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Water Quality Monitoring Using of Wireless Sensor

Bhupendra Singh Rawat[1], Gaurav Phulwari[2], Trimurti Narayan Pandey[3]

[1*]ACERC, Ajmer (Raj.) India
[2]Bhagwant University, Ajmer (Raj.) India
[3]Bhagwant University, Ajmer (Raj.) India

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Abstract:-The quality of water resources has a direct impact on the daily life of mankind and the sustainable development of society. However, with the rapid development of national industrialization, the current industrial wastewater discharge and improper handling have become more and more serious, especially for the growing domestic water pollution today; it is an urgent need for an efficient water quality monitoring system. With the rapid development of wireless sensor network application technology, people put forward higher requirements for the quality of water environment; wireless sensor network can be used in water environment for real-time monitoring of water quality.

Keywords- water; water quality monitoring system; wireless sensor network.

1. INTRODUCTION

In the context of economic globalization, water pollution in various countries is more serious, with the quick development of Zigbee technology, its powerful features are recognized and applied in various fields, but the traditional wireless sensor technology is generally applied to land, and land Research in various fields is relatively mature, but in the marine field, mainly the study of water quality monitoring is still unmarked. In view of this situation, this paper based on the seriousness of polluting water resources, as well as the water environment and its water environment in some of the essential elements of the analysis puts forward a real-time monitoring system based on wireless sensor network for water quality monitoring in water resources. The system through the monitoring of the installation of sensor nodes in the waters, timely collection of information, to the water quality monitoring and management centre to upload data, and according to the uploaded data to determine whether the pollution of water quality, and then make the alarm processing, real-time and effective management of water resources.

2. APPLICATION BACKGROUND

Water is one of the indispensable elements of mankind. Scientific research shows that people can survive for a week without food, but they can only survive for three days without drinking water. Looking at scrutiny of global water resources , the earth we live in seems to be covered with water, but the real consumption of fresh water is less than 0.2% of total water, coupled with the seriousness of water pollution, we human Survival environment is very critical. Water resources are increasingly tense, China's water resources are also very scarce, and China's drinking water accounted for less than five points, per capita water resources accounted for the proportion of the world's per capita share of four percent. With the development of the economy, water pollution has become more and more serious, and many cities have emerged water shortage. With the development of the times and the continuous progress of human civilization, people gradually realized the importance of the protection of fresh water resources. We must ensure the sustainable development of water resources, so as to ensure that all aspects of human progress. It is important to protect the water resources like lake and the groundwater and improve the comprehensive treatment of various kinds of sewage to the sustainable development of water resources. At present, the protection of water resources is achieved through the strengthening of scientific management and real- time monitoring of water resources, in order to achieve the optimal allocation of water resources and economic benefits, ecological and social benefits to maximize.

3. SYSTEM DESIGN

As a new period of scientific products, wireless sensor networks in the monitoring environment to install a large number of sensor monitoring nodes such as pH sensor, temperature sensor, depth sensor, dissolved oxygen sensor, etc. to collect data, and then in accordance with the specific routing protocol network standards, the data is sent to the sink node in the form of multi-hop routing. The convergence node will transmit the data to be sent and the integrated data will be sent to the management

node and sent to the central control centre. The Wireless sensor network has conspicuous advantages and features. Low cost, large scale wide range, low power consumption. In order to facilitate the installation, the sensor nodes are often relatively small size, easy to install and reliable, so that the monitoring environment can be perceived and monitored in the absence of human circumstances. On the other hand, because of the sensor node itself is flawed, power consumption is fast, the cost is high, it is necessary to pay special heed to the energy saving of the sensor in the selection of the equipment, to extend the life of the entire system.

A large number of scientific experiments show that dissolved oxygen, water pressure, pH value, conductivity, temperature, depth and other factors are the salient factors in the analysis of water quality. However, the data obtained by the traditional chemical detection method is not accurate. The system is based on the water quality monitoring system of the wireless sensor network. It can collect the information of various water quality factors through the sensor nodes, and the selected nodes have high wall , in the case of large buildings occlusion, the sensor node transmission distance of at least 100 meters, in the realization process, to achieve the system low power consumption, low cost, high stability and so on. The system network topology is shown in Fig.1.

