

AUTOMATIC DISTILLATION OF SALT GROUND WATER BECOME FEATURED FOR CONSUMPTION

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Abstract: Salty groundwater is water that comes from the ground, has a high salt content and is unfit for consumption. The problem faced by the community is the difficulty of obtaining clean water which makes people buy clean water for their daily needs such as drinking, bathing, washing and so on. The community processing salty groundwater so that it can be drunk is still not efficient, because it is still done manually by cooking the salty groundwater using a pot and stove to produce water vapor, then it is collected using a glass or other container. The purpose of this research is to produce an automatic distillation device using an electric water heater to be able to detect water temperature, salt content, and water level with rocks using the Arduino Uno Microcontroller. The method used in this study uses data collection and system development (prototype) methods. The results of the research resulted in an automatic distillation device that can separate the salt content in salty groundwater so that the water is suitable for consumption and also produces salt that can be used by the community for household needs.

Keywords: distillation apparatus; microcontroller; prototype; salty groundwater

Abstrak: Air tanah asin merupakan air yang berasal dari dalam tanah, memiliki kadar garam yang tinggi dan tidak layak untuk dikonsumsi. Masalah yang dihadapi masyarakat adalah kesulitan akan air bersih membuat masyarakat membeli air bersih untuk kebutuhan sehari-hari seperti minum, mandi, mencuci dan lain sebagainya. Masyarakat mengolah air tanah asin agar dapat diminum masih belum efisien, karena masih dilakukan secara manual dengan memasak air tanah asin menggunakan panci dan kompor untuk menghasilkan uapan air, kemudian ditampung menggunakan gelas atau wadah lainnya. Tujuan penelitian ini menghasilkan suatu alat destilasi otomatis menggunakan pemanas air listrik untuk dapat mendeteksi suhu air, kadar garam, dan level ketinggian air dengan batuan menggunakan Mikrokontroler Arduino Uno. Metode yang digunakan dalam penelitian ini menggunakan metode pengumpulan data dan pengembangan sistem (*prototype*). Hasil penelitian menghasilkan suatu alat destilasi otomatis yang dapat memisahkan kadar garam pada air tanah asin sehingga air tersebut layak dikonsumsi dan juga menghasilkan garam yang dapat dimanfaatkan masyarakat untuk keperluan dalam rumah tangga.

Kata kunci: air tanah asin; alat destilasi; mikrokontroler; prototype

INTRODUCTION

Salty groundwater is water that comes from the ground, has a high salt content caused by certain factors and is not suitable for consumption [1]. This salty groundwater source is found in many areas of North Padang Lawas Regency, especially in Padang Garugur Village, Suka Dame Hamlet, even though the area is very far from sea level and is a phenomenal event that rarely occurs. This causes the surrounding community to have difficulty with clean water, so they have to buy clean water for their daily needs such as drinking, bathing, washing and so on [2][3].

The people of suka dame village process salty groundwater so that it can be drunk manually by cooking salty groundwater using a pot and stove to produce water vapor, then collected using a glass or other container. The process carried out by the community is still inefficient because the results of evaporated water cannot be guaranteed to be healthy and suitable for consumption, due to the absence of measurements of the levels and substances contained in the water, so it is very dangerous for the community when consuming unclean water and can cause transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio when entering the human body [4].

The approach in solving problems in the community is carried out an innovation that can produce an automatic distillation or filtering device that can separate the salt content of salty groundwater so that the water is suitable for consumption and also produce salt that can be utilized by the community for household needs. This distillation tool can detect water temperature, salt content, and water level produced by the distillation process

with the help of Arduino Uno Microcontroller, electrode sensor, ultrasonic sensor and ds18b20 sensor equipped with a buzzer alarm as an indicator of water temperature, the buzzer alarm will work when the water temperature exceeds 38°C and all the results of the distillation process using Arduino Uno will be displayed on the LCD.

Distillation or distillation is a method of separating chemicals based on differences in the speed or ease of evaporation of materials or fresh water by changing the phase of water [5]. In distillation, the mixture of substances is brought to a boil so that it evaporates, then the vapor is cooled back into a liquid, in the distillation process substances that have a lower boiling point will evaporate first, therefore to get clean water from salty groundwater that can be consumed requires a process that separates the salt and water.

After analyzing these problems, an automatic distillation device using an electric water heater was designed to detect water temperature, salt content, and water level produced by the distillation process with the help of an Arduino Uno microcontroller, electrode sensor, ultrasonic sensor and LM35 sensor equipped with a buzzer alarm as an indicator of water temperature. Microcontroller is a computer system that most of the elements are packaged in the form of IC chips (Integrated Circuits), in the microcontroller there is also memory, processor (program memory, a small amount of RAM, or both), as well as input and output equipment [6] [7].

Arduino is a single-board microcontroller that is open-source. Arduino is designed in such a way as to make it easier for users. The programming language used is C / C ++, in an arduino microcontroller can be

embedded various libraries and methods as long as the memory capacity is sufficient [8] [9].

