

Design and Analysis of Automatic Monitoring System for Dissolved Oxygen in Fish Pond

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Abstract: Dissolved oxygen is an important monitoring indicator in the water quality monitoring of fish ponds. This paper designs an automatic monitoring system, which uses gsm module to maintain remote communication with the user client, so that users can obtain dissolved oxygen in fish ponds through the Internet of Things. The amount of information to effectively control the fish pond environment. Starting from the hardware design and software design, the module usage in the system is elaborated, and the system control measures are verified through verification.

1. Introduction

Based on the development of network information technology and sensing technology, the Internet of Things relies on the Internet. Under the advantage of radio frequency identification technology and wireless communication technology, the Internet of Things has created a real-time sharing network of goods information for people to facilitate people from real objects. Get an Abstract.conceptual model. With the development of aquaculture industry, China's agricultural exporting country, the monitoring of fish pond water environment is related to the development of aquaculture industry, reasonable monitoring and adjustment of temperature, is conducive to ensure that the concentration of dissolved oxygen meets the needs of fish pond farming.

2. Design and Analysis of Automatic Monitoring System for Dissolved Oxygen in Fish Pond

2.1. Hardware design

In order to promote the prosperity of the aquaculture industry, it is imperative to design a set of automatic monitoring system for dissolved oxygen in fish ponds. The current foreign systems have become more perfect, but China's water environment is different from that of foreign countries. Most of the foreign countries are fish in the flowing waters. China is a still water fish. If the whole system is imported, it will bring detection error. At present, the fish pond automation device needs to set the time according to the experience, so that the aerator can start and stop automatically. In order to let the fish have a good growth environment, the oxygenation machine starts for a long time, which not only brings power loss, but also cannot Users provide a remote monitoring environment. In this paper, a set of fish pond dissolved oxygen monitoring system based on IoT ZigBee network is designed, and the system of remote monitoring of fish pond environment is realized by LabVIEW recording, display and control, and the working condition of fish pond aerator is controlled in real time. The user can use the smartphone or computer client to control the fish pond aerator. When the fish pond environment exceeds the standard, the system automatically sends an alarm signal to the user. The user starts and stops the aerator according to the prompt, and reduces the power consumption caused by the long-term operation of the device. .

Based on the above, dissolved oxygen in fish ponds requires real-time collection and processing of information data. Efficiency, reliability, real-time and energy-saving are the key factors in system design. The ZigBee network is very power efficient and saves wiring costs in a wireless connection. Analysis of the overall structure of the fish pond dissolved oxygen monitoring system, users can

remotely monitor the system master station database based on the Internet and GSM network. The system can be divided into two parts: the main station and the extension. The main station is responsible for the data storage, processing and release, providing early warning information for the user client; the extension is responsible for collecting signals, calculating the temperature, and controlling the aerator. The two are connected through the ZigBee network, which has the function of self-organizing network. It is relatively simple to increase or decrease the node. The vector table is updated in the networking module in the manner of the spanning tree protocol. When the network is physically partitioned, the node searches for other paths to transmit data[1] to the system master station.

The main station design of the fish pond dissolved oxygen automatic monitoring system mainly consists of three parts: the AVR MCU reads the data from the ZigBee module, and then transfers the data to the host computer; the host computer runs the program written by LabVIEW to realize the control of dissolved oxygen in the fish pond. And display, all data is stored in the database; the GSM module and the user's smartphone constitute the external communication part, the upper computer needs to configure the corresponding apache server and user Internet communication. The main station of the dissolved oxygen automatic monitoring system of the fish pond accepts the dissolved oxygen signal from the extension, and stores the data in the database under the operation of the LabVIEW program of the upper computer, so that the user can enter the database to view the content in real time, so as to understand the current dissolved oxygen content of the fish pond. The program can transmit the aerator start and stop signal to the extension according to the customized upper limit value and the lower limit value in a user-defined situation.

