MICROCONTROLLER FOR MONITORING PH WATER AND WATER TANK ON TIRTA DAHAGA COMPANY BASED ON WEBSITE

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ABSTRACT

Tirta Dahaga is a company that runs the business on distribution of water from water spring which located in Soreang, Bandung. The owner of Tirta Dahaga does not stay in the office everyday because of the owner's house is located quite far about 10 kilometers. Based on an interview, the company has not had a water and pH gauges, so that to see water sales, the company's owner has to come directly to the place. Due to the time and place that quite far, so the owner cannot monitor the selling activities everyday, because there was not water gauge, the owner could not know the exact amount of water that had been sold. The employee sometimes forget to record how much water had been sold. Moreover there was still another problem, it was about the standard of the water pH that will be sold to consumers or other distributors had not been met the requirement of neutral pH because of the company had not have the system and the device to measure the pH.

To solve these problems, will be designed a pH water and filling water tanks monitoring system based on website by utilizing a microcontroller. The system will be able to present data and information relating to the amount of water debit and water pH that comes out. So the company's owner does not necessarily come to the office to monitor the activities that goes on the company.

Based on a Blackbox researched and beta testing that has been done, so can be concluded that functionally the whole process of pH water and filling water tanks monitoring system at Tirta Dahaga company based on website has been as expected and can help the owner of the company on monitoring activities that goes on the company without necessarily come to the office.

Keywords: *microcontroller, monitoring,* water companies.

1. PRELIMINARY

Tirta Thirst is a company engaged in the sale of water located in the district Soreang Bandung, Tirta Thirst has two kinds of business in the field of water namely drinking water refill depot and the mountain springs. Companies in the field of mountain springs have three (3) employees on duty to fill the water tank and fix something if there are problems such as paralon damaged or clogged water. Thirst Tirta company owners do not live every day in a water source because of his considerable which is about 10 km. Based on interviews with mothers Integration Wiwin as owners, that the company has not had a water discharge gauges and gauge the pH of the water.

To view the sale of the water company owners have to come directly to the place. Due to the time and place that is pretty much the owner of the company can not be every day watching for activity on company premises, Because of the lack of water meter, the owner of the company does not really know the water sold, often clerk water forget or do not record such sales resulting paid by the clerk did not correspond with water sold.

In addition another problem is the water standards that will be sold to consumers that water with pH neutral in tolerance is pH 6.5 to pH 8, because companies do not have the systems and tools that support for monitoring the pH of the water resulted in the company is not really applying the standard by which that water is distributed is decent water from the standards applied by the company.

In general, the monitoring system is a system that is applied to monitoring and securing an environment so that the owner can see whether the company's daily activities run by the rules, so if there are problems will be able to more easily and more quickly resolved. By utilizing the technology of arduino it will be created an application that can monitor water usage by using a flow sensor and also pH water using a pH meter sensor as a reference to get the sales data of water and also information pH of the water, then otomatisiasi uploaded periodically from arduino to webserver with using the mysql database as a repository for data and results can be seen using the website.

The purpose of this study is to Build a monitoring system so that business owners can find out how the discharge of water sold without having to come to the company and also to Build a monitoring system that can measure the pH of water is useful to implement water quality standards to be sold.

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2.1 Basis Theory

2.1.1 *Microcontroller*

A microcontroller is a mini version for specialized applications of the microcomputer or computer [1]. Microcontroller is a functional computer system on a chip. It contains a processor core, memory (a small amount of RAM, program memory, or both), and input and output equipment. In other words, the microcontroller is a digital electronic device that has inputs and outputs as well as control with a program that can be written and erased in a special way. Mikrokonktroller typically used in products and equipment are controlled automatically, such as engine control systems, remote controls, office machines, household appliances, heavy equipment, and toys. By reducing the size, cost, and power consumption compared to designs using microprocessor memory and input devices separate output, microcontroller presence make electrical controls for different process more economical.