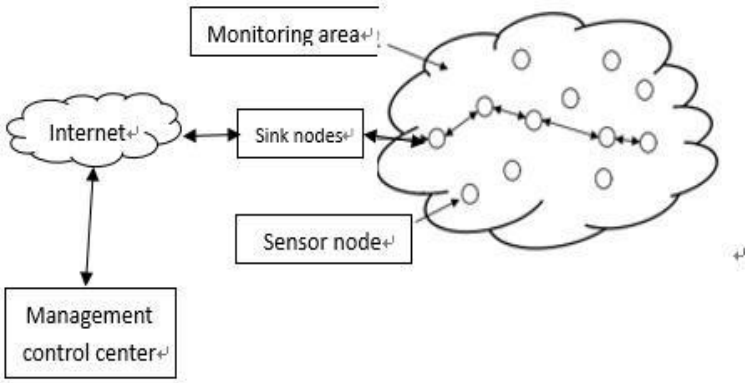

Figure.1.Topographic map of water environmental monitoring system

3.1 WATER RESOURCES SENSOR NETWORK ARCHITECTURE

Water resources sensor network system consists of monitoring sensor node network, intelligent wireless sensor network and real-time information processing system. Most of the nodes can perform the monitoring data collection, information transmission and processing. And ultimately to achieve water is monitoring and problem handling.

3.2 WORKING PRINCIPLE OF WATER RESOURCES SENSOR NETWORK SYSTEM

Water sensor network system based on wireless sensor network technology, first through various types of sensors such as temperature sensors, water pressure sensors, pH sensors, dissolved oxygen sensors and other data collection, and integration of network topology and ad hoc network features, through in the water environment monitoring area, the sensor nodes are installed to collect the water resources and environment information in real time, and the wireless communication module is sent to the gateway node through the wireless communication module, and then the data is transmitted to the convergence node to the data control centre.

And finally to the monitoring of water resources, the data transmitted by the sink node to the management node may be processed by multiple non-coherent nodes. The Quality of service protocol is suitable for research, self organizing network, low power consumption, low packet loss rate, low error rate and long transmission radius and so on. Any sensor node in the monitoring environment is self-harmonizing its own work at and quickly establishes a communication network.

When a node fails or a new node joins the communication network at some point, the self-organizing network can be reassembled, to adjust the accuracy of the overall detection, give full play to the benefits of sharing resources.

3.3 THE CHOICE OF WIRELESS TRANSMISSION PROTOCOL

3.3.1 INTRODUCTION TO WI-FI TECHNOLOGY

Wi-Fi technology, a communication standard defined by the Institute of Electrical and Electronics Engineers, is a substantive certification. Originally proposed in the 1990s, it defines the media access control sub layer and the physical layer, the transfer rate is very fast. Wi-Fi stands for wireless fidelity (it is simply trademarked term meaning IEEE 802.11x) .On this basis, Wi-Fi has a lot of updated version, which has a representative version: 2.4GHz transmission rate expanded to 11Mb IEEE802.11b, 2.4GHz transmission rate can reach 54Mb / s IEEE802. 11g.In the small-scale wireless LAN layout, Wi-Fi technology has become a recognized standard.

The advantages of Wi-Fi technology include:

a) Wide range of radio waves covered. Cover radius can reach 100 meters.

b) Fast. According to the experiment proved Wi-Fi transmission speed up to 54Mb / s, bandwidth can be automatically adjusted to meet the small local area network within the personal information on the rate of access requirements, with a certain degree of stability.

c) Get a variety of large-scale wireless device manufacturers affirmed.

d) Wi-Fi is a wireless communication, so no wiring is required.

Wireless equipment manufacturers such as Intel and other large companies have launched the patented Wi-Fi products. Of course, Wi-Fi technology itself also has its own shortcomings:

a) The signal will become weaker as the distance increases.

b) Safety is not high. Therefore Wi-Fi technology is not suitable for this system.

