Atlantis Highlights in Engineering, volume 7
Proceedings of the 4th Forum in Research, Science, and Technology (FIRST-T1-T2-2020)

Development Internet of Things for Water Quality Monitoring System for Gouramy Cultivation

Sujito[1,2,*] Danny Mayrawan[2] I Made Wirawan[2] Faiz Syaikhoni Aziz[2] Abdulah Iskandar Syah[2] Maulana Ahmad As Shidiqi[2]

[1] *Electrical Engineering Postgraduate, Universitas Negeri Malang, Indonesia*
[2] *Electrical Engineering Department, Universitas Negeri Malang, Indonesia*
[*] *Corresponding author. Email: sujito.ft@um.ac.id*

ABSTRACT
In freshwater fish cultivation, the quality and temperature also affect growth, each type of fish has different characteristics concerning water conditions and pond temperature. In this case, monitoring water quality in Gouramy cultivation. Monitoring of water and pond temperature is usually done manually by farmers and takes a long time. The purpose of this research is to design a water quality and temperature monitoring system based on IoT. In this system, monitoring is carried out from the Web which includes Ph, Temperature, and Turbidity in real-time. This water monitoring uses a microcontroller that is equipped with a Ph meter sensor, digital temperature, Turbidity Sensor, and Ultrasonic Sensor. The measurement data from the microcontroller is sent to a database that will be processed and displayed on the Web.

Keywords: *WQMS, Gouramy Cultivation, Ph, Temperature, Turbidity, IoT*

1. INTRODUCTION

In the process of cultivating gouramy until the harvest has many problems. The problem that often occurs is slow growth, frequent disease, and death of gouramy caused by water quality. Water that can be used for fish farming must have quality and quantity standards following the living requirements of gouramy. Although many parameters affect water quality, there are three most important in fish culture, namely parameters of temperature, pH, and water turbidity [1]. PH is a unit of measure that describes the degree of acidity or base level of a solution. pH is measured on a scale of 0 to 14 in pH units. In principle, the measurement of a pH is based on the electrochemical potential that occurs between the known solution in the glass electrode and the unknown solution outside the electrode glass [2]. Turbidity is an optical property of a solution that causes light through the water to be absorbed and refracted [3]. Turbid water is water that has many particles which will change the color and appearance of the water, turbidity has levels, transparent water is water that has low turbidity while water that is not transparent has a very high level of turbidity [4].

Currently, the way to see the water quality of the farmers is still based on direct observation. This method is deemed ineffective in assessing water quality because problems such as slow growth, the frequent disease in cultivation cannot be handled optimally. This partner village development program offers an application of a water quality monitoring system with parameters for the content of dissolved oxygen in water, water temperature, water pH, and water turbidity based on the Internet of Things in gouramy cultivation for maximum fish production.

2. MATERIAL AND METHOD

The purpose of this research is to create a water quality monitoring system using an IoT-based microcontroller. In making this system, it is necessary to design the hardware and software side.

