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Monitoring Water Levels in Fresh Water Tank Using The Concept of IoT *(Internet of Think)*

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Abstract

Fresh water generator is one of the most important auxiliary aircraft on ships to produce fresh water. The efficient use of fresh water can extend the life of the fresh water generator and save electricity usage. Efficient use of fresh water can be done by remotely monitoring the level of fresh water in the tank in real time.The system for knowing the water level in real time is built with an ultrasonic sensor to transmit data to the Wemos in the form of height data. Wemos converts freshwater level data into the volume of water in the tank. The volume and water level data is then displayed on the LCD and the Wemos sends data on the volume of fresh water to the internet in the form of a website with a design that is easy to understand (user friendly) and the website can be accessed anywhere. It can be seen that the system can work properly because the highest error reading is only 5%, namely in 4 liters with a tilt position og 20 right . Meanwhile, the biggest difference between sendor readings and real when testing 5 liters with a slope of 30 to the right is 0.23 liters. The best average result occur when testing flat conutions.

***Keywords**:* Wemos , Ultrasonic Sensors, Volume , LCD

1. Introduction

The area of the oceans compared to the land area in the world reaches approximately 70 to 30, so it becomes a challenge for countries in the world that have marine interests to advance their maritime affairs. Along with the development of the strategic environment, the role of the sea becomes significant and dominant in delivering the progress of a country. The use of fresh water on boats is needed for accommodation facilities such as bathing, washing, latrines, cooking and so on. In addition, fresh water also functions as a coolant on the ship. Sometimes the need for fresh water runs out before a vessel is sailing and the solution to it is to install the tool changer sea water into fresh water, and one such tool named fres h water generator .

Fresh water generator is one of the most important auxiliary aircraft aboard ships. This is because using FWG (Fresh water generator) can produce fresh water. Therefore, the importance of awareness of the efficient use of fresh water, this efficiency can be done by means of monitoring the condition of water availability in the fresh water tank . Knowing the water level in the tank is expected to play a significant role in efforts to conserve fresh water. In this era, efficiency is considered a very important specter. Therefore, we need a tool that can monitor the water level in a freshwater tank remotely.

Of course, this monitoring is carried out automatically by sensors which will then be sent to the internet so that it can be accessed anytime and anywhere.

2. Research Method

Iqbal Istiqobudi, Yama Fresdian Dwi Saputro, Amin Suharjono, Sidiq Syamsul Hidayat, Abu Hasan in their research conducted monitoring of wireless height and humidity sensors using a wifi shield [9]. YMV Galih Purwito Adi in his research conducted monitoring of 4 channel LM35 temperature sensors using Arduino Uno by sending data via Ethernet Shield [10] . Marti Widya Sari, Efendi Susilo conducted research in the form of internet-based remote light monitoring [11] . In this study using Wemos as a controller to detect the water level in the freshwater tank.

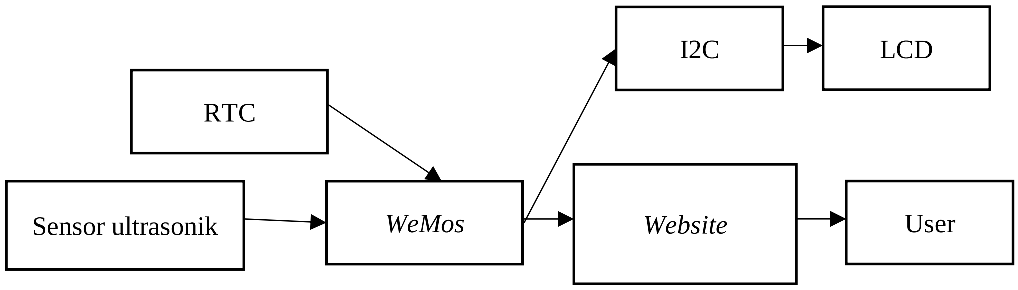

Figure 1. Block Diagram

The way the system works is that the ultrasonic sensor will read the water level in the fresh water tank and ensure continuous water availability by means of a reflection from water waves. The data from (RTC) ultrasonic sensor which is still analog is converted by Arduino Uno first to digital via ADC. Data that has been digital is processed in the Arduino Uno so that it becomes water level data in meters. This data will be sent continuously to the user's computer via WeMos ESP8266 (ESP-12E Module) . Because in this study WeMos is used as a web server, so when accessing an IP address, WeMos will take data from the sensor and send it to the web to be displayed in the browser. In addition, the data will be displayed on the LCD contained in the fresh water tank. In addition, the system is given I2C which functions to add ports to the microcontroller.

