Database replication method for real-time measurement pH parameter of fishery using a wireless sensor system

by Muhammad Imam Ghozali

Submission date: 29-Jun-2020 08:36PM (UTC+0700)
Submission ID: 1351332890
File name: Sugiharto_2020_J._Phys.__Conf._Ser._1524_012021.pdf (905.33K)
Word count: 2294
Character count: 12436

Database replication method for real-time measurement pH parameter of fishery using a wireless sensor system

Database replication method for real-time measurement pH parameter of fishery using a wireless sensor system

W H Sugiharto[1], M I Ghozali[1], H Susanto[2], M A Budihardjo[3], S Suryono[4]

[1]Department of Informatics Engineering, Faculty of Engineering, Universitas Muria Kudus, Kudus – Indonesia
[2]Department of Chemical Department of Chemical Engineering, Universitas Diponegoro, Semarang, Indonesia
[3]Department of Environmental Engineering, Faculty of Engineering, Diponegoro University, Semarang - Indonesia
[4]Physics Department of Science and Mathematics Faculty, Diponegoro University, Semarang – Indonesia

Corresponding author: wibowo.harrys@umk.ac.id

Abstract. The problem of mass fish mortality in Indonesia is already common, Environmental conditions determine the survival of fish. Determination of water environmental conditions has water parameters including water (depth, brightness, water temperature, acidity (pH), dissolved oxygen (DO) and ORP (Oxidation Reduction Potential)). Acidity (pH) is one of the important things in determining the water quality of water. The pH generally increases due to polluted waters. Environmental conditions that are always changing will affect the life processes of organisms in it, especially fish need to be monitored in realtime, especially to avoid massive fish mortality. This paper purpose the real-time acquisition builds with combine the wireless sensor system and database replication concept. From the result of implementation database replication method for real-time measurement pH parameter of fishery agriculture using wireless sensor system, that's the system can perform continuously to real-time acquisition data online

1. Introduction

Fisheries have now become a fast-growing industry due to a significant increase in demand to meet human nutrition [1][2]. Fish is one of the most efficient converters of feed into high-quality food and its carbon footprint is lower compared to other animal production systems [3]. In aquaculture development efforts such as fish farming, there are several types of fish including freshwater fish [4][5] and saltwater fish [6] [7]. Freshwater aquaculture has several fish alternatives that have high economic value, namely goldfish, Mujair fish, Tilapia fish, Gurame fish, Catfish, Patin fish, and Cork fIsh [8].

Indonesia as a maritime country has a very high potential as a supplier of fish throughout the world [9]. For example, Indonesia is the largest supplier of tuna in the world, and the largest supplier of crabs in the United States[10]. In 2011 the total fishery production reached 13.64 million tons, 2012 reached 15.50 reached a total production of 15.50 million tons, 2013 produced 19.42 million tons, 2014 a total production of 20.84 million tons, 2015 produced 22.15 million tons, and in 2016 produced a total production of 23.51 million tons. This total production is obtained from the results of fishing and aquaculture[11].

This proves the number of fish production continues to increase every year. The total production between 2011-2016 has a fish catch production rate that does not increase rapidly, with a total production of 5.7 million tons to 6.8 million tons. For 5 years there was only an increase of 1.1 million tons. Aquaculture has increased from a total production of 7.9 million tons, increasing rapidly to 16.6 million tons, an increase of 8.7 million tons in 5 years. Aquaculture has a very big role to meet the needs of fish consumption per year. In Indonesia the need for fish consumption per year in 2014 reached 38.1 Kg / Cap / Year, 2015 reaching 41.11 Kg / Cap / Year, 2016 43.9 Kg / Cap / Year, and in 2017 the need for fish consumption in Indonesia reached 46.49 Kg / Cap / Year [11].

Aquaculture can't be separated from several problems, including mass mortality in fish. The problem of mass fish mortality in Indonesia is already common and generally occurs in stagnant freshwater waters such as reservoirs and lakes [12][13]. Environmental conditions determine the survival of fish. Determination of water environmental conditions has water parameters including water (depth, brightness, water temperature, acidity (pH), dissolved oxygen (DO) and ORP (Oxidation Reduction Potential)) [14].