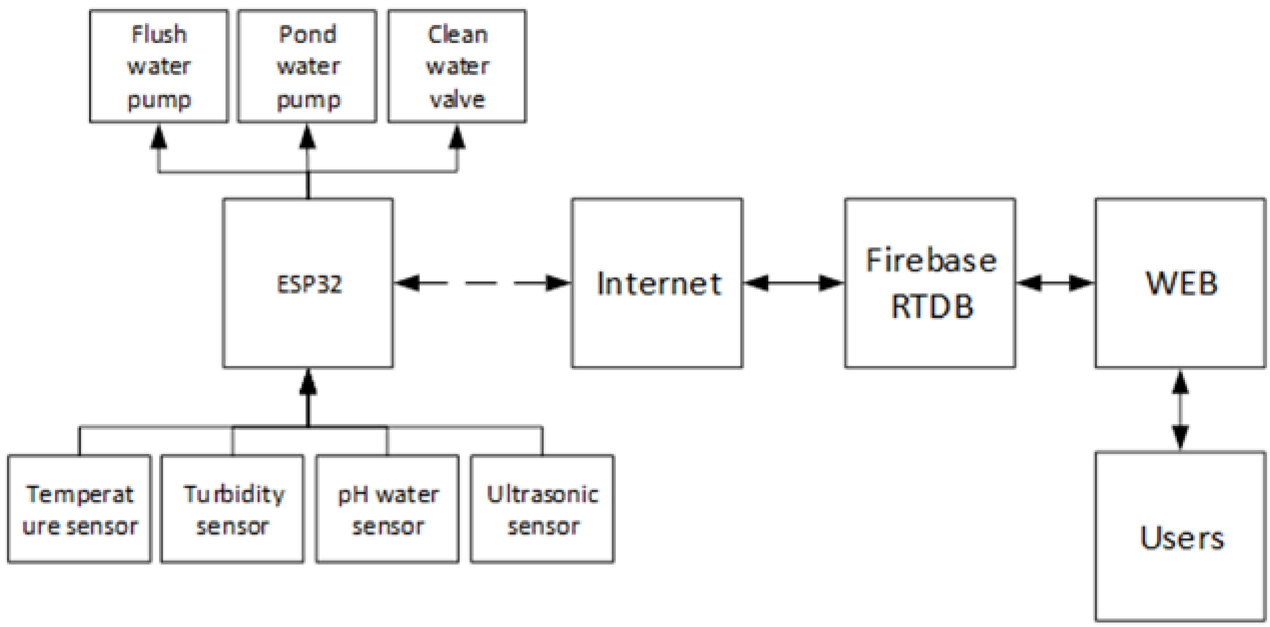

Figure 1 System Architecture

2.1 Material

WQMS is designed to use an ESP 32 microcontroller as a processor for processing data obtained from the installed sensors. ESP 32 has 15 pins analog and 2 pins digital input-output, Built-in WiFi 11b / g / n [5] pH sensor, Turbidity Sensor, Digital Thermometer sensors, and Ultrasonic Sensor.

2.2 Method

Figure 2 shows a flowchart from the user side (End-User). The microcontroller takes measurements through sensors that have been installed, then the data obtained is uploaded to a database via the internet which is then processed and displayed on a Web page.

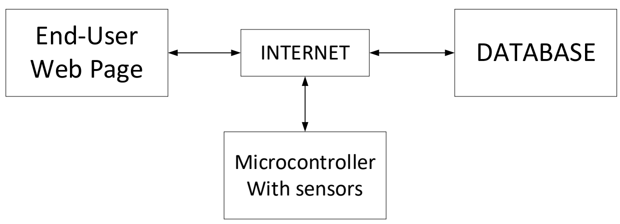

Figure 1 End-User flows diagram

2.2.1 Hardware Design

The system architecture (Figure 1) used in this system is hardware and software. In the hardware section, there are 4 sensors used, namely a temperature sensor, a water turbidity sensor, and a water pH sensor and ultrasonic. In addition to the 4 sensors, there are 3 actuators used, namely a water pump for draining, a water pump from a pond, and a valve for clean water. ESP 32 functions as a microcontroller connected to WiFi to send and receive data from the database.

2.2.2 System Design

The system architecture used in this system is hardware and software. In the hardware section, there are 4 sensors used, namely a temperature sensor, a water turbidity sensor, and a water pH sensor and ultrasonic. In addition to the 4 sensors, there are 3 actuators used, namely a water pump for draining, a water pump from a pond, and a valve for clean water. ESP 32 functions as a microcontroller connected to WiFi to send and receive data from the database.

2.2.3 System Testing Design

Pengujian sistem yang dilakukan dengan membandingkan data yang ditampilkan pada database dengan data yang ditampilkan pada laman Web.

3. RESULT AND DISCUSSION

System testing is carried out by comparing the data displayed in the database with the data displayed on the Web page.

3.1 System Testing Results

Testing by measuring the hardware sent to the database using a format string. The data sent to the database is processed and then displayed on the Web interface.

