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DESIGN AND IMPLEMENTATION OF WATER ENVIRONMENT MONITORING SYSTEM BASED ON WSN AND GSM TECHNOLOGY

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ABSTRACT

Due to the speed of Indian economic development we can also see the resulting speeding-up the contamination and damage to the water environment, Peoples also responsible who throw the garbage material in water due to which it is polluted. To overcome all this water environmental monitoring system based on a wireless sensor network developed. It consists of three parts data base station, data monitoring nodes and remote monitoring center. This system is useful for the complex and large-scale water environment monitoring, such as for lake's, reservoirs, swamps, rivers, and shallow or deep ground waters. The system provides the online auto monitoring of water temperature, turbidity, water level, and pH value environment of an artificial lake. There is a set point for each parameter for pH of water set point is 7 pH, for turbidity of water set point is 0.3NTU and for temperature of water set point is 60 degree Celsius, when these particular parameter crosses its set point the alarm is created then we comes to know that water is contaminated or polluted and at the same time SMS sends on management mobile that Emergency is occurred, due to which it is possible for that management person to take Appropriate action. In this sense water environment monitoring is one of the major methods for water resource management and contamination control. Different Sensors for water quality scenarios installed at the nodes to meet the monitoring demands for a variety of water environments and to obtain different parameters such as temperature, pH, water level and turbidity of an artificial lake.

KEYWORDS: Data Base Station, Data Monitoring Node, GSM, Water Environment Monitoring, Remote Monitoring Center, Wireless Sensor Network (WSN), Zigbee

INTRODUCTION

Wireless Sensor network consist of specially distributed autonomous devices using sensors to monitor environment or physical conditions such as temperature, sound, vibration, pressure, motion at different location. Different applications areas for WSN's include geographical monitoring (seismic Activity), Precision agriculture (soil monitoring), transportation (traffic monitoring), Habitat monitoring (tracking of animal herds) military systems, business processes, & in future, possibly cooperating small things at present there are four main methods present for monitoring. The water environment each method having its advantages & disadvantages
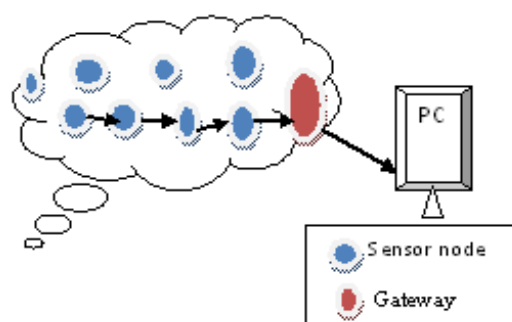

Figure 1: Typical Multi-Hop Wireless Sensor Network Architecture

- Automatic and continuous monitoring of water environment different parameters by an automatic monitoring system which consisting of monitors & control centers, and several monitoring stations .all data can be automatically transferred. Each data base station provides its real time water environment parameters these systems can be high costly and have great impact on the surrounding ecological environment.

- Artificial sampling with different portable water quality detecting devices and lab analysis. This method is applicable only to samplings on cross-sections of lakes and rivers with sampling frequency varying from several times a day to monthly. [1]

- Water quality monitoring technique realized using some sensitivity function of aquatic organisms to the presence of different poisonous substances in water bodies by measuring the change of activities of different organisms in different water environmental conditions, then next thing is the qualitative evaluation report of the water quality measuring methods of this type being practiced include beach louse, fish measuring. These methods can not provide reach high accuracy for water environment monitoring Comparing with all these methods developing a monitoring system based on WSN's with advantages arrangements, collection of variety of different parameters high detection accuracy and high reliability of the monitoring network, etc. A WSN's is a Ad-hoc network consist of different tiny low cost and low power consumption sensing nodes which are capable of calculating, sensing and communicating data with other node .This paper develops water environment monitoring system based on wireless sensor which is applied to a lake to realize remote and automatic online monitoring of temperature, turbidity, water level, and Ph of lake water. [1]