Based on the gsm module, the system main station communicates with the user. When the user requests the system to view the dissolved oxygen in the fish pond, the main station remotely queries the dissolved oxygen data transmitted from the fish pond, or retrieves the dissolved oxygen in the fish pond in the database. Historical data that conveys the information the user needs to the user. If the dissolved oxygen in the fish pond exceeds the limit, the primary station will send an alarm message to the user and send an order to the extension to control the fish pond aerator. The system main station communication function includes the number of slave stations, the owner's phone, the dissolved oxygen upper limit value and the lower limit parameter of the fish pond. Through the setting of these contents, the user can change the target mobile phone number in the fish pond dissolved oxygen automatic monitoring system. Among them, the lower limit of dissolved oxygen can be adjusted according to seasonal changes, and the fish pond dissolved oxygen monitoring system will also default to various parameter values. The main station can help users to unify the domain name address through dynamic domain name resolution software, so that people can log in to the system main station[2].

The main station design of the fish pond dissolved oxygen automatic monitoring system only needs to apply the GSM module, and the substation only uses the ZigBee network, thereby saving the network communication cost. After the user uses the system, not only in the power saving, human resource allocation and fish pond aquaculture industry development, the physical network server also provides users with more high-quality functional services, the database can facilitate users to view the fish pond dissolution in real time. Recordings related to oxygen and water quality environment.

The slave station receives the dissolved oxygen collection command from the fish station of the main station, and realizes the collection and forwarding of the signal, and controls the opening and stopping of the aerator in time. The sensor output current signal, under the action of amplification filtering and A/D conversion, uses the SPI bus to transfer the data to the AVR MCU. The MCU integrates the dissolved oxygen signal of the fish pond and the temperature sensor signal to realize the temperature of the dissolved oxygen signal in the fish pond. make up. The MCU transmits the compensated dissolved oxygen and temperature signals of the fish pond to the ZigBee module through the serial port protocol, and then passes it to the system main station. The signal returned by the system master station will also control the fish pond aerator through the AVR microcontroller.

Between the various extensions of the fish pond dissolved oxygen automatic monitoring system, the extension and the host need to communicate through the ZigBee module, which needs to work in the 2.4 GHz ISM band. This process does not require renting a toll signal, and can directly apply spread spectrum technology to improve the anti-interference ability of the fish pond dissolved oxygen monitoring system. The system uses the CC2430 system-on-chip ZigBee module produced by a certain company in the design. It does not cause excessive current loss during operation, and the current is only 27mA when transmitting and receiving data. The redundant link needs to be set in the network to ensure that the network of the fish pond dissolved oxygen automatic monitoring system can still operate after the module exits the network. However, redundancy will cause loops in the network, so that the transmission of information will cause repeated frame transmission, and the signal may not be stable enough when broadcasting. The spanning tree protocol is applied in the system communication network to highlight the advanced nature of the loop-free logical topology. The spanning tree protocol can continuously detect the system network. Once the network topology changes, the network will continue to update with changes. The Spanning Tree Protocol blocks redundant link ports at the logical layer when there is a loop in the network to ensure a loop-free state of the network. When the network increases or decreases nodes, the spanning tree protocol can establish a new link within the time allowed by the network to ensure that the system network is not interfered with.

2.2. Software design

The upper computer software of the fish pond dissolved oxygen automatic monitoring system needs to be implemented under the LabVIEW program. The software functions include data storage, display and data transmission with the user. The LabVIEW program can display the dissolved oxygen information of the fish pond by combining the tag numbers of different fish ponds. The LabSQL plug-in stores information in the MySQL database at regular intervals. All data are date, time, fish pond label, fish pond dissolved oxygen, temperature and alarm sign. To classify. The user can view the dissolved oxygen curve of the fish pond in the past through historical data to determine whether a manual opening of the aerator is required. In the LabVIEW software interface, the program receives the digital dissolved oxygen in the fish pond from the single-chip microcomputer based on the serial communication protocol. The user can set the lower limit of dissolved oxygen in different fish ponds to ensure that different types of fish have suitable growth environment.