3.1.1 PH sensor testing

Table 1 Test Result comparing data on web and database

Test	Web	Database
1	6.77	6.77
2	6.61	6.61
3	6.35	6.35
4	7.38	7.38

Figure 3 Display of pH sensor testing on Web

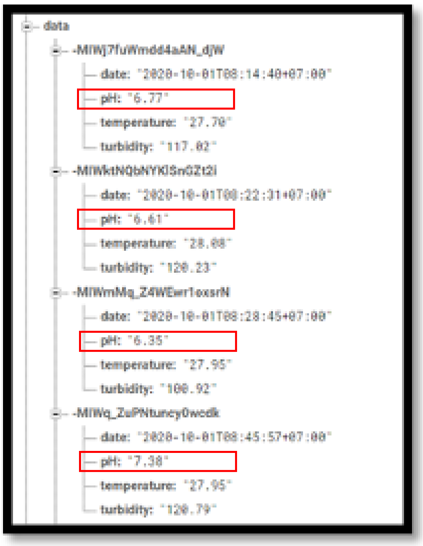

Figure 4 Display of pH sensor testing in the database

Comparing data from figure 3 and figure 4 displayed on table 1, The first data, the pH value read in the database is 6.77 and on the web is 6.77, so there is no difference whatsoever. The second data, the pH value in the database is 6.61 and the one read on the web is 6.61, so there is no difference in value. The third data obtained the pH value in the database of 6.35 and on the web of 6.35, based on these data there is no difference in values. The last data is in the database of 7.38 and 7.38 on the web. Based on the data above, there is no difference in reading at all.

3.1.2 Temperature sensor testing

Table 2 Test Result comparing data on web and database

Test	Web	Database
1	27.70	27.70
2	28.08	28.08
3	27.95	27.95
4	27.95	27.95

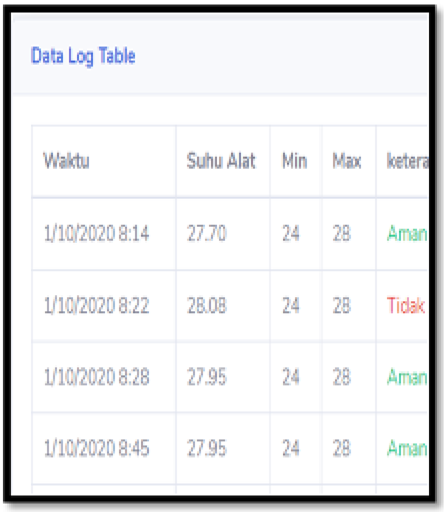

Figure 5 Display of Thermometer sensor testing on Web

Figure 6 Display of Thermometer sensor testing in the database

Based on the figur 5 and figure 6 that compared on table 2. The first data obtained was the temperature value database of 27.70, while the data read on the web was 27.70, so that there was no difference in the reading. The second data obtained a value of 28.08 in the database and 28.08 on the web, based on the comparison of these values, the read value was no difference. The third data in the database obtained a value of 27.95 and on the web, it was 27.95, when compared, there is no difference between the two. The last data read by the database is 27.95 and 27.95 on the web so that there is no difference from that value.

3.1.3 Turbidity sensor testing

Table 3 Test Result comparing data on web and database

Test	Web	Database
1	117.02	11.02
2	120.23	120.23
3	100.92	100.92
4	120.79	120.79

Data Log Table

Waktu	Alat	Min	Max	keterang
1/10/2020 8:14	117.02	30	99	Tidak Aman
1/10/2020 8:22	120.23	30	99	Tidak Aman
1/10/2020 8:28	100.92	30	99	Tidak Aman
1/10/2020 8:45	120.79	30	99	Tidak Aman