Acidity (pH) is one of the important things in determining the water quality of water. The pH generally increases due to polluted waters [15] [16][17]. pH indicates how acidic or basic a substance is. H refers to the number of hydrogen ions and hydroxide ions present in cait substances, these hydrogen ions affect the nature of a substance. The lower the number of hydrogen ions it's mean the more acidic substances. The higher the number of hydrogen ions means the more acidic substances. The pH scale has a value between 1-14 and neutral pH is at a pH level of 7.

Water pH will affect the fertility level of fish, fish will be more fertile if they live in a pH that is appropriate to their original environment. Some fish species have different pH levels. Young fish are more sensitive to higher acidic water than adult fish [18][19]. Environmental conditions that are always changing will affect the life processes of organisms in it, especially fish need to be monitored in real-time especially to avoid massive fish mortality [20].

The real-time data acquisitions have become a major issue [21][22], especially in water pollution monitoring [23][24], Without real-time information, people cannot avoid the danger of mass fish die because of unhandled water pH. Computer network-based automation can improve work effectiveness in measurement in processing. Computer-based systems are more precise and faster in execution so it is suitable for the that require high response speed [25]. This paper purpose to the new approach of using database replication for real-time monitoring of a wireless sensor system. Database replication is made replicas of a user and synchronizes with the design master on a network server [26]. The real-time information can be used as a reference to handling water pH.

2. Methods

2.1. Wireless sensor system

Wireless sensor network technology has been emerging as a viable solution to many innovative applications [27]. The Wireless Sensor Network consists of several sensors distributed randomly to measure physical parameters of the environment and transmit readings from these sensors wirelessly to the central station. The application of wireless sensors is being widely applied in environmental surveillance [28] because the wireless sensor network is a technology developed to collect data in real-time [29].

The wireless sensor network is an important application as it is used in environmental monitoring and target tracking. This has been implemented in recent years, with sensors that are getting smaller, cheaper and smarter. These sensors are equipped with wireless interfaces so that they can communicate with each other to create a network [30][31]. The main components of a WSN system consist of sensor nodes, base stations and databases, and web servers. The base station receives measurement data from the sensor node that is distributed periodically and then the data is forwarded to the database server for storage and management [32].

2.2. *Database replication concept*

Represents the process of sharing information to ensure consistency between redundant resources. database replication is the same store on multiple storage devices, or computation replication if the executed many times. Replication represents the process of sharing information to ensure consistency between redundant resources. data replication is the same data stored on multiple storage devices, or computing replication if the same computing task is executed many times.

Database replication is the duplicate process on multiple instances of the same database and the process of sharing data or database design changes between databases in different locations [26][33]. Figure 2 Shows the Cascading database replication.