The test design in this study is to implement it in a miniature freshwater tank in the shape of a block with a length of 30 cm, a width of 20 cm and a height of 25 cm. Above the miniature tank, an ultrasonic sensor and WeMos ESP8266 are installed to monitor the height of the water tank in real time and in real time as shown in the Figure 2.

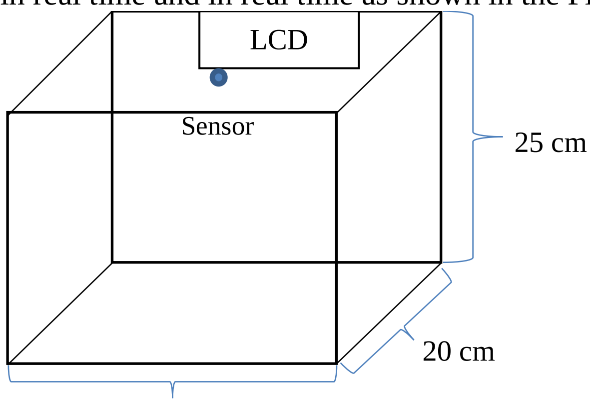

Figure 2. Miniature Fresh Water Tank

3. Results and Analysis

Tool testing in the research was carried out several tests, namely hardware testing, WeMos D1 testing, RTC testing, I2C testing , HC-SR04 Ultrasonic Sensor Testing, and overall system testing.This hardware test is carried out to ensure all hardware is working properly so that the results that are read on the website are not wrong.

3.1. Tools testing

At the initial test is WeMos D1 testing, Wemos D1 performed two different types of testing for Wemos D1 in this research has two different functions, namely as a controller and as the sender of data to the internet. Testing WeMos as a Controller, testing WeMos D1 as a controller is done by making a simple program, namely the lamp flip-flop program on Pins D 6 and D 7 with an interval of 500 ms. Tests are carried out using Pins D 6 and D 7 only to represent the testing Pins on WeMos D1 can work properly . The results of the test can be seen in Figure 3.

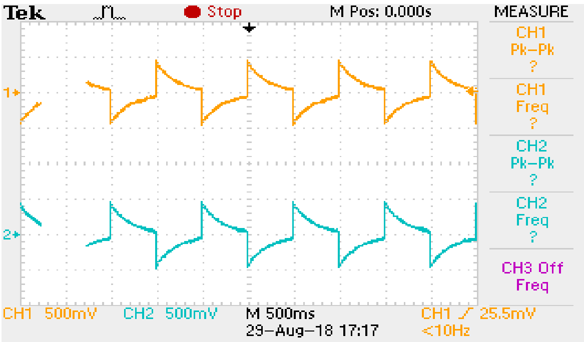

Figure 3. WeMos D1 Testing Results as a Controller

From the test results, it can be seen that WeMos D1 can work well, namely Pin D6 and D7 on WeMos D1 can output an output signal alternately as seen on the oscilloscope with an interval of 500ms .