2.1.2 ***Water Flow Sensor***

In this study, water flow sensor is useful as a tool that can calculate the flow of water, Water flow sensor consists of a plastic valve, water rotor, and a hall-effect sensor. The working principle of this sensor is to utilize Hall effect phenomenon. Is based on the Hall effect magnetic field effect on charged particles that move. When no electric current flowing to the Hall effect device is placed in a magnetic field whose direction perpendicular to electric current, the movement of charge carriers will turn to one side and produces an electric field. The electric field continues to grow until the Lorentz force acting on the particle becomes zero. The potential difference between the two sides of the device is called a potential Hall. Potential Hall is proportional to the magnetic field and electric current through the device.



Figure 1. *Water Flow Sensor*

2.1.3 ***Ph Meter Sensor***

In this study, the pH meter sensor is useful as a tool to calculate the solution pH, pH meter is a potentiometric pH measurement. The measurement system in pH meter for pH containing the working electrode and a reference electrode. The potential difference between two electrodes as a function of pH in the solution being measured. Therefore the solution must be measured electrolyte. Acids and Bases are two classes of chemical substances Acid Alkali pH is very important in daily life - today. In connection with the acidic nature Bases, solutions are grouped into three groups, namely acidic, alkaline and neutral. Acids and Bases properties - different properties, so that we can determine the nature of a solution.

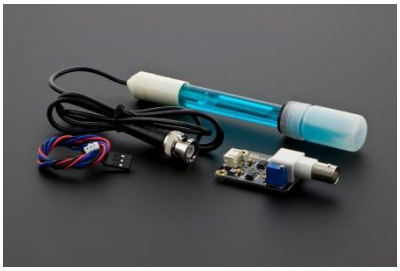


Figure 2. *pH Meter Sensor*

2.1.4 Module ESP266

ESP8266 wifi module is used as a wifi network solution is complete and self-contained, allowing it to host applications or wifi offload all network functions from other applications processor. Can serve as a wifi adapter, wireless internet access can be added to any microcontroller with simple connectivity via the UART interface. Esp8266 governed using AT Command.



Figure 3. *Wifi module ESP8266*

Table 1. Commands AT *Command*

AT commands Command	**Keteranan**
AT + RST	reset module
AT + CWMODE	configure as an access point
AT + CWJAP	Configure username, password
AT + CIPSERVER	turn on server on port 80
AT + CIPMUX	configure for multiple connections
AT + CIFSR	get ip address

2.1.5 Website

The website is a facility that is most frequently used and accessible to everyone on the Internet. Web has grown so rapidly these days. Many web that have sprung up on the internet. The web development to attract everyone to learn how to make it. A simple and informative web can be built using HTML, CSS, and JavaScript. Web

programming is divided into 2 of the Server Side and Client Side [2].

2.2 Analysis and Design

2.2.1 Analysis System

Construction of monitoring system is a system that will be applied to the company tirta thirst, monitoring includes monitoring the pH of the water and also filling the water tank, for filling water tanks parameters used are the parameters of the water flow out, this monitoring system will be done by utilizing the microcontroller, modules, sensors and also web server. With the development of this system the user does not need to come to a firm to do the monitoring, simply by opening the website, the user can see how the flow of water out and also the pH of the water.

In the construction of this system there are several conditions that must be met, both users and technically, the website is divided into two levels, namely the user with admin and user level with employee level. Users with admin level can see pages and pages of water discharge pH of the water, technically admin level users can add, delete and change employee. For users with the page-level employees can access will be restricted, which can only be viewed pages pH water, and user-level employees can not access the page the user.