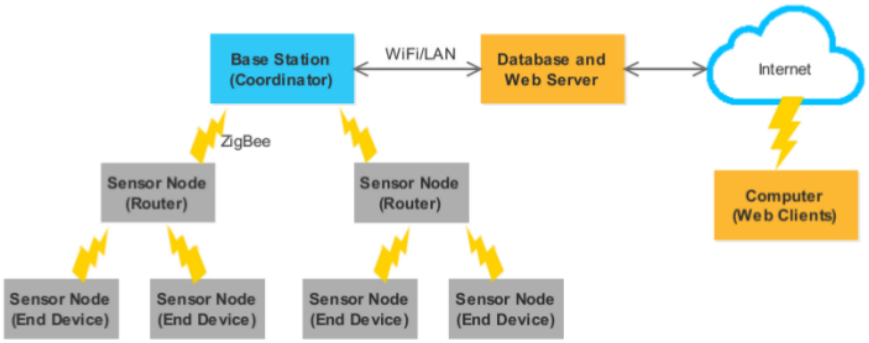

Figure 1. Wireless sensor network architecture

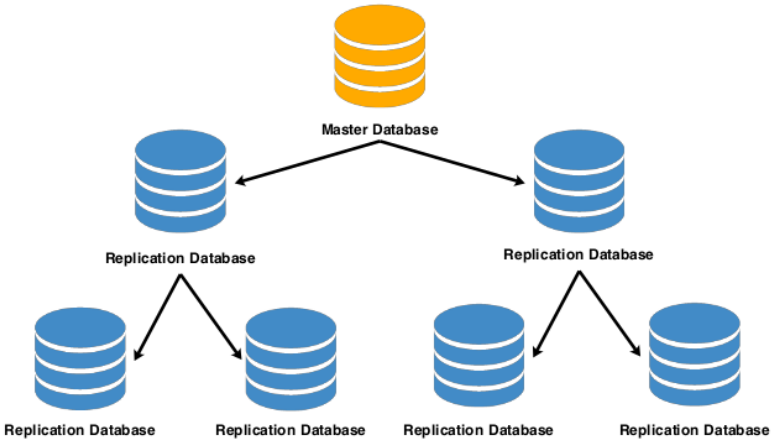

Figure 2. Cascading database replication.

2.3. *Real-time data acquisition*

The purpose of real-time data acquisition in this paper using pH sensors to capture the pH value. Figure 3. Show the real-time acquisition build to combine the wireless sensor system and Database replication

concept. The sensors installed on the node station will save the data into a local database, then the data from the local database replicate into replication in web service via HTTP request/response. The result will publish into the web as a reference to handling water pH.

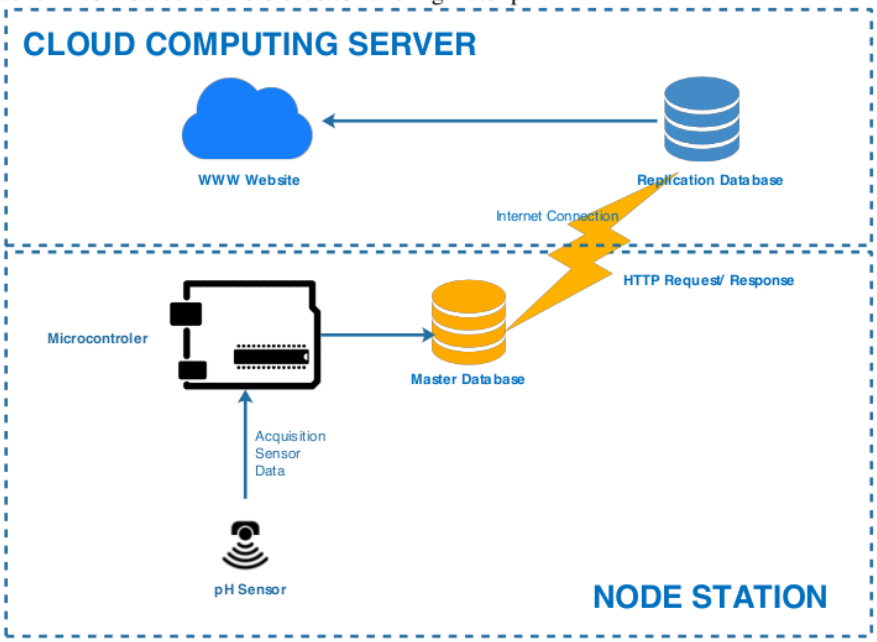

Figure 3. Real-time pH data acquisition with database replication

3. Real-time database replication implementation

Implementation of the Real-time pH Data Acquisition with Database Replication is applied to the web-based applications using PHP Web Programming and MySQL Database for the master and replication database. This application using HTTP request and response to send data from the master database (on the local database) to the replication database (on server database) it's shown in Figure 4.

For the node station shown in Figure 5, is built from the pH sensor in Figure 6 and microcontroller. The microcontroller collects data from the sensor and saves data into a local database as a master database.