3.3.2 INTRODUCTION TO BLUETOOTH TECHNOLOGY

Bluetooth is a communication protocol standard. 1994 Bluetooth technology was born, the full name of the Bluetooth technology alliance, Bluetooth generally support short-range communications, such as electronic equipment between the data transmission. Bluetooth is now one of the main means of wireless communication.

Advantages of Bluetooth technology include:

a) Wireless electronic devices can achieve simple and convenient communication

b) The data transfer rate can meet the short distance transmission.

c) Completely free, without paying any fees.

Similarly, it also has its own shortcomings:

a) Transmission distance is short. General distance can be transmitted up to 10 meters.

b) The capacity of network is low and the communication node is also less.

c) Transmission stability is not high.

d) Communication is easy to disconnect.

Therefore, Bluetooth technology is not suitable for the study of water environment monitoring system.

ZigBee is a standards-based wireless LAN protocol, mainly suitable for embedding in a variety of devices to achieve automatic control and remote control; the protocol is used in wireless sensor network protocols. Its underlying use of the standard to specify the media access layer and the physical layer. It can work in the following three bands: 2.4GHz global frequency band, 868 MHz European band and 915MHz US band, in these three bands under the maximum data transfer rates are 250kbit / s.20kbit / s and 40kbit / s. ZigBee has the following characteristics:

Low power consumption: ZigBee is a low-rate transmission of the wireless module, the transmission power is only 1mW; and when entering the sleep mode, the power consumption is only μW level. So it is very energy efficient at run time, you can work months or so, only two bells can work.

The cost of the low cost module is controlled at $ 1.5-2.5, and the agreement is royalty free.

- Time delay is short: there are two aspects of time delay: One is in the communication delay, and the other is from the sleep state to the activation state of the time delay, the two delay time is very short, only in 30ms-1s.
- Network capacity is large: Star ZigBee network topology can accommodate up to 255 devices and through the tree network and mesh network structure to expand network capacity.
- High reliability network In order to prevent the emergence of data when the emergence of competition and conflict, the use of collision avoidance approach.

3.4 WATER RESOURCES SENSOR NODE DIVISION

The composition of water quality monitoring system based on wireless sensor network mainly includes sensor nodes, sink nodes and management nodes, which are mainly responsible for monitoring various key water quality factors in water resources area, incorporating pollutant monitoring.

The sensor node is mainly accountable for the collection of key parameters in the self-organizing network and water environment, and transmits the data to the convergence node through multi-hop routing communication.

The convergence node is the central node of the ad hoc network it is mainly responsible for the information exchange between the sensor node and the management node. The data collected by the sensor node is aggregated and processed, and then uploaded to the management node. The management node receives the data from the sink node and fuses the data such as averaging and maximum, and then sends it to the central management centre. The management centre performs a series of processing based on the data sent to monitor the working status of the sensor nodes.

The central monitoring centre is responsible for summarizing and processing the data sent back to complete the topology of the network and network monitoring and other work.

In order to monitor a certain water environment area, the entire system needs to monitor the installation of a certain number of sensor nodes to achieve the coverage of the entire monitoring area, and it needs a convergence node to complete the sensor node data fusion processing, and uploaded to Central monitoring system to complete the data analysis and processing.

The sensor node and the sink node can be automatically formed into a network system. The sensor node automatically collects large amounts of data and sends the data to the management node in real time through multi-hop routing communication. The management node assembles the data after the fusion, and then forwards it to the central monitoring system.

3.5 WATER RESOURCES SENSOR NODE TO ACHIEVE THE TASK

To achieve water environment monitoring, we based on the 'Q o S' protocol to achieve the following tasks:

a) To achieve real-time monitoring of water resources, ecological environment, real-time data processing and transmission, information production.

b) Forecasting of water resources disasters.

c) Can monitor the parameters of the waters of a real- time collection, such as water temperature, PH value, dissolved oxygen and so forth.

4. WATER RESOURCES SENSOR NETWORK PROTOCOL

4.1 POSITIONING OF THE SENSOR NODES

Q o S protocol has the advantage of self-assembly, low power consumption, low packet loss rate, low error rate and long transmission radius. It sends message in the way of multicast mode, in the collection of water environment at the same time to the top of the dissemination of information. But in the water under the sensor node positioning is not a small snag. The positioning problem for sensor nodes is to use a buoy network location system.

