Proceeding International Conference Of Innovation Science, Technology, Education, Children And Health
Vol. 3 No. 1 2023
e-ISSN : 2776-9062, Page 122-128
Available online at: https://icistech.org/index.php/icistech/

Application Dissolved Oxygen (DO) For Water QualityMonitoring of Shrimp Ponds With IoT (Internet of Things)

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Abstract. *Water is a very important requirement, both for humans and other living things such as fish and plants[1][2][3]. In the fields of agriculture, fisheries, and the fresh water management industry is very important to improve quality. [4]. In its development, the demand for fish and seafood (shrimp, squid, etc.) increases so that to meet these demands, it is necessary to pay attention to the quality of the pond water that will be used to breed fish and seafood). The method used in this study is Research and Development (RnD). This research can produce readings using cayenne.mydevice.com one of the Internet providers of things with communication web Internet of thing message queue telemetry transport (MQTT)[12]. This research was conducted at the "Balai Besar Perikanan Budidaya Air Payau (BBPBAP)". The parameters studied were sensor accuracy, system constraints and the application website. Conclusion this research is (1) the average sensor accuracy is good, namely 88.86%. (2) there are two obstacles faced, namely sensor maintenance and storage and (3) monitoring the data in live, minute, hour, day, week, month, 3 months, 6 months and 1 year.*

Keywords *Water Quality, Shrimp, MQTT, Accuracy*

1. INTRODUCTION

Water is a very important requirement, both for humans and other living things such as fish and plants (M. B. Kawarkhe, S. Agrawal, and I. Corresponding 2019). In the fields of agriculture, fisheries, and the fresh water management industry is very important to improve quality (S. Pappu, P. Vudatha, A. V. Niharika, T. Karthick, and S. Sankaranarayanan 2017). In its development, the demand for fish and seafood (shrimp, squid, etc.) increases so that to meet these demands, it is necessary to pay attention to the quality of the pond water that will be used to breed fish and seafood (S. B. Chandanapalli 2014)

The importance of monitoring water quality is monitoring water pollution which is one of the biggest fears in greening globalization (B. Patil and J. Digge 2018). so it needs to be monitored continuously in order to know the quality of pond water that will be used for seafood breeding.

The method used today is still the old way, namely by taking away the sample ponds from the pond water, then measuring with a measuring instrument then recorded twice a day, recap then just analyzed which is almost the same as said by Mourvika Shirode et al who stated that. Conventional water quality testing is to take a water sample and then test and analyze it in the laboratory (K. S. Adu-Manu, C. Tapparello, W. Heinzelman, F. A. Katsriku, and J. D. Abdulai 2017)To facilitate understanding in the conventional method in question can be seen from the image below

Received June 01, 2023; Revised June 14, 2023; Accepted June 28, 2023; Published June 30, 2023

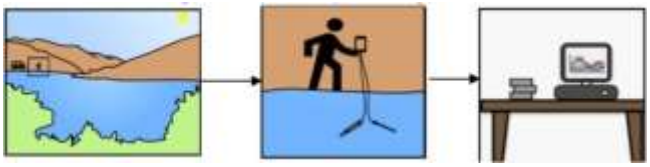

Figure 1. Conventional Water Quality Monitoring

By using conventional water quality monitoring methods there are deficiencies such as inaccurate, unable to real time, and human error etc. So to overcome these shortcomings we try to make improvements by creating a monitoring system that can be used in real-time. For more details can be seen in the picture

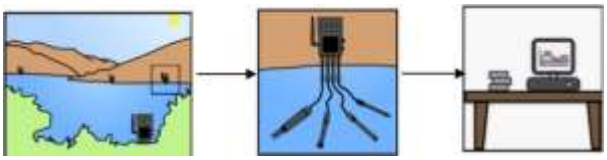

Figure 2 Illustration of Water Quality Monitoring with IoT[6]

Shrimp is one of the mainstay commodities from the fisheries sector[7]. At the "*Balai Besar Perikanan* Budidaya *Air Payau (BBPBAP)*" a place from the government to develop brackish water aquaculture in Jepara, vanamei shrimp is one of the main commodities in aquaculture.

So from the above background, the writer wants to apply the Dissolve oxygen (DO) sensor in the vanamei shrimp pond as one of the parameters that must be done to determine water quality.

2. MATERIALS AND METHODS

The method used in this study is Research and Development (RnD). The research process is carried out by characterization to determine the characteristics of sensors and multiplication to match the results of sensor readings with a measuring instrument so that it has a very small error rate.