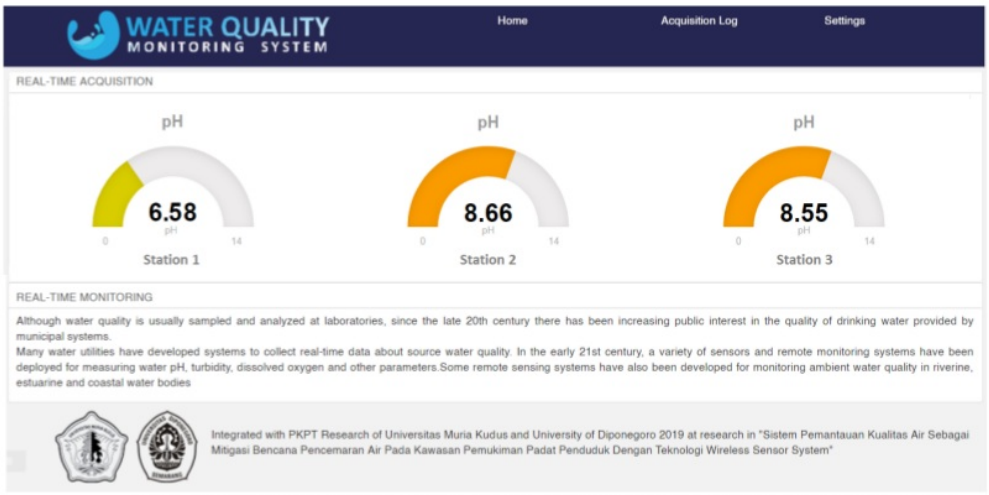

Figure 4. Real-time pH data acquisition website with database replication on cloud computing server

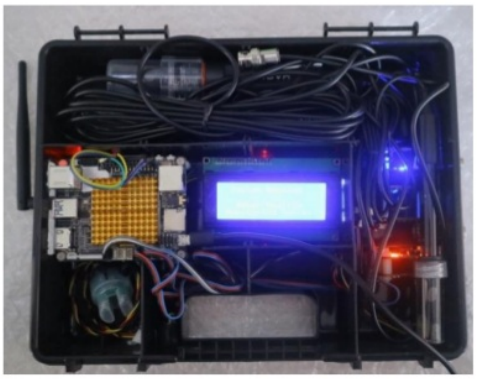

Figure 5. Node station

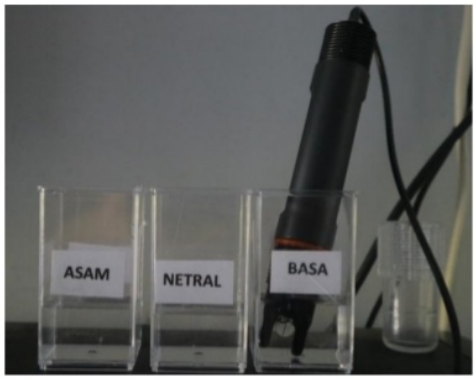

Figure 6. pH sensor

4. Conclusion

From the result of implementation Database Replication Method for Real-Time Measurement pH Parameter of Fishery Agriculture Using Wireless Sensor System, that's the system can perform continuously to real-time acquisition data online. With the combined concept of replication, the database is possible to build multiple data acquisition from multiple node station. This method had a weakness is the master database on the node station server continues every second checking data to send newer data to the replication database on the cloud server.

Acknowledgment

The research is funded by the Directorate of research and community services Directorate General of Strengthening Research and Development Ministry of Research, technology and higher education In accordance with the letter of the contract Research Number: 86./LPPM.UMK/B.09.55/V/201

