase-change characteristics of the working fluid, the refrigerant, to exchange large quantities of heat. Refrigeration cycles, on which refrigerators, air conditioners, freezers, and heat pumps operate, consist of the following four components. A **Compressor** is used to raise the pressure of the refrigerant. The compressor is usually powered by an electric motor that provides the input power that drives the refrigeration system. A **Condenser**, a heat exchanger that removes heat from the refrigerant, transfers heat from the refrigerant to the outside environment, usually as a refrigerant-to-air heat exchanger. In a home central air-conditioning system, this is the large unit that sits outside the house. A **Throttle** is then used to suddenly reduce the pressure and temperature of the refrigerant, making it very cold. This is usually a fixed throttle, through an adjustable throttling valve can be used. Finally, the cycle is completed with an **Evaporator**, another heat exchanger that transfers heat from the volume being cooled to the refrigerant. In a refrigerator or freezer, this heat exchanger would be built into the inside wall to transfer heat from the interior.

III. METHODOLOGY

This chapter presents the required gathering of relevant data to be used by the researcher and a comprehensive understanding of the development of this study. The research methodology requires the air condition integrated with water cooler and water heater.

The following materials were used in constructing the design.

1. *Air-condition Unit*-is a system or a machine that treats air in a defined, usually enclosed area via a refrigeration cycle in which warm air is removed and replaced with cooler air. In construction, a complete system of heating, ventilation, and air conditioning is referred to as HVAC.

2. *Water Reservoir* – is a container for storing water

3. *Water pipes*-a pipe or conveying water

4. *Metal frames*- to support the system

5. *Faucet*- is a device by which a flow of liquid or gas from pipe or container can be controlled

6. *Water Filter*- removes impurities by lowering contamination of water using physical barrier, a chemical process or a biological process.

7. *Heating coil*- it converts electrical energy to heat energy by the process of joule heating

Project Construction Procedure

- *Project Designing*- starts with an idea to design an air condition integrated with water cooler and water heater that can produce hot and cold water.
- *Selection of Materials and Components*- The selection of materials and components happen in this section where the proper materials and components are being selected.
- *Purchasing of Materials and Components*- The purchasing of the selected material and components are being done
- *Fabrication*- This is when the material and the components are being constructed.
- *Adjustment and Finalizing of the Structure*- Some problems in fabrication are being corrected
- *Installations of additional Parts of the Project Improvement*- Additional parts of the machine are installed for the project improvement.
- *End*