3. Experimental Verification of Automatic Monitoring System for Dissolved Oxygen in Fish Ponds

Analysis of the impact of dissolved oxygen in fish ponds on the aquaculture industry, people have developed an automatic monitoring system for dissolved oxygen in fish ponds, and officially used in aquaculture farms in some places. In the experiment, people conducted on-site dissolved oxygen experiments on fish ponds that were cultured with white peony. The system was set up with a main station and two base stations. The fish pond area was 20 mu, the water depth was 2 meters, and the sensor entered the water at 0.85 meters. Take a certain day as a case to analyze the temperature and dissolved oxygen information detected by the system on this day. The experimental results are as follows: temperature is 26.6e at 0:00, dissolved oxygen concentration is 1.8mg/L; temperature is 26e at 3:00, dissolved oxygen concentration is 1.6mg/L; temperature is 26.9e at 6:00, dissolved oxygen concentration It is 3.5mg/L; the temperature is 29.2e at 9:00, the dissolved oxygen concentration is 5.9mg/L; the temperature at 12:00 is 27.8e, the dissolved oxygen concentration is 8.8mg/L; the temperature at 15:00 is 28.5e, and the dissolved oxygen concentration is 10.4mg/L; 18:00 temperature 28.3e, dissolved oxygen concentration 9.9mg/L; 21:00 temperature 27.4e, dissolved oxygen concentration 5.0mg/L; 24:00 temperature 26.8e, dissolved oxygen concentration 2.2mg/ L[3].

According to the analysis, when the dissolved oxygen concentration is less than 1.5mg/L, the fish in the fish pond will die due to insufficient oxygen supply, and the dissolved oxygen must be

kept above 2.5mg/L, so that the fish can grow normally. After adding the fish pond dissolved oxygen automatic monitoring system, the experiment will set the lower limit of dissolved oxygen of the host to 2.5mg/L, which can ensure that the dissolved oxygen concentration of the whole fish pond is higher than 2.5mg/L, and the white peony can be under the control of the system. Maintain normal growth. After many tests and analysis, it is recommended to set up 2 3kW aerators per mu of fish ponds. If the pond culture density is large, it is recommended to open at least 5 aerators every day. The total opening time of the aerators is reached. 12 hours, an average of 5 hours a day. After applying the system, it can save about 40% of the cost of fish pond aquaculture and increase the fish production to some extent.

When the temperature difference between day and night is large, the staff is required to adjust the automatic monitoring system of dissolved oxygen in the fish pond. In fish farming, phytoplankton needs to be cultured. The pH value is tested twice a day in the morning and evening. If the results of the two tests are quite different, this indicates that the phytoplankton production is strong. The daytime sunshine is sufficient, and the oxygen capacity of the water is high. At 3 o'clock in the afternoon, the difference in dissolved oxygen between the upper and lower layers of the fish pond is the largest. Therefore, the staff is required to apply the system for regulation and testing, and open the aerator in time to ensure the full mixing of the upper and lower layers of water in the fish pond. Microbial preparations can also be used to ensure balanced growth of aquatic plants. The water temperature drops at night, and the dissolved oxygen in the upper layer is the lowest at about 5 pm. At this time, the system should be used to measure the dissolved oxygen amount, and the aerator will be adjusted in real time.

4. Summary

In summary, this article cites ZigBee wireless network technology, based on the Internet of Things and GSM network, allows users to remotely control the fish pond environment, timely understand the dissolved oxygen information of the fish pond, and protect the development of fish farming through the start-stop control of the aerator. After the application of the system, through the detection of temperature and dissolved oxygen, the system starts the aerator when the dissolved oxygen is too low, thereby reducing the cost of electricity consumption and improving the production efficiency of fish farming.

References

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