For WeMos D1 testing as sender of data to the internet by creating a program on WeMos D1 so that it can send data to the website via wifi . The data that will be displayed on the website is the date, time and height of the tank. The website used is https://soundingwater.000webhostapp.com/ultrasonikwater/html. The test results can be seen in Figure 4

Rata Rata Perbulan

No	Tahun	Bulan	Volume Rata"	Pemakaian
1	2019	10	2291.3 L	708.64 L
1	2019	11	881.40 L	2118.5 L

Rata Rata Mingguan

No	Minggu	Volume rata"	Pemakaian Rata"
1	Minggu pertama	2300	700
2	Minggu Kedua	2106.9	893.03
3	Minggu Ketiga	464.89	3000

Figure 4. WeMos D1 Testing Result as a Data

From the test results shown that Wemos D1 can function well is the website https://soundingwater.000webhostapp.com/ultrasonikwater/html . can display data sent from WeMos D1.

For RTC testing with creating a program on the WeMos D1 microcontroller in order to display the data received from the RTC serially to the computer. RTC functions to issue time data in the form of days, dates and hours . The test results can be seen in Figure 5 .

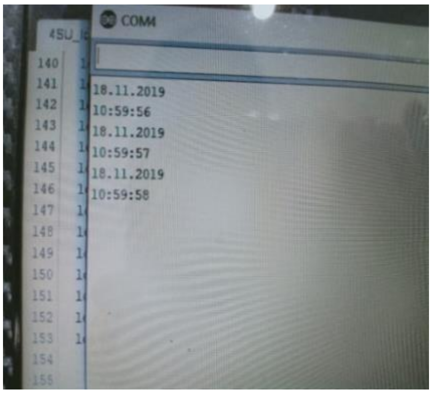

Figure 5 RTC Test Result

From the test results, it can be seen that the RTC can function properly, namely the RTC can output time data that can be read by the microcontroller which is then displayed on the computer.

For I2C testing with making a program on the WeMos D1 microcontroller so that it can display TESTING writing on the first line on the LCD and writing I2C LCD on the second line on the LCD via I2C. The test results can be seen in Figure 6.

Figure 6 I2C Test Results

From the test results, it can be seen that I2C can function properly, namely I2C can send data from the WeMos D1 microcontroller to the LCD, this is evidenced by the LCD can display the text according to the WeMos D1 microcontroller program, namely the LCD OK !! on the first line on the LCD .

Testing the HC-SR04 sensor with creating a program in WeMos D1. The program generates data from the HC-SR04 sensor which is still digital data to be displayed on a computer. The results of reading the data are as shown in Figure 7

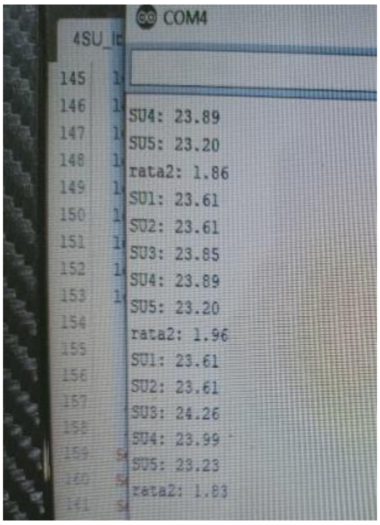

Figure 7 HC-SR04 Test Results

From the test results, it can be seen that the computer can display the data released by the DHT22 sensor. The data is in the form of data for the three dimensions in cm.

For the overall system testing is a test that is carried out using all the hardware and software equipment used such as WeMos D1, RTC, HC-SR04 ultrasonic sensor, I2C LCD, and website . This test ensures that the HC-SR04 sensor data can be sent to WeMos D1 which can then be displayed on the LCD via I2C and data from the DHT sensor can also be sent to the internet so that it can be displayed on the website https://soundingwater.000webhostapp.com/ ultrasonicwater / html . In addition to data from the HC-SR04 sensor in the form of height in the tank, the website also displays data in the form of time, namely the date and time sent by the RTC. The results of the overall system testing can be seen in Figure 8.

