# A Review of Water Environment Monitoring System based on Zigbee Technology

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## ABSTRACT

*The Zigbee network is used to monitor the environment parameters of aquiculture water. Each sensor node of the network, which is composed of various sensors pH value, content of ammoniacal nitrogen etc. A GPRS module is used to complete data exchanging between remote monitoring center and the wireless sensor network. This system is an application in acquiculture field. Through an algorithm based on neural BP network and D-S Evidence Theory, this system could diagnose the type of water environment parameter abnormity automatically. Wastewater treatment processes are concerned with controlling the energy efficient removal of pollutants in the smallest possible space in the shortest possible time. Required are Detailed knowledge of the underlying process, Highest possible transparency of the process steps through corresponding measuring methods. The efficient control of Nitrogen in wastewater systems is possible by making those measurements directly in the wastewater process. This not only ensures purification but above all guarantees economic operation of the entire plant. This paper gives review of different sensors used for waste water treatment.*

**Keyword:** - *Sensor, SMS, GPRS*

## 1. INTRODUCTION

As the country is making its progress through industrialization, our water resources are prone to a threat of pollution especially from the industrial activities. It is a challenge in the enforcement aspect as it is impossible for the authorities to continuously monitor the location of water resources due to limitation especially in man power, facilities and cost of equipment. This project focuses on the use of multiple sensors as a device to check the level of water quality as an alternative method of monitoring the condition of the water resources. The wireless sensor network based on Zigbee technology is developed to solve the defects of existing parameters monitoring system. In the wireless system, all the data will be transmit in wireless method. The environment data from temperature sensors, pH value sensors, tachometer and ammoniacal nitrogen sensors will be collected in every network node and transferred to monitoring center. Since the real-time measuring data could be transmit to monitoring center via Zigbee network and GPRS network, the operation staff will only sit in the office to check up the system running state. ZigBee is developed by ZigBee alliance, which has hundreds of member companies (Ember, Freescale, Chipcon, Invensys, Mitsubishi, CompXs, AMI Semiconductors, ENQ Semi conductors), from semiconductor and software developers to original equipment manufacturers. Power needed for ZigBee is very small. In most cases it uses 1mW (or less power). But still it provides range up to 150 meters in outdoor which is achieved by the technique called Direct Sequence Spread Spectrum (DSSS). Also DSSS consumes less power compared to Frequency Hopping Spread Spectrum (FHSS). It works in the 868 MHz (Europe), 915 MHz (North America and Australia) and 2.4 GHz (available worldwide) ISM band with up to 20kbps, 40kbps and 250kbps data rate.

## 2. LITERATURE REVIEW

There are many works on the application of WSN for monitoring system where Zigbee is used to monitor the condition of long span bridge after considering disadvantages of the currently used wire and cable for data communications such as high installation cost of communication and power supply for the sensors, difficulty in the installation of steel pipeline for protecting the cables, sensor data distortions due to temperature changes on cables,

noise affecting cables and sensors. The Zigbee is used for the short distance communication while CDMA (Code Division Multiple Access) infrastructure was used for long distance communication between sensors and the server system [5]. Zigbee provides the ability to run for years on inexpensive batteries for a host of monitoring applications: Lighting controls, Automatic Meter Reading (AMR), smoke and CO detectors, wireless telemetry, High Voltage AC control, heating control, home security, Environmental controls and shade controls. Sensor nodes enable environment sensing together with data processing. Instrumented with a variety of sensors, such as temperature, humidity and volatile compound detection, allow monitoring of different environments. They are able to network with other sensor systems and exchange data with external users [4]. This system hardware consists of three parts: wireless sensor nodes, data exchanging nodes and monitorting platform.