The specific purpose of this research is to produce a tool design that utilizes the Arduino Uno Microcontroller to help the community in the process of distilling salty groundwater into clean water that is suitable for consumption by controlling and controlling automatically using electrode sensors, ultrasonic sensors and ds18b20 sensors equipped with a buzzer alarm that will work when the water temperature exceeds 38° C and then all the results of the distillation process using Arduino Uno will be displayed on the LCD.

Beberapa penelitian juga dilakukan dengan mengembangkan menggunakan penyulingan dan Mikrokontroler [10][11]. Pada penelitian lainnya juga menambahkan teknologi reflektor cahaya matahari dengan cermin datar pada proses destilasi atau penyaringan [12]. Dalam penelitian lain yaitu tentang sistem pengontrolan pompa otomatis pada sistem destilasi air laut dengan bantuan mikrokontroler dapat mempermudah dalam pengontrolan penampungan air laut yang akan dilakukan proses destilasi [13]. Dari beberapa permasalahan diatas, maka dikembangkanlah alat destilasi otomatis menggunakan pemanas air listrik untuk dapat mendeteksi suhu air, kadar garam, dan level ketinggian air yang dihasilkan proses destilasi dengan menggunakan Mikrokontroler Arduino Uno.

METODE

The framework of this research can be seen in Image 1.

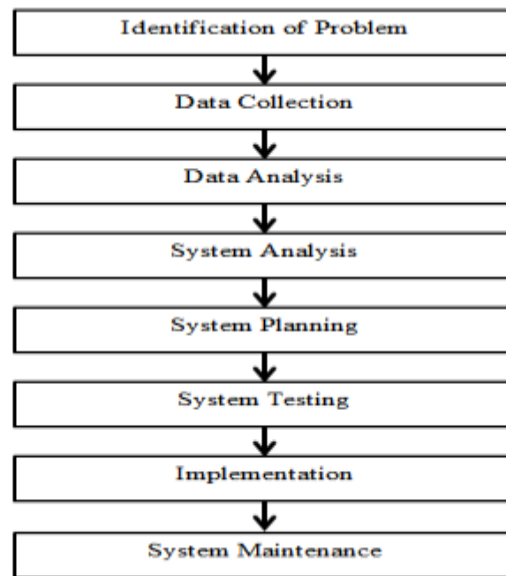


Image 1. Research Frameworks

Identification of Problem

The identification of the problem under study must be determined in advance because the problem identification stage begins by studying several things related to the distillation or filtration of salty groundwater into water suitable for consumption is still inefficient, because it is still done manually by cooking salty groundwater using a pot and stove to produce water vapor, then accommodated using a glass or other container, the results of evaporated water cannot be ascertained as healthy and suitable for consumption, due to the absence of measuring the levels and substances contained in the water, so it is very dangerous for the community when consuming unclean water and can cause transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio when entering the human body.

Data Collection

Data collection is carried out in order to obtain accurate information so that the objectives of the research can be achieved. Data collection by conducting

interviews with sources who are experts in their fields. In addition, literature studies to strengthen the information and data that has been collected through literature / journals related to this research.

Data Analysis

After the data is collected, then the data that has been collected is analyzed. This aims to group the data so that it will make it easier for the author to do the next analysis.

System Analysis

This system analysis stage aims to study and understand the materials used as a prerequisite for the next stage, namely system design, so that the expected goals can be achieved

System Planning

At this stage, it will be discussed about the design of the system model by determining the input-output design that will be used in automatic control of the salty groundwater distillation device so that it is suitable for consumption.

System Testing

The designed system and software are completed, it is necessary to test whether it can run as planned and in accordance with the objectives of the research. In addition, to test whether there are still problems with the application and product designed and then correct any errors in the application.

Implementation

After the testing stage is completely finished, it will continue at the next stage, namely system implementation. The application of this system will make it easier for people to carry out the distillation process by not doing it manually anymore in order to get clean water that is suitable for consumption.

System Maintenance

System maintenance is a stage for maintaining a system, whether the system that has been made is in accordance with existing provisions and expected desires and the extent to which the system can be applied.

Main Research Tools

In this research, there are several main tools in designing an automatic distillation device for salty groundwater. Some of the main tools used to build a salty groundwater distillation system to be able to determine the output of the system are Image 2:



Image 2. Arduino Uno

The Arduino Uno function is something that can facilitate electronic control in all fields or can make devices more sophisticated based on microcontrollers.



Image 3. pH sensors

The pH sensor functions to detect the pH of water or to determine the degree of acidity of salty groundwater before and after the distillation process.



Image 4. DS18B20 sensor

The DS18B20 sensor has the function of detecting water temperature, and then sending a signal to the micro-controller to take the necessary action.

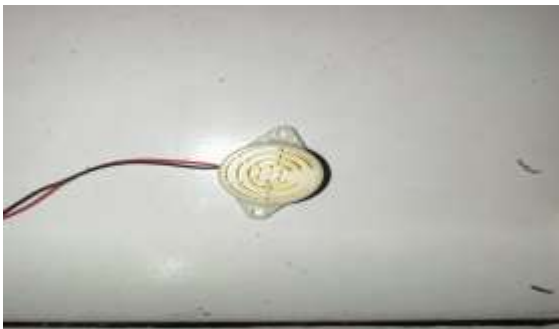


Image 5. Buzzer

A buzzer is a device that is used as a sound warning to mark the distance on the buzzer.



