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Implementation of Wemos D1 Microcontroller to Monitor Water pH in Real Time at WWTP (Waste Water Treatment Plant) Based on Internet of Things

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ABSTRACT

Industrial wastewater treatment must pay attention to the following points, including the volume of wastewater to be treated, the expected quality of the water resulting from the WTP process, the ease of wastewater management, energy sources, and low process operational costs. This study aims to reduce the process from wastewater sampling to laboratory analysis to obtain the results of monitoring the pH of the water. In this study, the authors make a WWTP automation system for monitoring pH that can be carried out in real time along with the development of industry 4.0. By using Wemos D1 which is integrated by the internet of things through the internet network from a Wi-Fi router. Data from pH monitoring results can be seen in real time through a user interface that is accessed via a smartphone or PC with a server and client distance of more than 50 meters. By using a real-time pH monitoring system, you can cut down the pH monitoring process and view monitoring results through the user interface.

1. Introduction

The development of information technology continues to play a role in encouraging humans to carry out activities. The benefits of the development of information technology can make it easier for humans to obtain more efficient and accurate information. The development of information technology will not succeed without human innovation to manage and care for it properly. To obtain information, information technology is the most appropriate tool for humans. The use of computers can be applied in various fields of human life. The increasing need for information and computer users encourages the creation of a computer network that is able to assist and serve various aspects of human needs.

This technological advancement requires companies to keep abreast of technological developments and innovate in utilizing information technology in managing various data and information more efficiently and accurately. But if the company does not follow the flow of technology there will be many negative impacts that will be created. Such as experiencing material losses or abandonment of company reports.

In this era of globalization, information technology plays a very important role in meeting all the company's business needs, in terms of production, supervision, or analysis. The existence of information technology makes it easier for companies to promote company advantages and promote the advantages of their products. Information technology plays a very important role in analyzing the company's own processes. And can speed up and make it easier to get information on the results of process analysis.

WWTP has not yet fully implemented information technology, so the authors are encouraged to conduct research to create an innovation to facilitate the process of industrial wastewater in the Jababeka area. Based on what the authors have observed at this time, there are several systems that are less efficient and take a long time, the objectives of this final project are as follows: a. Get the results of monitoring water pH in real time. b. Trimming the process of wastewater sampling.

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2. Research Method

The research stage begins with designing the system and determining the hardware that will be used, then making the software that will be used. After the software and hardware used have been completed, then assemble the tool into a prototype and then test the tool / prototype.

3. Result and Analysis

3.1 Analysis Sistem

Use Case Diagram Realtime pH monitoring interface is a sequence of steps that the user must take to the system.

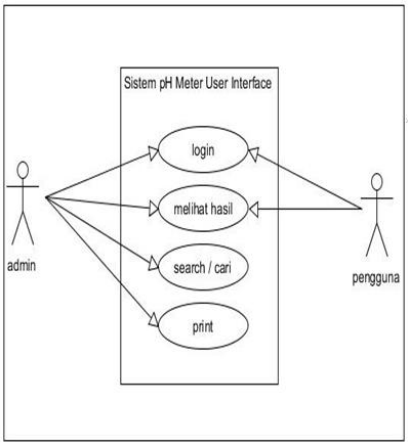

Fig 1. Usecase Diagram

3.2 Hardware Design

In implementing the Wemos D1 Microcontroller to Monitor Water pH in Real Time at WWTP (Waste Water Treatment Plant) based on the Internet of Things, the Real Time water pH monitoring system must first be described using a block diagram about the configuration to be applied, this will help in knowing errors and weaknesses in the event of a failure in the system design. In addition, block diagrams will also help to understand the system design that is being carried out.

The design of the block diagram aims to provide an overview of the tool designed by the author starting from the source of the pH sensor and the pH sensor module then connected to the microcontroller using a jumper cable, the microcontroller is connected to the server wirelessly, then the server and client are connected to the available network. For more details, see the following image:

Fig 2. Block Diagram

Description of the water pH analysis block diagram in real time

a. The pH sensor and the pH sensor module, as sensors that function to read the pH of the water and the sensor module as a liaison between sensors and wemos.

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b. Wemos D1, becomes a data control center that has been filled with programs for controlling security system devices.
c. Router, as a liaison between wemos, server and client, the router also functions to give IP to each device.
d. Server, as a data storage medium for pH monitoring results
e. Client, computer or gadget that will be used by the user to display the results of pH monitoring.