The following analysis of the existing system on water pH monitoring system and replenishing water tengki:

1. The water sensor and pH sensor sends data to arduino, for water sensor data is transmitted in the form of digital data, and for a pH sensor data to be sent in the form of analog data.
2. RTC module provides data such as time, bertujan so arduino can control when the system will upload the data and when the system performs data backups.
3. The Arduino receive data from sensors of water and the pH of the water, in order to meet the needs of the arduino process data into data that can be understood that the data flow of water and the pH of the water. After that arduino provide such data to the SD card module that aims to do data backup.
4. Once the pH of the water and the data processed by the water discharge arduino, arduino will provide the data to be displayed on the LCD module / I2C.
5. After the data the pH of water in the can, arduino will check on the pH value if the pH is above 8 or below 6.5 then the module buzzer will sound a few seconds.
6. Module initializes wifi network to connect to the internet and also webserver, after the arduino sends the data that has been though to a wifi module to send it directly to a webserver.
7. Webserver receive and process data transmitted by the wifi module, and such data is processed to be stored in the database.
8. Users can view data pH water and discharge water at a website that has been provided.

2.2.2 Analysis System Ongoing

Analysis of the current system in which the Company Tirta Thirst sale process involved using a ledger to record and store all data and hours worked by employees, following the analysis of the current system. current procedures in the sale process as follows:

1. Consumers ordering water to employees.
2. Employees check the queue tank.
3. If masi a tank is being filled, consumers are welcome to wait until the queue is empty.
4 If there is no queue of the employee filling the tank consumers, charging time takes approximately 20 minutes.
5. Once the tank is full of water sales employee record data.
6. Data recording proficiency level will be checked every month by the owner of the company.

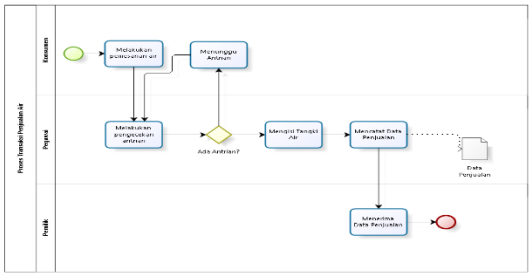


Figure 4. Sales Transaction Process water

2.2.3 Analysis of Network Architecture

In this analysis will provide steps on how this system will be designed, to clarify the explanation of the architectural design of the system, it can be seen below.

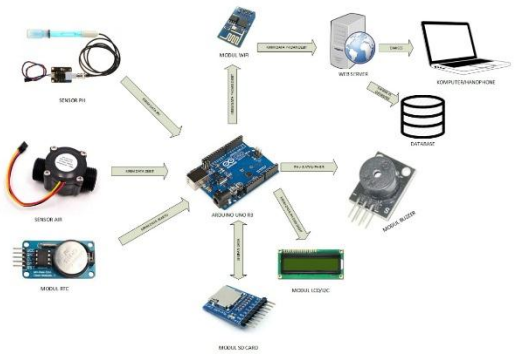


Figure 5. Design System Architecture

First of all the water sensors and sensor pH data to the microcontroller arduino form of digital data for a water sensor that is through serial 2 and the analog data to the pH sensor through a serial analog A01, then arduino that get power from the adapter with tengangan 9v process such data into data required for the measurement of the flow of water and the pH of the water, after the data processed wifi module configuring a modem that has been provided, the goal for wifi module receive data packets from the modem and wifi module to

configure the TCP Ip of the webserver that has been provided and once all completed wifi module will send the data to a webserver, the webserver contained in the php file that can process the data and the data will be forwarded to the database, to be viewed with a layout user friendly then the user can access the information via the main page or website.

2.2.4 Analysis Hardware

Analysis of hardware requirements needed to meet the application to be run can be seen in Table 2.

Table 2. Minimum Specifications

Hardware	Specification
Operating system	Windows 7
RAM	1GB
Procesore	Core 2 Duo
disk Space	2GB

While the specifications that have been filled with users that can be seen in **Table 3.**

Table 3. Specifications owned

Hardware	Specification
Operating system	Windows 7
RAM	16GB
Procesore	Intal Core i7
disk Space	1 TB

After an evaluation of the specifications of the hardware that the hardware requirements are met

2.2.5 Data Analysis

Data analysis aims to determine what data is needed in the application system monotring water pH and water sales in the company tirta thirst, and the relationship of each data with one another. To illustrate the connectedness of data commonly used tools, Entity Relationship Diagram (ERD).

