

BAB 1 INTRODUCTION

1.1 Background

Catfish is one of the leading fishery commodities in Indonesia with high economic value.¹ According to the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, catfish production reached 1.12 million tons in 2022, making catfish one of the largest aquaculture commodities in Indonesia.² The use of natural resources such as catfish in meeting human needs, in the Islamic view, is allowed as long as it is carried out responsibly and in accordance with Islamic law. Allah SWT said in the Qur'an Surah An-Nahl verse 11:

يُنَبِّئُكُمْ بِهِ الرَّزْعَ وَالرَّزِيُونَ وَالنَّحِيلَ وَالْأَعْنَبَ وَمِنْ كُلِّ الثَّمَرَاتِ ۗ إِنَّ فِي ذَلِكَ لَآيَةً لِّعَوْمٍ يَتَفَكَّرُونَ ۝ ۱۱

It means: "And He also created the cattle, which you drive and you eat their flesh." (Qur'an Surah An-Nahl:11)

In the process of catfish cultivation, water quality is a very crucial factor.³ Poor pond water can negatively impact the health of catfish, causing disease, and even death.⁴ For example, diseases such as columnaris thrive in ponds with unmaintained water quality, which can cause huge losses for farmers.⁵ Poor water quality can also cause stress in catfish, inhibit their growth, and lower the body's resistance to disease.⁶ Two important parameters that must be monitored to maintain the quality of catfish pond water are temperature and pH.⁷ The ideal temperature for catfish ranges from 25-30°C, and the optimal water pH is between 6.5 and 9.⁸

So far, water quality monitoring in catfish ponds has been carried out manually through water sampling and testing in the laboratory.⁹ Although accurate, this method has drawbacks, such as taking a long time, high cost, and requiring a lot of labor. In addition, changes in water quality can occur quickly, while laboratory test

¹ Central Statistics Agency (BPS - Statistics Indonesia), "Aquaculture Production by Main Commodity (Ton), 2019-2020," 2023, <https://www.bps.go.id/id/statistics-table/2/MTUxMyMy/produksi-perikanan-budidaya-menurut-komoditas-utama.html>.

² Central Statistics Agency (BPS - Statistics Indonesia).

³ Djpb KKP, "Ministry of Marine Affairs and Fisheries of the Republic of Indonesia," KKP RI, 2023, <https://kkp.go.id/>.

⁴ Efan Toro et al., "Kajian Kualitas Air Terhadap Pertumbuhan Ikan Sidat Pada Kolam Air Mengalir Study of Water Quality on the Growth of Tropical Anguillid Eels in Running Water" 3, no. 1 (2024): 50–55.

⁵ Study Program et al., "APPLICATION OF WEB-BASED EXPERT SYSTEM," 2022.

⁶ Aquaponics Systems, "Doi: Manuscript Accepted: February 28, 2023 Journal of Science and Technology Manuscript Approved: August 28, 2023," 2023.

⁷ Mijani Rahman et al., "Journal of Community Service" 2, no. December (2021): 113–18.

⁸ Types of Pavement et al., "Temperature and PH Reference for Catfish Cultivation," n.d.

⁹ M.P. Dr. Parwi, S.P., "Evidence of Recorded Interviews with Catfish Farming Experts," n.d., <https://drive.google.com/file/d/1wAvRDRGF1YtHntgCq2Udc0drKkDPdeWX/view>.

results are only available after a few days. This makes manual monitoring less efficient, especially for small-scale cultivators.

Several catfish cultivation lands in Ponorogo, including Pondok Modern Darussalam Gontor 1,¹⁰ Pondok Al-Amin Hudatul Muna Ponorogo Brotonegaran Village,¹¹ Agroindustry University of Darussalam, and several other catfish farms in Ponorogo, have not implemented an Internet of Things (IoT)-based system and monitoring through applications. The farm still monitors water quality manually, which can hinder its effectiveness in maintaining water quality in a sustainable manner.

To overcome this problem, the use of Internet of Things (IoT)-based technology offers a more practical and efficient solution.¹² By using IoT sensors, water quality parameters such as temperature and pH can be monitored in real-time. Data from IoT sensors can be sent directly to a mobile application, making it easy for cultivators to monitor pond water conditions anytime and anywhere.¹³ In addition, this system can also provide notifications or early warnings when water conditions reach a threshold that has the potential to harm catfish.

This research aims to develop an IoT-based catfish pond water quality monitoring system that can provide early warning through notifications on mobile applications.¹⁴ This system is expected to help catfish farmers maintain pond water quality effectively and efficiently, as well as minimize the risk of loss due to poor water quality.¹⁵

1.2 Problem Formulation

Based on the above background, the formulation of the problems raised in this study is:

1. Manual monitoring of the water quality of catfish ponds has limitations in time, cost, and effectiveness.
2. Lack of application of IoT technology for real-time monitoring of water quality in catfish ponds.
3. There is no early warning system through mobile phone notifications that helps catfish farmers maintain the quality of pond water.

¹⁰ "G1 Land Proof," n.d.

¹¹ "Bukti Lahan Al-Amin Hudatul Muna," n.d.

¹² Wikipedia, "Definition of IoT," 2023, https://simple.wikipedia.org/wiki/Internet_of_things.

¹³ Hsiu-Yu Wang, Chechen Liao, and Ling-Hui Yang, "What Affects Mobile Application Use? The Roles of Consumption Values," *International Journal of Marketing Studies* 5, no. 2 (2013): 11–22, <https://doi.org/10.5539/ijms.v5n2p11>.

¹⁴ Wang, Liao, and Yang.

¹⁵ Arsyi Mart Hendri et al., "Ammonia Level Monitoring and PH Control Tool in IoT-Based Catfish Ponds," *Brilliant: Research and Conceptual Journals* 8, no. 1 (2023): 272, <https://doi.org/10.28926/briliant.v8i1.1200>.

1.3 Purpose

Based on the formulation of the problem, the objectives of this study are:

1. Developing an IoT-based catfish pond water quality monitoring system for real-time temperature and pH parameters.
2. Build a notification-based early warning system that can be accessed through the mobile application.

1.4 Research Benefits

This research is expected to provide the following benefits:

1. For Catfish Farmers
 - a. Simplify real-time monitoring of pool water quality through IoT technology and mobile applications.
 - b. Increasing cultivation efficiency with early warning when water quality is outside safe limits.
2. For Academics
 - a. Adding insight related to the application of IoT in monitoring the water quality of catfish ponds.
 - b. Contribute to the development of relevant technologies for aquaculture.
3. For the Community
 - a. Raising awareness about the importance of maintaining water quality for environmental sustainability and health.
 - b. Providing real-time access to information through technology that can be used widely.

1.5 Problem Limitations

The objectives of this study are:

1. Developing an IoT-based catfish pond water quality monitoring system for real-time temperature and pH monitoring.
2. Build a notification-based early warning system that can only be accessed through a mobile application.