Then sent to the web server so that it can be seen from a PC or smartphone that works can be seen in the picture below

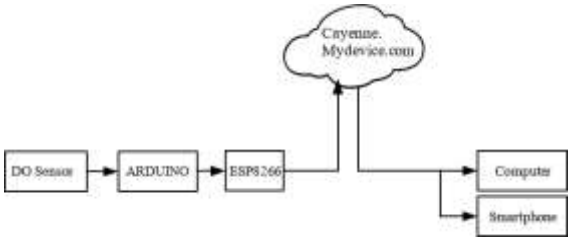

Figure 3 How WQM With IoT works

Hardware Design

The six parameters used in WQI are dissolved oxygen (DO), pH, total suspended solids (TSS), biochemical oxygen demand (BOD), ammonia nitrogen (NH3-N) and chemical oxygen demand (COD)[8]. Parameters that may be tested include temperature, pH, turbidity, salinity, nitrates and phosphates [9]. Water quality parameters like turbidity, pH, conductivity and temperature etc[10] Sensor nodes that can be used on a cheap and efficient basis are pH sensors, DO sensors, and temperature sensors[4]

Water quality parameters viz., Temperature, pH, Salinity, Dissolved Oxygen, Alkalinity, Hardness, Nitrite- Nitrogen, Nitrate-Nitrogen and Ammonia were studied in 14 shrimp culture ponds[11]. The parameters considered to test the quality of water are Temperature, Turbidity, pH, Conductivity. temperature, pH, turbidity, salinity, nitrates and phosphates[10].

Software Design

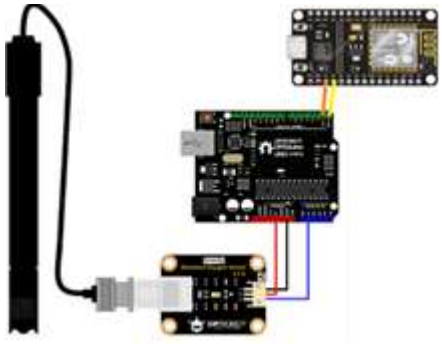

Figure 4 Wiring DO Sensor With Controller

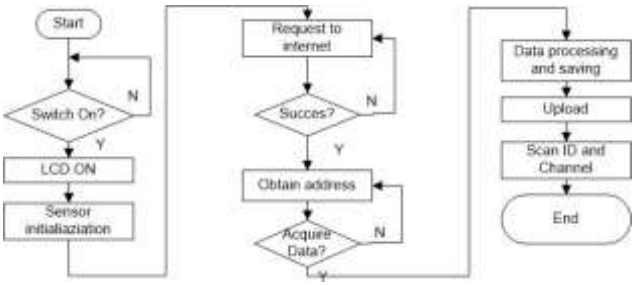

Figure 5 Flowchart software

Results And Analysis

This research can produce readings using cayenne.mydevice.com salah satu penyedia web Internet of thing dengan komunikasi message queue telemetry transport (MQTT)[12]. This research was conducted at the "Balai Besar Perikanan Budidaya Air Payau (BBPBAP)". The parameters studied were sensor accuracy, system constraints and the application website.

Sensor Accuracy

acuration was based on deviation between official source and forecasting, the more deviation the more non accurate[13]. The accuracy of the DO sensor that we use can be seen in the image below

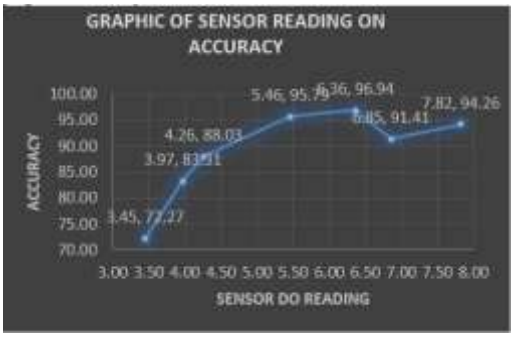

Figure 6 Graphic of Sensor Reading on Accuracy

In the picture above, we can see the results of the sensor acquisition, namely 72,23%; 83,32%; 88,03%; 95,79%; 96,94%; 91,41%; and 94,26%. From this data, the average accuracy is 88,86%

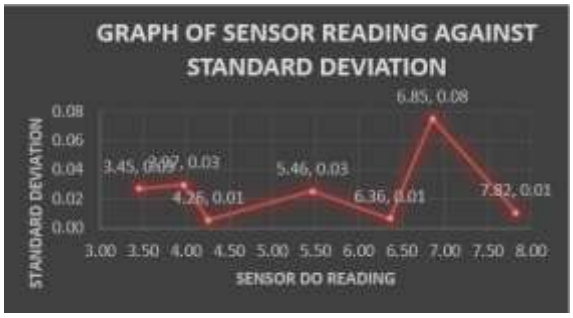

Figure 7 Graphic of Sensor Reading on Standard Deviation

In the picture above, we can see the results of the sensor acquisition, namely 0,03; 0,03; 0,01; 0,03; 0,01%; 0,08%; and0,01%. From this data, the average Standard Deviation is 0,03.

