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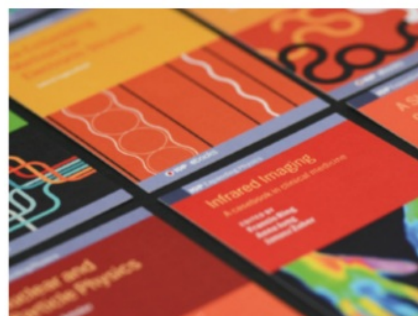
by Muhammad Imam Ghozali

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QoS of network infrastructure in a wireless sensor system for real-time measurement pH parameter of fishery

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Abstract. The problem of mass fish mortality in Indonesia is already common and generally occurs. Environmental conditions determine the survival of fish. Acidity (pH) is one of the important things in determining the water quality of water. real-time information about pH water is important to avoid the danger of mass fish dies because of unhandled water pH. *Network Infrastructure* devices comprise those devices that facilitate the movement of data along with the communication media. the difference between the station distance and the wireless access point does not affect the change in the bitrate of each station QoS measurements based on data distribution delay. Shows that if the wireless sensor's connectivity in sending data acquisition pH from the node station to the web service, Delay data transmission affects the accuracy of the measurement and presentation of data on the cloud server.

1. Introduction

The total area of Indonesia is 7.81 million km^2 which consists of 2.01 million km^2 of land, 3.25 million km^2 of the sea, and 2.55 million km^2 of the Exclusive Economic Zone (EEZ). Indonesia became a country with a greater water area than the land area, therefore Indonesia is referred to as the Maritime State. Indonesia is the second-largest producer of marine fisheries in the world, after China. Indonesian society in 2017 experienced an increase in fish consumption. From these data the total Indonesian fish consumption of an average of 20-31.4 kg/cap (moderate), in recent years even tends to increase 31.4 kg/cap-height. With consumption increasing every year, meeting the needs of fisheries production becomes important [1].

From 2011 to 2016 fisheries production in Indonesia has increased both from capture fisheries and aquaculture production, where aquaculture production is greater than capture fisheries. For example, in 2016 capture fisheries production was 6.83 million tons while aquaculture production was 16.68 million tons, the range of margin data is the basis for opportunities to open new land for fish conservation for Indonesian people. Starting in 2014 - 2017 the area of conservation areas has always increased, from 16.4 million hectares in 2014 to 19.14 million hectares in 2017[1].

Unfortunately, the problem of mass fish mortality in Indonesia is already common and generally occurs [2], for example, November 30th, 2015 more than 650 kg fishes found dead in the coast of Ancol-Jakarta[3], March 2010dmore than 1.150-ton fishes found dead inManjau Lake -West Sumatera 1.150 [4]. 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. real-time information of pH water is important to avoid the danger of mass fish dies because of unhandled water pH.pH indicates how acidic or basic a substance is. H refers to the number of hydrogen ions and hydroxide ions present in substances; these hydrogen ions affect the nature of a substance. Some fish species have different pH levels. Wireless sensor network activities include several aspects of data traffic including receiving, sending and processing data[5], this wireless sensor network can be used to monitor pH in real-time. The development of wireless sensor networks has begun to develop in various aspects of life including the environment[6], natural disasters [7], medical health [8], agriculture [9], transportation [10], industry [11] and smart city [12].

Performance of the wireless sensor system is strongly influenced by the network infrastructure, errors in infrastructure can have an impact on the failure of sending data to the wireless sensor, so information cannot be conveyed in real-time. QoS can be defined as well as the ability to provide performance guarantees on the network. The performance of the wireless sensor system can be seen based on QoS measurement parameters including Packet Loss, Delay (Latency), Jitter, and Throughput [13].

When the network infrastructure is built the next challenge is maintenance to ensure the network running well, unfortunately, stable Quality of Service (QoS) requirements become an interesting problem because of heterogeneous data traffic flows, dynamic network conditions, and resource-limited nature of sensor nodes [8].

The development of the Wireless Sensor Network communication system is usually using multi-hop communication design, more routing loops used in the wireless sensor system will affect the sensor data distribution [14]. The real-time performance of the communication data in the wireless sensor system to the router requires a stable quality of service (QoS) [15][16]. This paper purpose to measure the QoS in the design of wireless sensor network infrastructure to maintain the performance of the network to deliver real-time data.

2. Method

2.1. Wireless sensor system
Wireless sensor network technology has been emerging as a viable solution to many innovative applications [17]. 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 [18]because the wireless sensor network is a technology developed to collect data in real-time [19].

2.2. QoS
Quality of service comprises requirements on all the aspects of a connection, such as service response time, loss, signal-to-noise ratio, crosstalk, echo, interrupts, frequency response, loudness levels, and so on. A subset of telephony QoS is a grade of service (QoS) requirements, which comprises aspects of a connection relating to capacity and coverage of a network, for example, guaranteed maximum blocking probability and outage probability.

QoS is sometimes used as a quality measure, with many alternative definitions, rather than referring to the ability to reserve resources. Quality of service sometimes refers to the level of quality of service, i.e. the guaranteed service quality. High QoS is often confused with a high level of performance, for example, high bit rate, high latency and low bit error rate [5].

2.3. Network infrastructure

Network Infrastructure comprises those devices that facilitate the movement of data along with the communication media[20]. A link is a communication path between two nodes. The terms " circuit " and " Channel " are frequently used as synonyms for the link. There are different types of topologies like bus, ring, tree, mesh etc. However, we will consider five basic network structures-topology [21]. Therefore, it is necessary to build the right network topology without obstacles to collect geologically distributed data quickly and move it to the data center for subsequent processing [22].