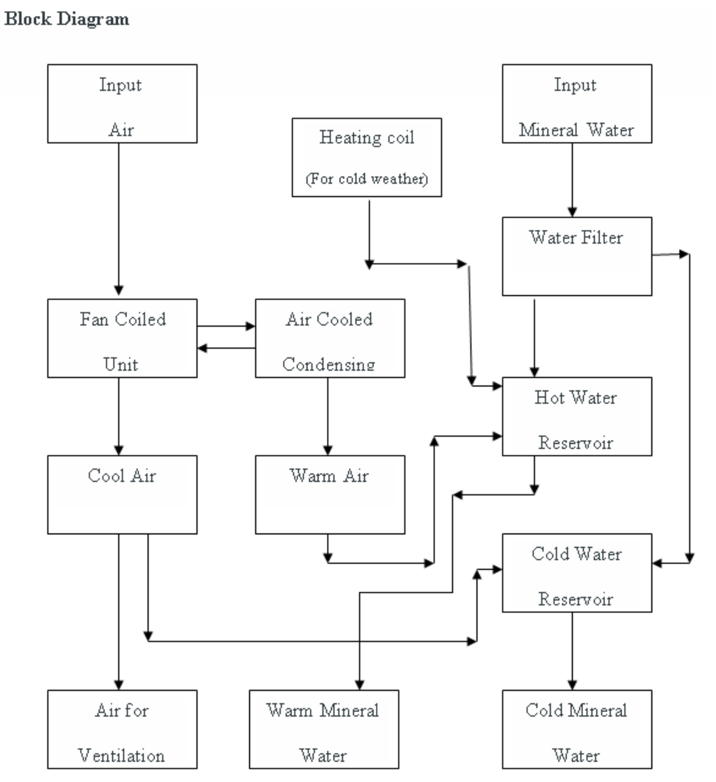


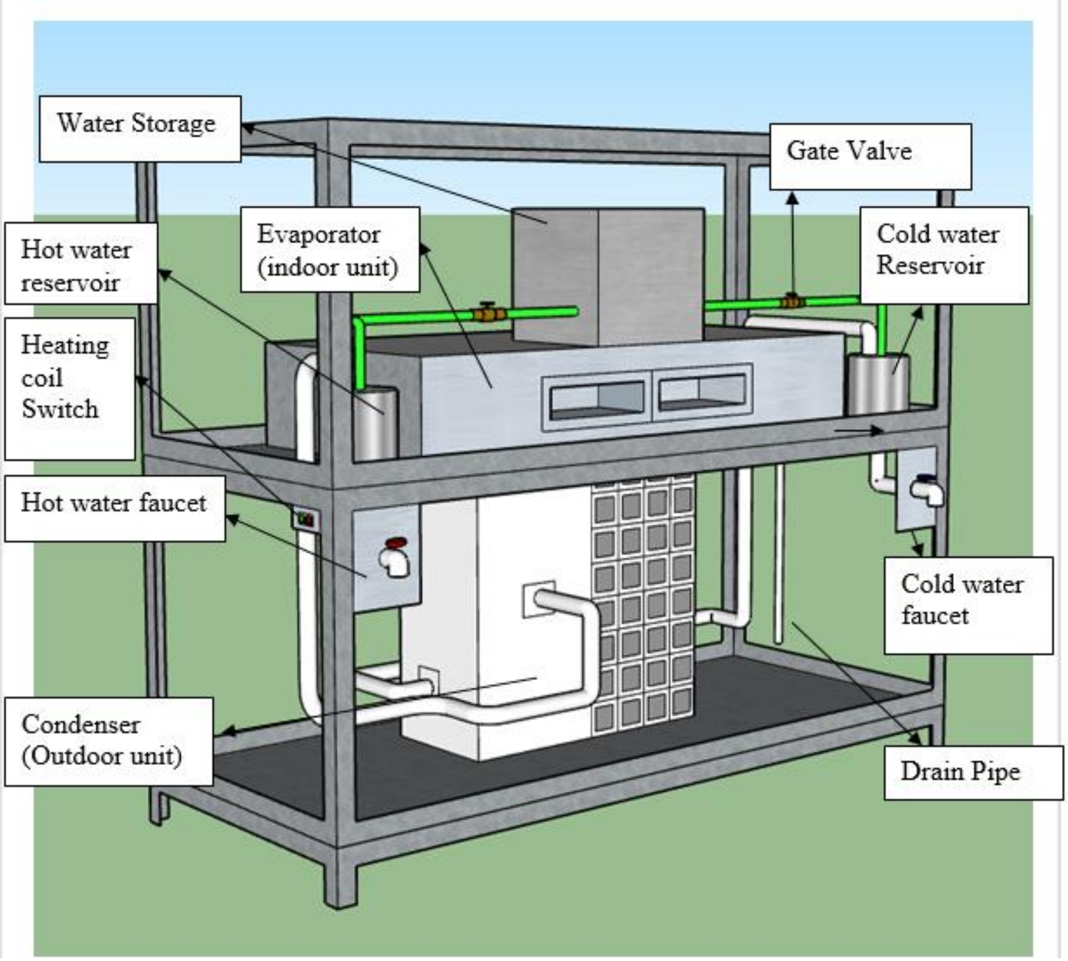
Figure 1: Block Diagram

IV. ANALYSIS AND PRESENTATION OF DATA

A. Table 4.1 Temperature obtain after a given time

Trial 1				
Time	*30 mins*	*45 mins*	*60 mins*	*75 mins*
Hot water Temp.	*51°C*	*60°C*	*71°C*	*83°C*
Cold water temp	*4°C*	*2°C*	*2°C*	*2°C*
Trial 2				
Time	*30 mins*	*45 mins*	*60 mins*	*75 mins*
Hot water Temp.	*45°C*	*54°C*	*67°C*	*79°C*
Cold water temp	*9°C*	*6°C*	*6°C*	*4°C*
Trial 3				
Time	*30 mins*	*45 mins*	*60 mins*	*75 mins*
Hot water Temp.	*49°C*	*61°C*	*70°C*	*79°C*
Cold water temp	*5°C*	*4°C*	*2°C*	*2°C*
Trial 4				
Time	*30 mins*	*45 mins*	*60 mins*	*75 mins*
Hot water Temp.	*55°C*	*66°C*	*75°C*	*84°C*
Cold water temp	*6°C*	*6°C*	*4°C*	*4°C*
Trial 5				
Time	*30 mins*	*45 mins*	*60 mins*	*75 mins*
Hot water Temp.	*50°C*	*63°C*	*71°C*	*80°C*
Cold water temp	*5°C*	*5°C*	*4°C*	*3°C*

B. Research Design Presentation



C. . Energy consumption comparison

Using the formula for energy consumption

$$E = P \times T \qquad \text{(Eqn. 1)}$$

The energy consumed in Kilowatt-Hours per day is equal to the power P in Watts multiplied by the number of usage Hours per day T divided by 1000 Watts per Kilowatt.

$$1 \text{ Horsepower} = 0.7457 \text{ Kilowatts} \qquad \text{(Eqn. 2)}$$

Power ratings are commonly indicated in horsepower so it must be converted to Kilowatts to be able to come up with Kilowatt – Hours based on eqn. 1

D. Energy consumption comparison

Units	AC system	Water Dispenser	AC and Water Dispenser (Total)	AC with Water dispenser (Thesis)
Rated power	1.865 KW	.650 KW	2.515 KW	2.165 KW
8hrs usage	14.92 KW	5.2 KW	20.12 KW	17.32 KW
24hrs usage	44.76 KW	15.6 KW	60.36 KW	51.96 KW
7 day usage	313.32 KW	109.2 KW	422.52 KW	363.72 KW
1 month usage	1253.28 KW	436.8 KW	1690.08 KW	1454.88 KW

V. CONCLUSION

From several test conducted the water temperature can be raised in the range of 50 to 80 degree Celsius. The water gets heated from condenser unit cycle with help of heating coil if the condenser cannot produce enough heat due to the coldness of the weather. The temperature of the cold water can be reducing up from 9 to 2 degree Celsius. The water gets colder from the evaporator that is coiled around from the water reservoir. The energy consumption of the system is much lower than conventional air-conditioners and water dispenser that's why it is more economical. This principle can be used for household and office purposes and others that uses air-condition.

Based on the energy comparison, even with an added heating coil to hasten the heating process for the hot water, the prototype has lower energy consumption than the individual energy consumption of the air-conditioning system and the water dispenser

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BIOGRAPHY

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