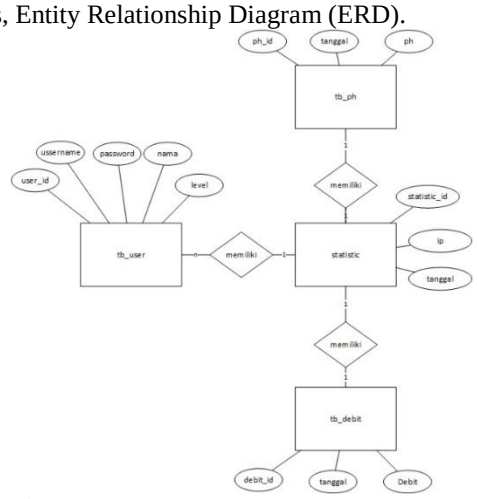


Figure 6. ERD Monitoring System

The following data dictionary ERD in Table 4:

Table 4. ERD Data Dictionary

name of Entity	Attribute name
user	user_id, name, username, password, level
statistic	statistic_id, ip, date
Water discharge	debit_id, date, debit
Ph_air	ph_id, date, ph

2.2.6 Analysis Software Requirements

The software used in the construction of this system is as a medium to program the hardware so that the hardware can run the monitoring system in accordance with the working system to be built, it can be seen in Table 5.

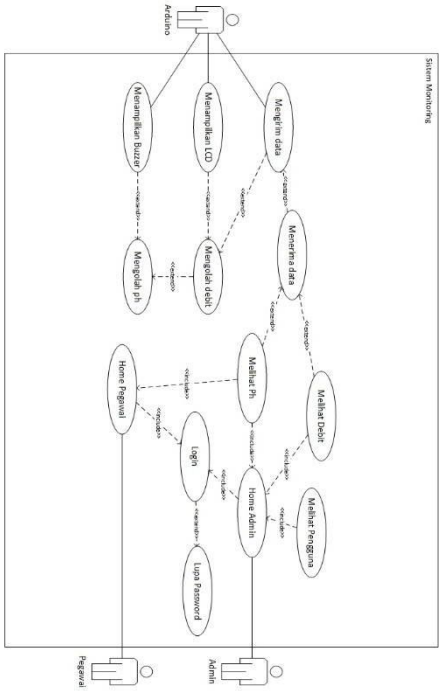
Table 5. Analysis of Software Requirements

name of Entity	Attribute name
Arduino IDE	As a software which can give the arduino program.
Sublime Text	As software to make the program, the excess Sublime Text is a good user interface and pemilihian folder that is designed for programming the website.
MYSQL	As Database.

2.2.7 Use Case Diagram

Use case diagram is a diagram showing the functionality of a system or class and how these systems interact with the outside world and explain the system functionally apparent to users. Identification of actors involved in on the Use Case diagram is shown in Figure 7.

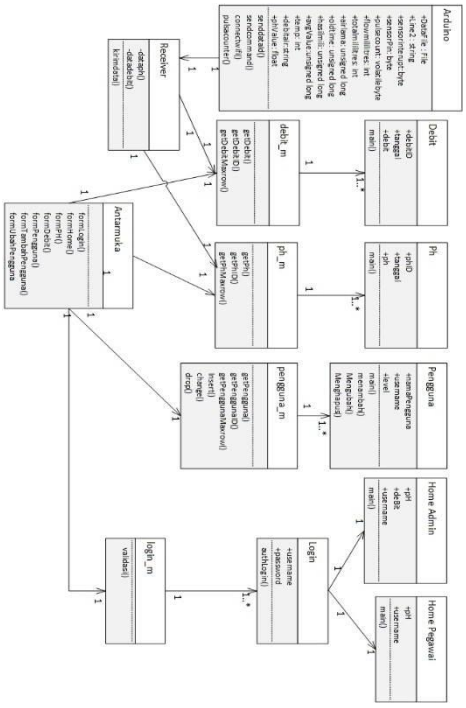
Figure 7. Use Case Diagram



2.2.8 Class Diagram

The class diagram (Class diagram) is a structural diagram that models a set of classes, interfaces, collaborations and relationships. The class diagram depicted with a box that is basically divided into three parts: class name, attributes, and operations.