Network topology without using a router when QoS analysis shows packet loss during data distribution, after the addition of a router results in a decrease in packet loss during data distribution [23]. Figure 1 shows the router hardware and Figure 2 shows the access point hardware to build the infrastructure of the wireless sensor network.

Figure 1. Router Hardware

Figure 2. Access point hardware

3. Network infrastructure for wireless sensor design

Figure 3 shows the design of infrastructure network realtime pH acquisition, this design involves the multiple node station. The node station has a pH sensor to collect pH value in the monitoring area. Each node station connects into the wireless access point in the monitoring area. Router gateway manages the transmission data between access point and internet service provider. The data then sent into the cloud computing server and represent real-time data acquisition from the node station. Figure 4 shows real-time online data is present with a web-based online application.
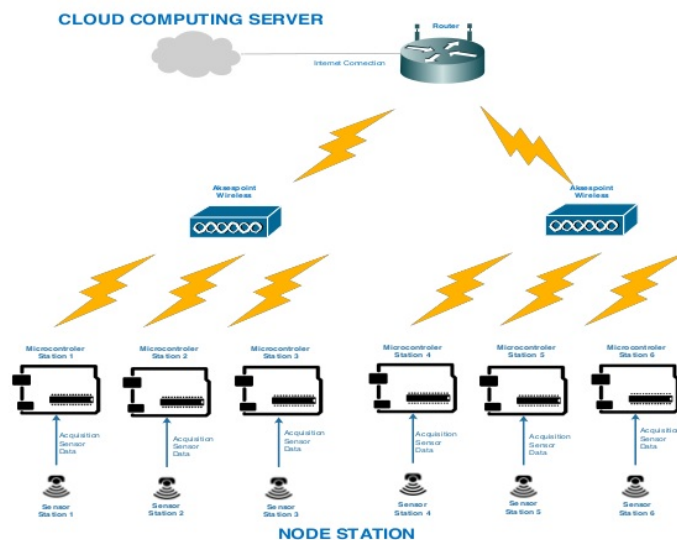

Figure 3. Real-time infrastructure data acquisition

Figure 4. Implementation of Network Infrastructure For Wireless Sensor

4. Result and discussion

4.1. Implementation of network infrastructure for wireless sensor

Node Station is equipped pH sensor and wireless device to connect into an access point its show in Figure 5 and Figure 6. The Figure shows the access point connected into the router gateway that's served internet connection by Internet service protocol. Realtime web-based online application for pH sensor its show in Figure 7, that's the application present the multiple data from each node station.
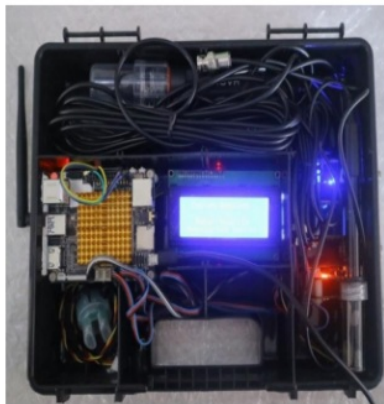

Figure 5. Node station

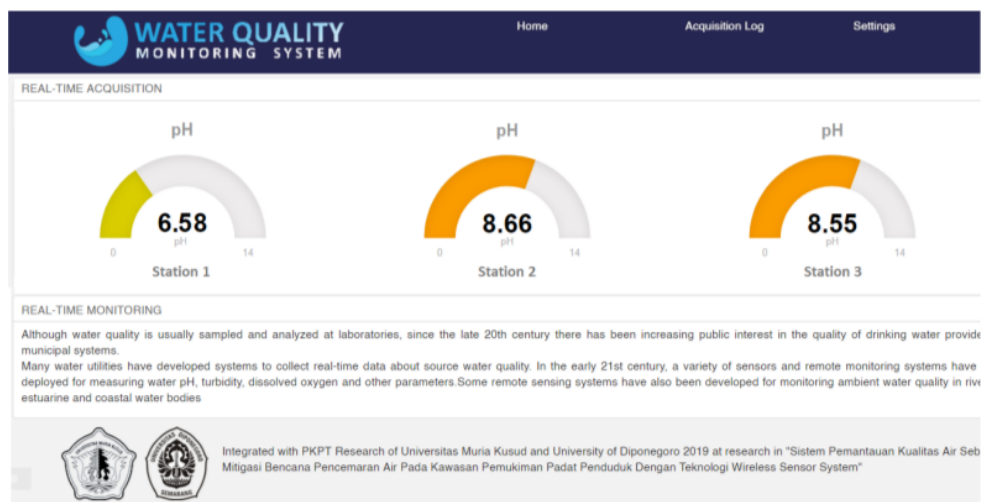**Figure 6.** Wireless connection on a node station

Figure 7. Real-time pH data acquisition website on cloud computing server

4.2. QoS of network infrastructure for wireless sensor

The results of the measurement of delay can be seen that the delay of each station changes, where the difference between the station distance and the wireless access point does not affect the change in the bitrate of each station. What matters is the greater the bitrate value, the smaller the delay that occurs. This condition occurs because when the bitrate that is transmitted is large, the data transfer process will become faster. So the time needed for the data to arrive is faster.

Table 1 QoS measurement of delay and bitrate each station

Station	Distance (km)	Bitrate	Delay (bit)
1	2	220	0.04
2	5	199	0.08
3	10	155	0.08
4	15	120	0.15
5	20	96	0.27
6	30	77	0.25

5. Conclusion

Based on QoS measurements based on data distribution delay in table 1. Shows that if the wireless sensor's connectivity in sending data acquisition pH from the node station to the web service, Delay data transmission affects the accuracy of the measurement and presentation of data on the cloud server.

Acknowledgment

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