### 2.1 Comparative Study of Zigbee and Bluetooth

Table 1 provides a comparison between ZigBee and Bluetooth. For applications where higher data rates are important, Bluetooth clearly has the advantage since it can support a wider range of traffic types than ZigBee. However, the power consumption in a sensor network is of primary importance and it should be extremely low. Bluetooth is probably the closest peer to WSNs, but its power consumption has been of secondary importance in its design. Bluetooth is therefore not suitable for applications that require ultra-low power consumption; turning on and off consumes a great deal of energy. In contrast, the ZigBee protocol places primary importance on power management; it was developed for low power consumption and years of battery life. Bluetooth devices have lower battery life compared to ZigBee, as a result of the processing and protocol management overhead which is required for ad hoc networking. Also, ZigBee pro-vides higher network flexibility than Bluetooth, allow-ing different topologies. ZigBee allows a larger number of nodes – more than 65,000 Sensors – according to specification [10].

**Table -1: Comparison of Zigbee and Bluetooth**

| | Bluetooth | Zigbee |
|---|---|---|
| Standards | IEEE 802.15.1 | IEEE 802.15.4 |
| Data rate | 1 Mb $s^{-1}$ | 20-250 kb $s^{-1}$ |
| Latency (time to establish a new link | <10s | 30 ms |
| No.of nodes Range | 2.4 GHz | 2.4GHz |
| Range | 8m (Class II,III) to 100m (ClassI) | 1- 100m |
| Modulation | FHSS [2] | DSSS [1] |
| Battery Life | 1 week | 1 year |
| Extendibility | No | Yes |
| Frequencies | 8 | 65,000 |
| Network topology | Ad hoc piconets Audio,graphics,pictures,files | Ad hoc,star,mesh small data packet |

### 2.2 Wireless Sensor Node

The wireless sensors node are used to detect the states of the sensors fixed in some important places and transfer the results to data exchanging node in same subnet in form of digital signal. As shown in Figure 2.4, the hardware structure of this kind of node is mainly composed of digital sensor and integrated chip CC2430 from Chipcon.

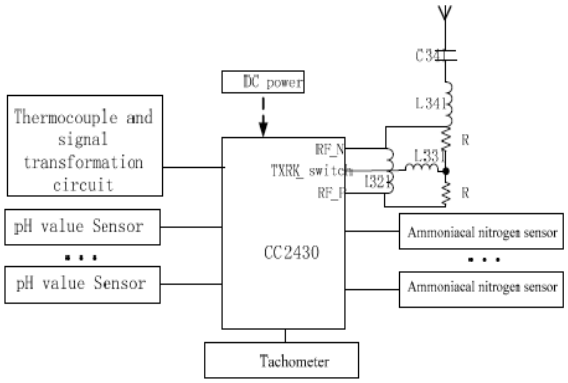


**Fig-1:Wireless Sensor Node**

**2.3 Data exchanging node**

As the coordinator of the Zigbee network, the data exchanging nodes builds and manages the whole wireless network. Simultaneously, it is the interface between the GPRS network and the Zigbee subnets. As shown in Figure, the data exchanging node is mainly composed of CC2430 chip, GPRS module, displaying module, clock module, USB interface and EEPROM.

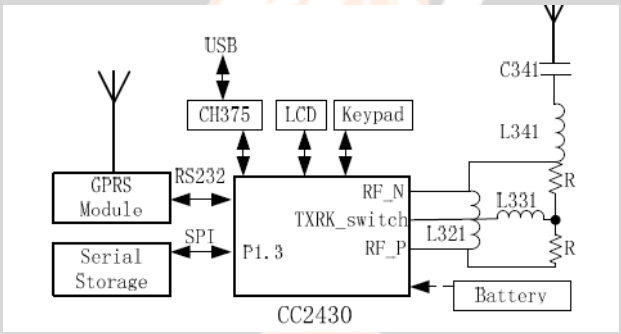


**Fig-2:Data Exchanging Node**

**2.4 Data route**

The data route of the system is shown in Figure. After the measurement starts, the sensor nodes will detect the temperature and secirity states every monitoring period under the control of the monitoring platform. The measurement results and the monitoring states will be transferred to the monitoring platform and stored in the EEPROM. The monitoring platform sends the data to remote monitoring platform via GPRS Module.