References

[1] Fatuchri M 2002 *J. ikhtiologi Indonesia*
[2] Chasanah E, Nurilmala M, Purnamasari A R and Fithriani D 2015 *J. Pascapanen dan Bioteknol. Kelaut. dan Perikan.*
[3] Béné C *et al.* 2015 *Food Secur.*
[4] Rosalina D 2005 *Maspari J.*
[5] Muhammad W N and S Andriyanto 2013 *Media Akuakultur*
[6] Hatmanti A, Nuchsin R and Dewi J 2010 *MAKARA Sci. Ser.*
[7] Neptunus 2008 *Budidaya Ikan Kerapu (Serranidae) dan Kualitas Perairan*
[8] Listyanto N and S Andriyanto 2009 *Media Akuakultur*
[9] Tran N *et al.* 2017 *Mar. Policy*
[10] Pratama A M 2019 https://money.kompas.com/read/2019/04/12/172100026/menteri-susi-indonesia-penyuplai-tuna-terbesar-dunia. [Accessed: 19-Aug-2019]
[11] Kementrian Kelautan dan Perikanan 2018 *Forum Merdeka Barat 9Kementerian Komun. Dan Inform.*
[12] Nasution Z, Sari Y D, and Huda H M 2011 *J. Kebijak. Sos. Ekon. Kelaut. dan Perikan.* vol. **1** no. 1 pp. 19–31
[13] Rasidi R, E Erlania, and A B Prasetio 2010 *Media Akuakultur*
[14] Putri M R A, Hartati S T, and F Satria 2016 *Bawal Widya Ris. Perikan. Tangkap* vol. **8** no. 2 pp. 77–90
[15] Gerhardt A, Janssens L D B, and Soares A M V M 2004 *Environ. Pollut.*
[16] Chuan M C, Shu G Y, and Liu J C 1996 *Water. Air. Soil Pollut.*
[17] Kohlmann F 2003 *A Tech. Handb. Ind.*
[18] Sigit A 2019 *Puluhan Ribu Ikan Mati di Laguna Tisik, pH Air di Atas Normal okezone.com*
[19] Irwandy S, Usman, and Polaris N 2011 *Studi Kualitas Air Untuk Kesehatan Ikan Dalam Budidaya Perikanan Pada Aliran Sungai Kampar Kiri* vol. **1** no. April pp. 64–70
[20] Nisa K M, and Fitrani M 2014 *J. Akuakultur Rawa Indones.* vol. **1** no. 1 pp. 57–65
[21] Suryono S, Surarso B, R Saputra, and S Sudalma 2019 *J. Appl. Eng. Sci.* vol. **17** no. **1** pp. 18–25
[22] Otahalova T, Slanina Z and Vala D 2012 *IFAC Proc. Vol.* vol. **11** no. PART 1 pp. 261–264
[23] Perumal T, Sulaiman M N and C Y Leong 2016 *IEEE 4th Global Conference on Consumer Electronics GCCE 2015*
[24] Realtime Water Quality Monitoring 2018 *Int. J. Comput. Commun. Netw.*
[25] Suryono S, Suseso J E, Mashuri C, Sabila A D, Nugraha J A M, and Primasiwi M H 2017 *Adv. Sci. Lett.*
[26] Kemme B, Jimenez-Peris R and Patino-Martinez M 2010 *Synth. Lect. Data Manag.* vol. **2** no. 1 pp. 1–153
[27] Ferdoush S and X Li 2014 *Procedia Comput. Sci.* vol. **34** pp. 103–110
[28] Ozdemir S 2009 *RFID and Sensor Networks: Architectures, Protocols, Security, and Integrations*
[29] Chen W, Chen L, Chen Z, and Tu S 2005 *Proceedings of the International Conference on Parallel Processing Workshops*
[30] Yick J, Mukherjee B and Ghosal D 2008 *Comput. Networks*
[31] Srivastava S, Singh M and Gupta S 2019 *ICACE 2018*
[32] Othman M F and Shazali K 2012 *Procedia Engineering*
[33] Mazilu M C 2010 *Database Syst. J.* vol. **1** no. 2 pp. 33–28

Database replication method for real-time measurement pH parameter of fishery using a wireless sensor system

ORIGINALITY REPORT

12%	13%	14%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.e3s-conferences.org Internet Source	5%
2	Ourania Sidiropoulou. "Effect of mesh geometry on resistive Micromegas for the ATLAS experiment", Journal of Physics: Conference Series, 2020 Publication	4%
3	www.dbjournal.ro Internet Source	3%

Exclude quotes	On	Exclude matches	< 3%
Exclude bibliography	On		

Kudus, 30 Juni 2020
Ka. UPT Perpustakaan UMK

Noor Athiyah, S.S., M.Hum.