Image 6. Ultrasonic Sensor

Ultrasonic sensors function to convert

physical quantities (sound) into electrical quantities and vice versa.



Image 7. Relay

The relay functions as a safety lock or is used to control the electric current in electric heaters.



Image 8. Pan

The pan is used to cool evaporation water and also to store water resulting from evaporation or distillation of salty groundwater.



Image 9. Copper Pipe

Copper pipes function as a place for salty groundwater to escape during the evapo-

ration process which is heated using an electric heater.



Image 10. Electric Water Heater

The Electric Water Heater functions to heat salty ground water so that it evaporates through a copper pipe and then releases it into a holding pan.



Image 11. LCD 16X2

The LCD function is to display sensor detection results which are processed using the Arduino Uno microcontroller.

RESULTS AND DISCUSSION

At this analysis stage, an analysis will be carried out based on the results of tests carried out by the researcher, so that the researcher can find out the advantages and disadvantages of the system. After carrying out several tests on the automatic control system on the distillation apparatus, it can be concluded that the system designed can function well as expected by the author in the research. This research can produce a prototype of an au-

tomatic distillation device that can separate the salt content in salty groundwater so that the water is suitable for consumption and also produces salt that can be used by the community for household purposes.

Tool Prototype

The completed Tool Prototype circuit can be seen in Image 12 below.



Image 12. Tool & Arduino circuit

Image 12 above is a picture of an automatic distillation tool for salty groundwater to be suitable for consumption that has been assembled and is ready for the testing stage.

Software Implementation

The software that can be used to implement this system can be seen in Image 13 below.



Image 13. Arduino IDE Program Coding

In Image 13 above is the Arduino IDE Program Cod-ingan for the distillation tool process, as for the results of the cod-

ing displayed through the Arduino LCD can be seen in Image 14 below.



Image 14. Display of Salty Groundwater PH Value Before testing

In Image 14 above, is a display of the PH value of salty groundwater before testing, as for the initial PH value before the test is 9.61 and the results of the analysis of the salty groundwater system are not suitable for consumption.



Image 15. Display of Salted Groundwater PH Value After testing

In Image 15 above, is a display of the PH value of salty groundwater after testing, as for the PH value after completing the test is 6.12 and the results of the analysis of the salty groundwater system are suitable for consumption.



Image 16. Distillation Test Results

Image 16 above is a display of the results of the process of distillation of salty groundwater into fresh water or worthy of consumption, from a volume of 1 liter of salty groundwater getting the results of volume distillation testing that is 120 ml, as measured by a measuring cup / ml.



Image 17. Salt Result of Distillation process

Image 17 above is the salt produced from the distillation process of salty groundwater, this process can produce fresh water and salt that is good for consumption by the community.

Table 1. Test Table of Distillation Results

No	Salty Ground Water	Time	Results Evaporation	Salt Yield (Gram)	PH Beginning	PH End	Description
1	1Liters	2.21 Hours	120 MI	5.0 Gram	9.61	6,12	Worthy of Consumption
2	1Liters	2.26 Hours	110 MI	5.5 Gram	9.52	6,15	Worthy of Consumption
3	1Liters	2.30 Hours	125 MI	6.0 Gram	9.46	6,10	Worthy of Consumption
4	1Liters	2.30 Hours	120 MI	6.6 Gram	9.49	6,15	Worthy of Consumption
5	1Liters	2.33 Hours	130 MI	6.9 Gram	10.02	6,18	Worthy of Consumption
6	1Liters	3 Hours	160 MI	9.3 Gram	9.52	6,20	Worthy of Consumption
7	1Liters	3 Hours	140 MI	10.7 Gram	9.49	6,10	Worthy of Consumption
8	1Liters	3 Hours	180 MI	8.3 Gram	9.46	6,12	Worthy of Consumption

Table 1 above is the result of testing salty groundwater distillation with a volume of 1 liter of water, in the test carried out 8 times and all the results obtained fresh water and salt that is suitable for consumption by the community.

CONCLUSION

This research aims to produce an automatic distillation device using an electric water heater that is capable of detecting water temperature, salt content and water content resulting from the distillation process with the help of an Arduino Uno microcontroller, electrode sensor, ultrasonic sensor and DS18B20 sensor equipped with a buzzer alarm as an indicator. water temperature and water level. By designing and making this prototype, it can be used as an effective and efficient solution for the community in separating the salt content in salty groundwater so that the water is suitable for consumption and also produces salt

that the community can use for household purposes.

Previous research on this distillation process mostly used seawater as the object and had never been carried out on salty groundwater, so the researchers developed this automatic distillation using salty groundwater, in order to help overcome the problem of the community in Suka Dame hamlet getting water, clean easily without having to buy. Further research can be developed with a larger scope so that all communities can have their clean water needs met and can also develop salt production to improve the economy of local communities.

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