3.3 Implementation

The following is a display of the results of the implementation of the Wemos D1 Microcontroller for Monitoring Water pH in Real Time at the WWTP (Waste Water Treatment Plant) based on the Internet of Things that the author proposes is the display of the real-time pH monitoring interface. The following is a display of the pH monitoring interface including:

3.4 PH Monitor Display

In this view, the user can see the monitoring results in real time, the user can also search for the monitoring results as needed by the user.

Fig 3. pH Monitor Display

3.5 Print pH Monitoring Results

In the print display of the pH monitoring results, the user can get the desired results in the form of hardcopy.

PH	Tangal	Waktu
6.69	2019-08-02	19:39:41
6.91	2019-08-02	19:39:39
6.85	2019-08-02	19:39:38
6.8	2019-08-02	19:39:37
6.58	2019-08-02	19:39:36
6.63	2019-08-02	19:39:34
6.69	2019-08-02	19:39:33

Fig 4. Print pH Monitoring Results

3.6 Operation and implementation

In this chapter the author will implement and explain how to operate the pH monitoring tool in real time. From sensor readings to displaying data on the interface.

a Step 1

In the first step the author took was to assemble the pH sensor, module and wemos. The pH sensor is immersed directly in the water to be monitored in real time. The pH sensor is connected to the pH sensor module with a cable. From the module it is connected to Wemos using 4 jumper cables. Where the power from Wemos comes from the power bank, the power from Wemos can also use an adapter that uses a micro USB cable, because Wemos D1 uses the Micro USB port as a power source.

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b Step 2

In step 2, what the author has to do is connect the circuit from the pH sensor and wemos D1 to the router. After both are connected, it can be viewed using a browser by typing the IP address of the wemos D1 as shown below:

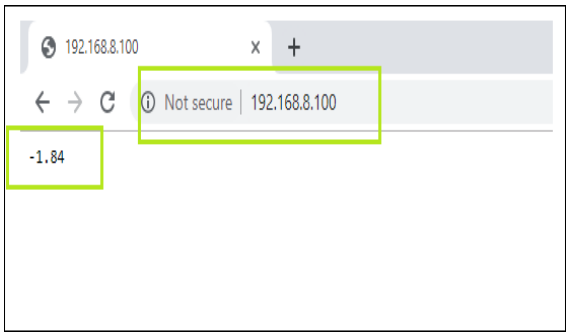

Fig 5. Tool Connection Test

c Step 3

In the third step, this is a step taken by the author to parse the data and input the monitoring results to the database by a service application made with Lazarus.

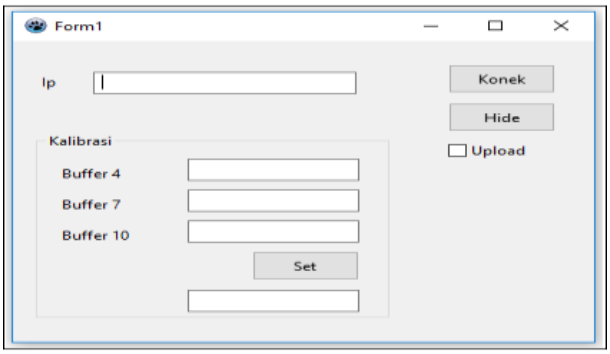

Fig 6. Service Application Display

Information :

a. IP : Fill in the IP address of Wemos.
b. Calibration: form to calibrate the pH sensor.
c. Connect button: serves to connect the application with wemos.
d. Button hide: serves to minimize the application.
e. Check box upload: function input continuously to the DB.

This service application is very important in real-time pH monitoring systems. So that when monitoring is done, the application should not be closed.

d Step 4

In this step, the pH sensor readings are calibrated.

1) Calibration on 4.01 . buffer

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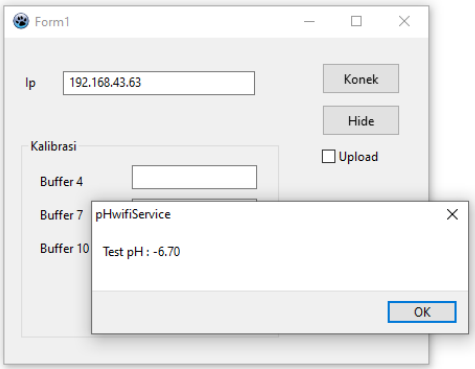

Fig 7. Display Calibration *pH 4.01*

Dip the sensor in the buffer solution, then type the ip address of wemos and click the connect button. The original display of sensor readings will appear, then click ok. Set the reading to be close to the value of 4.01 entered in column buffer 4.