In using cayenne my device.com, it can be seen in several modes, namely live, minute, hour, day, week, 1 month, 3 months, 6 months and 1 year. In the following we present an example of how the display is on the start page, displays forminutes, hours, days and weeks

Figure 8 display in minute

Figure 9 display in hours

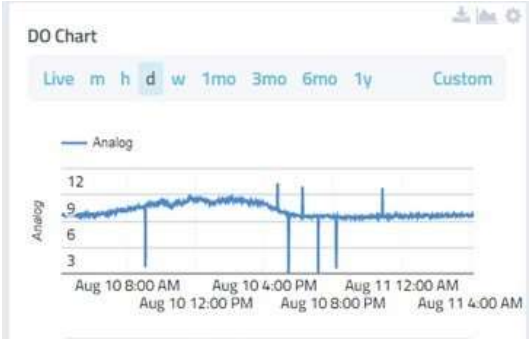

Figure 10 display in days

Figure 11 display in week

3. CONCLUSION

From the results and discussion, it can be concluded that (1) the average sensor accuracy is good, namely 88.86%. (2) there are two obstacles faced, namely sensor maintenance and storage and (3) monitoring the data in live, minute, hour, day, week, month, 3 months, 6 months and 1 year.

Acknowledgements

The author would like to thank the Ministry of Research and Technology (Kemenristek/BRIN) for funding this researchthrough the 2020 PKPT Scheme.

REFERENCES

Adu-Manu, K. S., Tapparello, C., Heinzelman, W., Katsriku, F. A., & Abdulai, J. D. (2017). Water quality monitoring using wireless sensor networks: Current trends and future research directions. ACM Transactions on Sensor Networks, 13(1). https://doi.org/10.1145/3005719

Chakravarty, S., Das, P., Saha, P., & Paul, A. (2016). Spatial variation of water quality parameters of shrimp (Litopenaeus vannamei) culture ponds at Narsapurapupeta, Kajuluru, and Kaikavolu villages of East Godavari district, Andhra Pradesh. International Journal of Fisheries and Aquatic Studies, 4(4), 390–395.

Gorde, S. P., & Jadhav, M. V. (2013). Assessment of water quality parameters: A review. International Journal of Engineering Research and Applications, 3(6), 2029–2035.

Juwita, P. S., Fadhil, R., Damayanti, T. N., & Ramadan, D. N. (2020). Smart parking management system using SSGA MQTT and real-time database. Telkomnika (Telecommunication Computing Electronics and Control), 18(3), 1243–1251. https://doi.org/10.12928/TELKOMNIKA.v18i3.14869

Kawarkhe, M. B., Agrawal, S., & Corresponding, I. (2019). Smart water monitoring system using IoT at home. Volume 21, 14–19. https://doi.org/10.9790/0661-2101021419

Meher, P. K., Sharma, P., Gautam, Y. P., Kumar, A., & Mishra, K. P. (2015). Evaluation of water quality of Ganges river using water quality index tool. EnvironmentAsia, 8(1), 124–132. https://doi.org/10.22135/sje.2017.2.3.93-98

Pappu, S., Vudatha, P., Niharika, A. V., Karthick, T., & Sankaranarayanan, S. (2017). Intelligent IoT based water quality monitoring system. International Journal of Applied Engineering Research, 12(16), 5447–5454.

Paska, D. (2018). Digitalized water and smart cities - How can telecommunication networks be used for environmental resilience? ITU Journal: ICT Discoveries, Special Issue(2), 1–8. Retrieved from https://www.itu.int/pub/S-JOURNAL-ICTS.V1I2-2018-3

Patil, B., & Digge, J. (2018). Water quality monitoring in IoT environment. IOSR Journal of Engineering, 20–25. Retrieved from http://www.iosrjen.org

Prayuginingsih, H., & Java, E. (2017). Accuration of Indonesian rice supply and demand. pp. 142–150.

Segara, N. B. (2015). Education for sustainable development (ESD): Sebuah upaya mewujudkan kelestarian lingkungan. SOSIO DIDAKTIKA: Social Science Education Journal, 2(1), 22–30. https://doi.org/10.15408/sd.v2i1.1349

Thirupathi Rao, N., Bhattacharyya, D., Madhusudhan Rao, V., & Kim, T. H. (2019). Water quality testing and monitoring system. International Journal of Innovative Technology and Exploring Engineering, 8(5), 162–166.

Zainuddin, Z. (2019). Water quality monitoring system for Vannamae shrimp cultivation based on wireless sensor network in Taipa, Mappakasunggu District, Takalar. Proceedings of ICMEMe 2018, 165, 89–92.