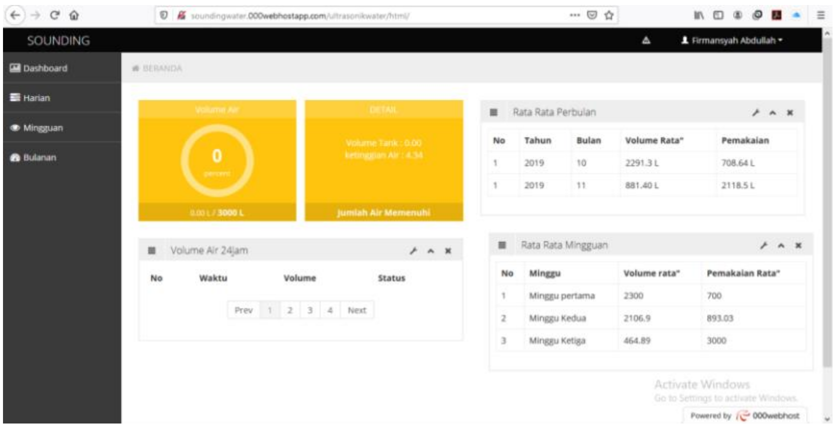

Figure 8 Overall System Test Results

After testing the overall system, it can be seen that the system can work properly, namely the website can display data from sensors.

3.2. Analysis

Readings from sensors with several flat positions, 20 right tilt, 20 left tilt, 30 right tilt, and 30 left tilt with a volume of 1 liter to 7 liter can be seen in Table 1.

Table 1. Result Of Research

No	Real Volume (L)	flat	Error	20^0 Right	Error	30^0 Right	Error	20^0 Left	Error	30^0 Left	Error
1	1.00	1.02	2.00%	0.81	19.00%	0.77	23.00%	0.81	19.00%	0.78	22.00%
2	2.00	2.03	1.50%	2.19	9.50%	2.23	11.50%	2.29	14.50%	1.72	14.00%
3	3.00	3.02	0.67%	3.14	4.67%	3.00	0.00%	3.12	4.00%	3.02	0.67%
4	4.00	4.01	0.25%	4.20	5.00%	4.13	3.25%	4.13	3.25%	4.01	0.25%
5	5.00	5.02	0.40%	5.22	4.40%	5.23	4.60%	5.12	2.40%	4.95	1.00%
6	6.00	6.05	0.83%	6.22	3.67%	6.09	1.50%	6.01	0.17%	6.09	1.50%
7	7.00	7.04	0.57%	7.05	0.71%	7.08	1.14%	7.06	0.86%	7.11	1.57%

in Table1, it can be seen that a large error occurs when 1 liter and 2 liters are tilted at the water position. This happens because the water passes half the length of the tank causing the sensor to read the bottom of the tank. Based on this the analysis on 1 liter and 2 liters is ignored. Data analysis was taken in 3 to 7 liter conditions with a flat position, 20^0 right slope, 30^0 right slope, 20^0 left slope, and 30^0 left slope.

Analysis of the data based on the resulting error percentage shows that, the largest percentage error data occurs in 4 liters of 200 to the right with a percentage of 5.00% and the smallest error is at 3 liters of 300 to the right with a percentage error of 0%. For the average, the smallest error percentage in flat conditions is 0.54%, while the largest average error percentage is on the 200 to the right slope, which is 3.69%.

Analysis based on the difference in volume between the sensor readings and the real one shows that the largest difference occurs at 5 liters with a slope of 300 to the right, namely 0.23 liters and the smallest difference occurs at 3 liters with a slope of 300 to the right, which is 0 liters. For the smallest average difference between real and sensor

readings when water is in a flat condition, it is 0.03 liters and the largest average water level at a slope of 200 to the right is 0.17 liters.

Based on these two analyzes, it can be seen that the system can work properly when the condition is 3 liters to 7 liters because the resulting error does not exceed 5%, and there is an error of only 0%. The difference for each liter tested with a sensor reading does not exceed 0.17 liter. And for best reading results when water conditions are flat.

4. Conclusion

Based on the analysis and test results it can be concluded that the system can work well as water level monitoring because when the condition is 3 liters to 7 liters, the resulting error does not exceed 5% and users can monitor water level remotely while connected to the internet because the system can send readings from the sensor to the website https://soundingwater.000webhostapp.com/ultrasonikwater/html

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