2) Calibration on 6.86 . buffer

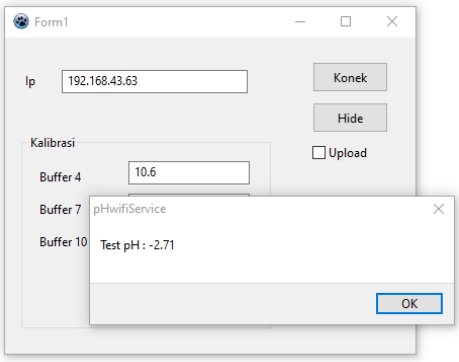

Fig 8. Display Calibration *pH 6.86*

Dip the sensor in the buffer solution, then type the ip address of wemos and click the connect button. The original display of sensor readings will appear, then click ok. Set the reading to be close to the value of 6.86 entered in column buffer 7.

3) Calibration on 9.18 . buffer

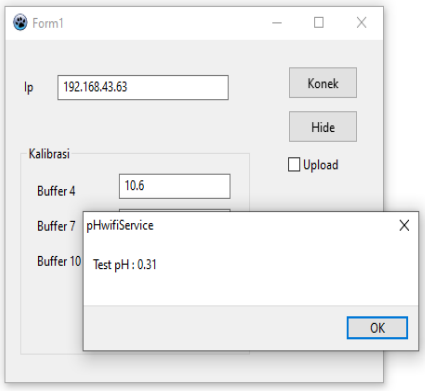

Fig 9. Display Calibration *pH 9.18*

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Dip the sensor in the buffer solution, then type the ip address of wemos and click the connect button. The original display of sensor readings will appear, then click ok. Set the reading to be close to the value of 9.18 entered in column buffer 10.

e Step 5

After being calibrated, the author conducted a field trial in the waste entering the wwtp jabaebaka. The trial was carried out on the inlet and outlet of wwtp.

1) Inlet wwtp

Fig 10. Inlet Check

A sample is taken at the wwtp inlet to check the pH, after the sensor is immersed it will display the results on the web.

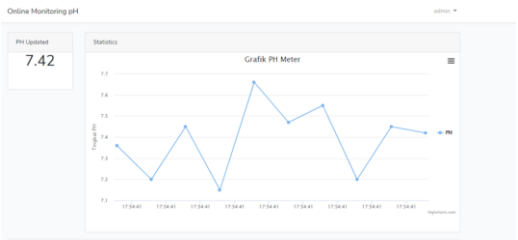

Fig 11. Inlet Check Display

2) wwtp outlets

Fig 12. Outlet Check

A sample is taken at the wwtp outlet to check the pH, after the sensor is immersed it will display the results on the web.

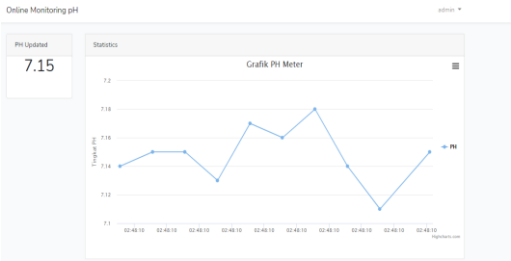

Fig 13. Outlet Check Display

4. Conclusion

Based on the results of this study, the authors conclude several things regarding the Implementation of the Wemos D1 Microcontroller to Monitor Water pH in Real Time at the WWTP (Waste Water Treatment Plant) based on the Internet of Things as follows: 1. By using the Wemos D1 microcontroller to monitor the pH of water in real time at WWTP Jababeka based on the Internet of Things that uses a pH sensor connected to Wemos as a microcontroller then connected to a server wirelessly and the monitoring results are stored in a database so that users can view pH monitoring data in real time. 2. The implementation design of realtime water pH monitoring at WWTP 1 Jababeka based on the Internet of Things designed using the Wemos D1 microcontroller can be used to provide real-time information even though the distance between the waste reservoir and the server and client is more than 50 meters, the results of monitoring can be seen by opening the user interface on a PC or smartphone with a browser application.

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