The buoy network positioning system consists of GPS, buoy network, underwater sensor node, ground monitoring centre or measuring ship. Buoy built-in GPS receiver to obtain the location information, while the underwater sensor node to the buoy primitive sound pulse information, and then buoy their own GPS location information and received sound pulse information sent to the ground in the form of radio monitoring centre or measurement ship, The position information of the underwater sensor node is settled by the corresponding positioning algorithm and sent to the buoy, and the positioning target is informed by the acoustic pulse. Underwater wireless sensor network location technology can provide information for the sensor to obtain the location information, escalate the spatial attributes, so as to better serve the application of underwater environment detection.

The superiority of network topology is often a key factor in determining energy consumption, quantity, and network accuracy when the wireless sensor network location technology used underwater, In addition, the installation conditions of the underwater acoustic channel are extremely harsh, with the attributes of low bandwidth, high bit error rate and high propagation delay. The sensor node consumes electricity from the chemical battery when collecting data and it is more onerous to replace the battery. There is need for underwater wireless sensor network topology design and optimized layout.

4.2 ROUTING NODE LAYING

Due to the complexity of the freshwater environment and the high fluidity of the water, it is very difficult to lay the pavement. In order to solve the hurdles of routing nodes, we can use the flow of seawater to expand the monitoring of the sea area, and use the nodes to capture the information, through their own carrying Wi-Fi function to pass data to the host computer, after the node with the water flow so far of the sea, but also to monitor the waters of the place.

4.3 WATER ENVIRONMENT SENSOR NETWORK SYSTEM ROUTING PROTOCOL SELECTION

Because of this wireless sensor network is working in the water environment, we need a low-power, adaptive, ad hoc wireless sensor network routing protocol we use the Q o S protocol.

Q o S protocol is low power consumption and loss of network, the network needs of the router's processor memory and power consumption problems basically meet the work of the water environment, its adaptive, low power advantage to cover up the other agreement choice. The network connection also has the advantages of low packet loss rate, high data transmission rate and high stability. However, compared with other protocols such as Leach protocol, it satisfies the underwater environment, and the number of nodes that make up the network architecture is also multitudinous. A simple network may have only a few nodes, but the underwater complex environment may also have thousands of nodes.

The selected Q o S protocol is a vector routing protocol. By constructing a directed acyclic graph to form a topology, the nodes in the topology are adaptively formed to form a physical path to the root node. The Q o S protocol is mainly responsible for the data aggregation in the scene design, and the data flow in the leaf node points to the root node. Of course, the Q o S protocol also supports point-to-point (P2P) and multipoint point (MP2P) practical application scenarios. Based on the data information in the collected information network, the node periodically sends the measurement data to a sensor section Point, and point to multipoint communication, and then from the convergence node to the management node in the LLN, in the laying of the node, we choose a sea, assuming that the laying of six nodes as a sea, according to the characteristics of the Q o S protocol , Q o S support mesh topology, it allows routing between the brothers and nodes to replace the routing between the father and child nodes when necessary, we can set each node is equal and likely to become cluster head node, also itself is carrying Wi-Fi function , upload the collected information to the host computer. When one of the nodes is selected as the cluster head node, when the node consumes power out, at random selection of a cluster head node, due to the special environment of the freshwater area, power consumption is an important issue to consider. To this end, other routing protocols have chosen Q o S as a low-power protocol.

5. CUNCLUSION

With the ceaseless improvement of wireless sensor technology, the field of search based on wireless sensor networks is expanding. This paper is based on wireless sensor network water environment monitoring system for water pollution prevention has important research significance. In this paper, through the sensor network system architecture, wireless communication protocol selection, the installation of the relevant routing nodes to conduct a monitoring of the water environment. ZigBee technology is more suitable for the study of this system by comparing with Wi-Fi technology and Bluetooth technology. The system can be timely detection of water environment temperature, pH value, dissolved oxygen and other important parameters to monitor. And respond quickly to the greatest extent possible to avert the occurrence of water

pollution. Because water resources are an indispensable element to mankind, it is of some social significance to study this subject.

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