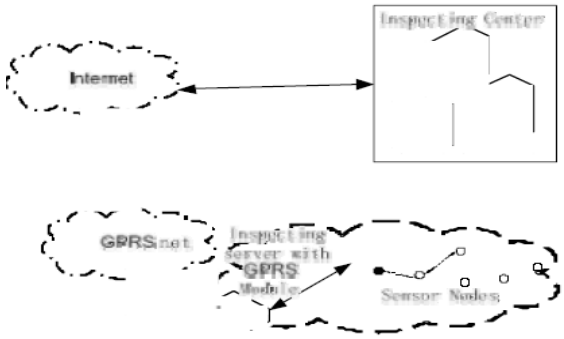


**Fig-3:Data Route**

**2.5 Ongoing Process**

The WFP is designed to remove this undesirable matter, and produce water fit and safe for drinking. The raw water is delivered into a pit chamber or channel where two chemicals are added and the mixture is agitated by a propeller type Flash Mixer. The chemicals used in raw water include:

1) Alum (aluminium sulphate) to flocculate ( join together) the tiny particles suspended in the water;
2) Polymer, consisting of long chain molecules which join the 'floc' into even large particles;
3) Soda ash (sodium carbonate) to prevent the water from becoming acidic and therefore corrosive, as it would if only alum were added. This is used to adjust the pH at the end of process.
4) A powdered activated carbon (PAC) dosing plant is located near the raw water pumps (only dosed when there is an algae problem or taste or odour, which has been rare).

## 3. PROPOSED SYSTEM

Current water quality assessment methods of these parameters, which form the basis for sound water resources management, are mainly laboratory based, require fresh supply of chemicals, trained staff and are time consuming [12]. Real-time water quality monitoring is essential for National and International Health and Safety, as it can significantly reduce the level of damage and also the cost to remedy the problem. This paper critically analyses both commercially available and state-of-the-art research methods and devices suitable for real-time wastewater quality monitoring and suggests further developments in this area. In particular, the focus is made on the monitoring of nitrates and phosphates in wastewater and a novel microwave based method for instantaneous water quality assessment is suggested.

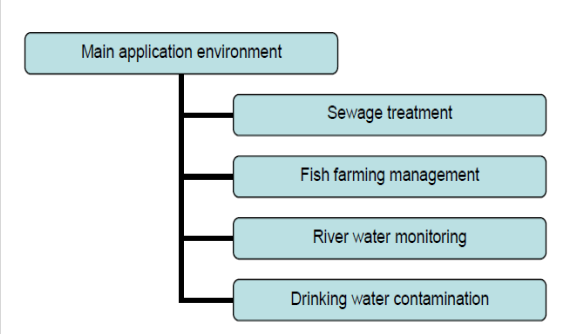


**Fig4:Water Quality Monitoring Application**

There is a general framework in water quality monitoring system. At first, the real-time values of analytical instruments are sent to the wireless data acquisition terminal, the data are processed and packaged, and sent to the data center through wireless network. After decrypting, the system will do the data analysis, storage, display and alarm automatically by management information system (MIS) and geographic information system (GIS). Then publish data to the upper network control and management system Via TCP / IP protocol and exchange data with other control centers. At last, the center sends the command to the sub-stations and summary the feedback through GSM/GPRS communication. In short range, Zigbee and WiFi are frequently used in water monitoring area. For sensor network applications, Zigbee is a low data rate, low power consumption, low cost wireless networking protocol targeted towards automation. On the other hand, GSM/GPRS is applied on long range communication. There are one control center and several branch monitoring stations in the water quality monitoring system.

## 4. CONCLUSIONS

The real-time measuring data and security states could be transferred in time, and the monitoring platform could deal with the accident during the measuring period. Wireless data transmission protects the sensor signals from interfering. The system has little volume and light weight. LCD display make the operation flexible. Accurate pH measurement and the resulting precise control that it can allow, can go a long way toward process optimisation and result in increased product quality and consistency. Accurate, stable pH measurement also controls and often lowers chemical usage, minimising system maintenance and expense.

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