Figure 8. Class Diagram



2.3 Design

2.3.1 Interface Design

The design of the interface is a description of the interface layout system to be created. With the interface design is expected to both application developers and users can unify their views on the display layout application is made. The design of the interface is made to describe more details about the design of the display and navigation menus contained therein. Here is the interface design and navigation.

1. Design Interface Login

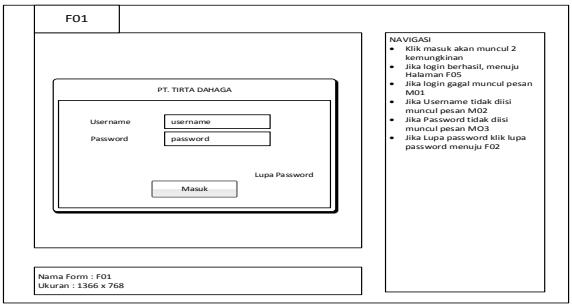


Figure 9. Interface Design Login

2. Design Interface Forgot Password

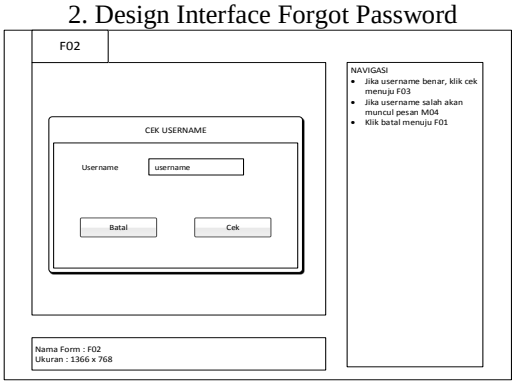


Figure 10. Interface Forgot Password

3. Home Admin Interface Design

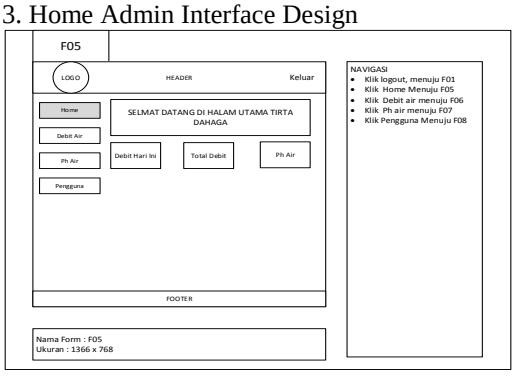


Figure 11. Home Admin Interface

4. Discharge Air Interface Design

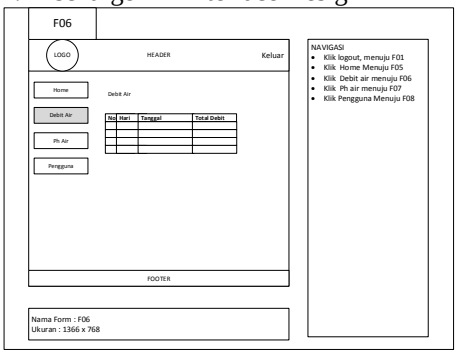


Figure 12. Air Interface Debit

5. Ph Air Interface Design

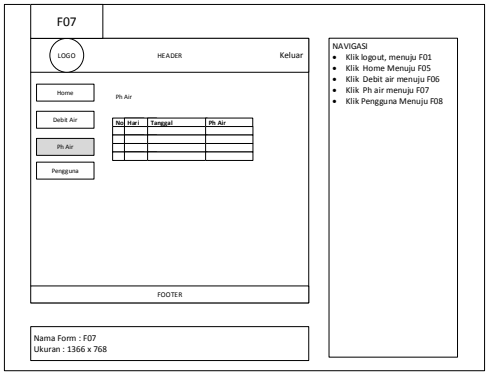


Figure 13. Ph Air Interface

6. User Interface Design

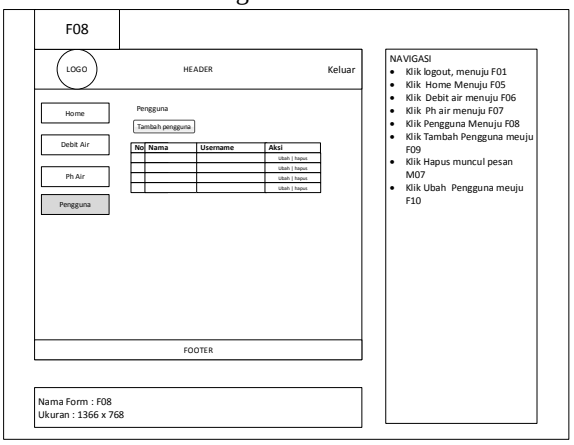


Figure 14. User Antaruma

2.3.2 Design Book

The design is done to adjust the message to the user information on the status of the success of the activities undertaken, such as the login process and deleting data. Each message should be determined the location of its appearance so that the message displayed to the user right. The details of the design of messages and their location in a particular form can be seen in Table 6.