Figure 7 Display of Turbidity sensor testing on Web

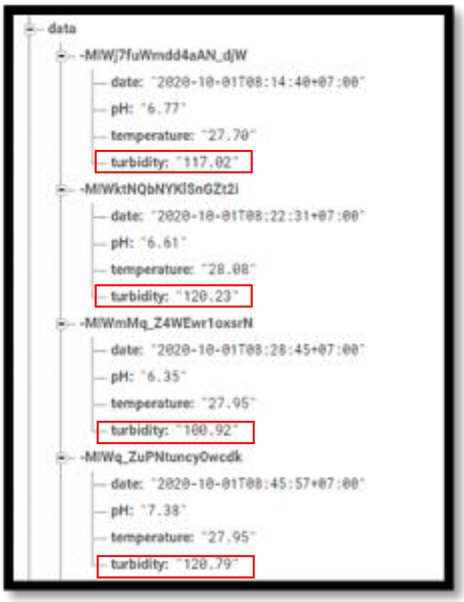

Figure 8 Display of Turbidity sensor testing in the database

Data displayed on figure 7 and figure 8 compared on table 3, the first data obtained a value of 117.02 in the database, and 117.02 on the web, when compared there is no difference in value. The second data, there is a value of 120.23 in the database and 120.23 on the web, based on these two values, there is no difference in reading. The third data has a value of 100.92 in the database and 100.92 on the web, there is no difference in the data. The fourth data, obtained a value of 120.79 in the database and 120.79 on the web so that there is no difference from the data.

4. CONCLUSION

After designing and testing the system, the results of sending data from hardware to the database are compared with the data displayed on the Web interface. The results obtained were that the data in the database was the same as the data displayed on the web interface. It can be concluded that the system designed has worked well.

ACKNOWLEDGMENTS

This research and development of Internet of Things for Water Quality Monitoring System is funded by the PNBP 2020 research program of the State University of Malang

REFERENCES

[1] Budiarti, R. P. N., Tjahjono, A., Hariadi, M., & Purnomo, M. H. (2019). Development of IoT for Automated Water Quality Monitoring System. Proceedings - 2019 International Conference on Computer Science, Information Technology, and Electrical Engineering, ICOMITEE 2019, 1, 211–216. https://doi.org/10.1109/ICOMITEE.2019.8920900

[2] Faricha, A., Adiputra, D., Hafidz, I., Amifia, L. K., Studi, P., Elektro, T., … Surabaya, K. (2019). Analisa Studi Tentang Perancangan Alat Monitoring Kualitas Air Pdam Berbasis Internet of Things Analysis Study : Design of Local Water upply Quality Monitoring Using Internet of Things, 2(1), 53–58.

[3] Pramana, R. (2018). Perancangan Sistem Kontrol dan Monitoring Kualitas Air dan Suhu Air Pada Kolam Budidaya Ikan. Jurnal Sustainable: Jurnal Hasil Penelitian Dan Industri Terapan, 7(1), 13–23. https://doi.org/10.31629/sustainable.v7i1.435

[4] Roza, Elviana.2017, Maritim indonesai kemewahan yang luar biasa.kementrian kelautan dan perikanan. Jakarta

[5] Mario Orlando, Desta Yolanda, & Werman Kasoep. (2020). Sistem Monitoring dan Penjernihan Air Berdasarkan Derajat Keasaman (PH) dan Kekeruhan Pada Bak Penampungan Air Berbasis Internet of Things. Chipset, 1(01), 17–22. https://doi.org/10.25077/chipset.1.01.17-22.2020

[6] Aminah, S., Maulana, G., Wibisono, A., Teknik, J., Manufaktur, O., Politeknik, M., … Kanayakan, J. (2019). Perancangan Sistem Monitoring Kualitas Air Pada Tambak Udang Berbasis Internet of Things. Seminar Nasional Informatika Dan Aplikasinya (SNIA), (September), 2019.

[7] Wu, N., & Khan, M. (2019). LoRa-based Internet-of-Things: A Water Quality Monitoring System. Conference Proceedings - IEEE SOUTHEASTCON, 2019-April, 1–4. https://doi.org/10.1109/SoutheastCon42311.2019.9020583