Table 6. Designing a Message

code Message	Message	Used on Form
M01	Login Failed	F01
M02	Please enter your username	F01
M03	Please enter the password	F01, F04
M04	Your username wrong	F02
M05	Your answer is incorrect	F03
M06	Password Minuimal 5 Characters	F04
M07	Data Successfully Added	F08
M08	Data failed Plus	F09, F10
M09	Enter the username	F09
M010	Please fill in your password again	F10

2.3.3 Semantic Network

Semantic network is a description of the relationship navigation menu from one page to another. Semantic network on a website tirta thirst has two networks, namely the semantic network as an admin user and the user semantic network as an employee. The following semantic networks can be seen in the picture 15 and 16.

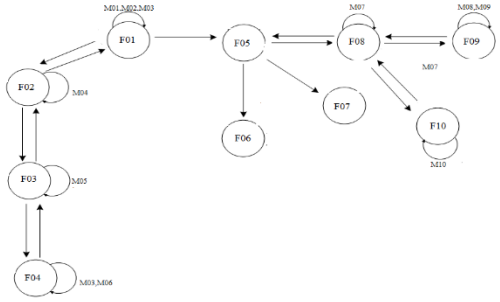


Figure 15. Semantic Network Admin

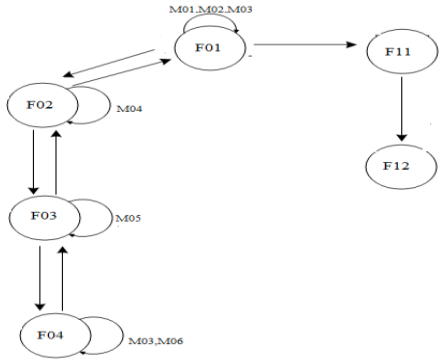


Figure 16. Semantic Network Employees

2.3.4 Design Prototype

The design prototype is a simulation of the design that will be in practice, this design is a prototype that aims to make the functions of this research provable, prototype design also explains details of the functionality of the tools used. The design of this prototype will be focused on designing prototype water discharge and also the design of prototype pH of the water.

1. Prototype Design of Water Discharge

The design of this prototype is done by comparing the volume of water that has passed through the meter with the lapsed time. Thus the accuracy of discharge data obtained can be proven in practice.



Figure 17. Prototype Debit Water

2. Design Prototype Water Ph

The design of this *prototype* was done by mamsukan *pH* meter into the liquor neutral and acidic liquids, thus the value of the *pH of* the liquid may be a reference that the system can work well.

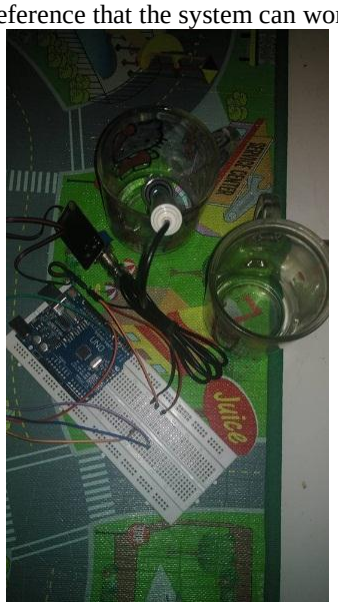


Figure 18. Prototype pH of water

2.4 Implementation and Testing

2.4.1 Hardware Implementation

Hardware specifications on the hardware used microcontroller in Table 7.

Table 7. Hardware Implementation

Hardware	Specification	QTY
microcontroller	Arduino Uno R3	1 piece
Debit Sensor Water	Water Flow Sensor	1 piece
pH sensor	Analog pH Sensor V1.0	1 piece
RTC module	DS3231 RTC	1 piece
LCD module / I2C	Green Screen Version	1 piece
Module Sd Card	SD Card Reader Writer Module	1 piece
Wifi module	wifi ESP8266	1 piece
Box	Box No. 8 Colour Black	1 piece
baud Spacer	high 4mm	4 pieces
Jumper cables	Male-Male-Female and Miale	-
Breadboard	Mini Breadboard White	1 piece
Adapter	Adaptor 9V / 1A	1 piece

2.4.2 Debit Water Testing

Testing the water flow to be done is to put water in 1500 mL each one test, the test was conducted 50 times.

Table 8. Discharge Water Testing

No.	Error	Water entering
1	10 mL	1490 mL
2	16 mL	1474 mL
3	74 mL	1426 mL
4	30 mL	1470 mL
5	22 mL	1522 mL
6	8 mL	1493 mL
7	74 mL	1426 mL
8	11 mL	1511 mL
9	20 mL	1480 mL
10	111 mL	1611 mL
11	52 mL	1552 mL
12	25 mL	1475 mL
13	3 mL	1503 mL
14	24 mL	1524 mL
15	55 mL	1555 mL
16	20 mL	1480 mL
17	90 mL	1590 mL
18	18 mL	1482 mL
19	21 mL	1521 mL
20	40 mL	1540 mL
21	97 mL	1597 mL
22	100 mL	1400 mL
23	44 mL	1456 mL
24	20 mL	1520 mL
25	40 mL	1540 mL
27	2 mL	1498 mL
28	11 mL	1511 mL

29	74 mL	1426 mL
30	40 mL	1460 mL
31	56 mL	1444 mL
32	10 mL	1490 mL
33	14 mL	1486 mL
34	13 mL	1513 mL
35	20 mL	1480 mL
36	30 mL	1530 mL
37	70 mL	1570 mL
38	20 mL	1520 mL
39	40 mL	1460 mL
40	30 mL	1530 mL
41	86 mL	1414 mL
42	10 mL	1490 mL
43	13 mL	1513 mL
44	100 mL	1600 mL
45	20 mL	1520 mL
46	50 mL	1450 mL
47	3 mL	1503 mL
48	21 mL	1521 mL
49	87 mL	1413 mL
50	48 mL	1548 mL

From Table 8 it can be seen that at the time of testing the amount of water entering the most ie 1611 mL, and the amount of water entering the smallest is 1400 mL. of all the testing was that the greatest error is 111 mL or the percentage is 7.4%, and the average error was 1893 mL / 50 mL = 37.83% or the percentage is 2:52. Of testing proficiency level that the percentage of error in the measurement of water discharge is a relatively small and acceptable.

2.4.3 Testing Water Ph

In testing the pH of water is prepared 3 different solutions are acid (vinegar), an alkaline solution (perfume) and a neutral solution (water) to test it will try one by one from the solution so that it can be seen that the tool used to calculate the pH of the solution.

Table 9. Ph Water Testing

Mixed solution	Which are expected	value solution	Conclusion
Drinking water	Neutral (PH = 6.5-8)	7:30 *pH*	[] Received [ ] Rejected
Water mixed with vinegar	Acid (PH <6.5)	3:34 *pH*	[] Received [ ] Rejected
The water is mixed with perfume	alkali (PH> 8)	8:17 *pH*	[] Received [ ] Rejected

In such testing can be proved that the appliance can perform calculations pH of the water is good and right.

2.4.4 Test Buzzer Sounds

Testing buzzer sound is a test that aims to make the buzzer can be tested properly, whether when the pH is more than 8 and a pH of less than 6.5 buzzer will sound.

PH	Which are expected	Observation	Conclusion
3:34	buzzer sounds	buzzer sounds	[] Received [ ] Rejected
8:17	buzzer sounds	buzzer sounds	[] Received [ ] Rejected
7:30	Buzzer does not beep	Buzzer does not beep	[] Received [ ] Rejected

2.5.5 Testing Data Upload

Testing upload the data that is by uploading the data to the website, there are two (2) value will be examined, ie the value of the water flow and the value of delay in penguploadan. The test is performed 10 times every 1 minute once, and discharge data will be rated 1500 mL.

Table 10. Data Upload

No.	Upload Waktup	Time in Accept	Debit Air T erupload
1	06: 31: 00	6:31:04	1500 mL
2	06: 32: 00	6:32:03	1500 mL
3	6:33:00	6:33:03	1500 mL
4	6:34:00	6:34:03	1500 mL
5	6:35:00	6:35:02	1500 mL
6	6:36:00	6:36:03	1500 mL
7	6:37:00	6:37:03	1500 mL
8	6:38:00	6:38:03	1500 mL
9	6:39:00	6:39:03	1500 mL
10	6:40:00	6:40:03	1500 mL
11	6:41:00	6:41:02	1500 mL
12	6:42:00	6:42:03	1500 mL

13	6:43:00	6:43:03	1500 mL
14	6:44:00	6:44:03	1500 mL
15	6:45:00	6:45:03	1500 mL
16	6:46:00	6:46:02	1500 mL
17	6:47:00	6:47:02	1500 mL
18	6:48:00	6:48:02	1500 mL
19	6:49:00	6:49:03	1500 mL
20	6:50:00	6:50:03	1500 mL
21	6:51:00	6:51:03	1500 mL
22	6:52:00	6:52:03	1500 mL
23	6:53:00	6:53:03	1500 mL
24	6:54:00	6:54:03	1500 mL
25	6:55:00	6:55:03	1500 mL
26	6:56:00	6:56:03	1500 mL
27	6:57:00	6:57:03	1500 mL
28	6:58:00	6:58:03	1500 mL
29	6:59:00	6:59:03	1500 mL
30	7:00:00	7:00:02	1500 mL

In these tests can be seen that the delay in the data penguploadan which ranges from 2 to 4 seconds. And discharge of water after uploaded to the website does not change the data. It can be concluded that the test data upload to walk properly.

3. Conclusions

3.1 Conclusions

Based on the analysis, design and testing of the research that has been done, it could be concluded that the monitoring system has been able to assist the owners in monitoring the pH of the water and filling water tanks at the company tirta thirst, and the owner of the company does not have to come every day to the company for memontoring. It can be said that the original purpose of this study has been reached

3.2 advice

Suggestions for the development of this application monitoring system that is enhanced or focused more on information systems, the website so that the information obtained could be useful for business owners.

BIBILIOGRAFI

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