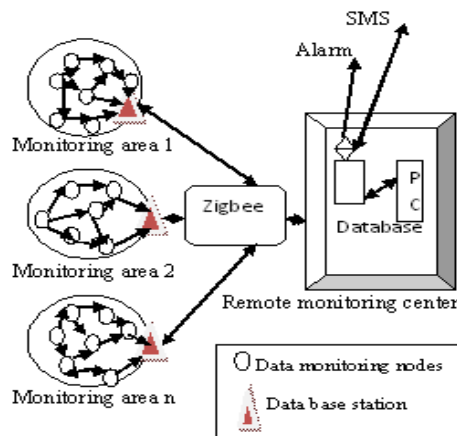## COORDINATE MODEL

System Architecture

Figure 2: Water Environment Monitoring System Based on WSNS

The whole system is divided in three parts as shown in figure 2. Data monitoring node, Data base station and remote monitoring center for water area detected. Different data monitoring nodes distributed in water to measure different water parameters such as temperature, turbidity, water level and Ph of water. The data monitoring nodes also performs the task like temperature compensation, data packaging and linearization. Measured parameters memorize and routing to a data base station the data from monitoring nodes is transfer to a remote by the base station via Zigbee network. The monitoring center analyzes and processes the water quality parameter and through graph and reading of particular parameters we comes to know that whether water contamination occur or sudden changes occur in water quality or increase or decrease in water level and also provide supports for decision making in prevention of water contamination. another thing is that there is a set point for each parameter and once that parameter crosses it's set point then alarm is created and sms send's to the

management mobile that emergency is occurred, due to which it is possible for that management person to take appropriate action .[2]
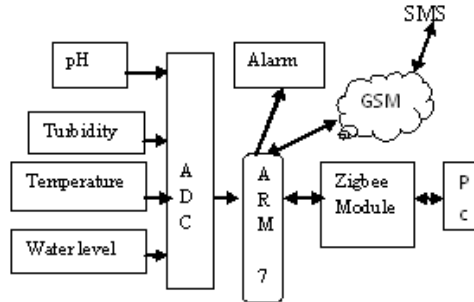
System Block Diagram

Figure 3: System Block Diagram

As shown in figure 3 different data monitoring node's distributed in water to measures water parameter such as pH, turbidity, water level and temperature of water. Data monitoring node's store all measured parameter and also performing functions such as temperature compensation, linearization and data packaging, the parameter measured by different node's are analog in nature. Data monitoring node's store all measured parameter and also performing functions such as temperature compensation, linearization and data packaging, the parameter measured by different node's are analog in nature.

After that all measured parameters comes in Signal conditioning section where all measured analog signals manipulate in such a way that they useful for further operation of system. It performs the functions like amplification, filtering, range matching and isolation of analog signals. ADC converts all measured analog signals in digital format the processor reds all digital information such as temperature turbidity, water level and pH of water and it store all parameters according to time sequence they collected. All the real time data and history of data store in external memory. In this sense all the measured parameter display on PC.Other part in this system is that there is a set point for each parameter, after they cross this set point the alarm is created and at the same time message is sends on management mobile using GSM module that emergency is occurred, due to which it is possible for that management person to take appropriate action. In this sense this system is useful for control the water contamination and also provides the proper water resource management.

Data Monitoring Node

The measuring functions of data monitoring nodes are collecting the parameter such as temperature, turbidity, water level and pH of the water to be monitored. Four sensors temperature sensor, Water level sensor, Turbidity sensor and pH sensor installed on to a monitoring nodes can meet the above need s and realize the linearization and temperature compensation for the data collected Setting up the wireless sensor network based on Zig-bee protocol. [4]
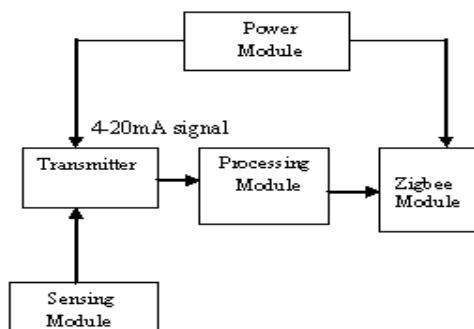

Figure 4: System Architecture of Data Monitoring Node

Via which the temperature, turbidity, water level, and pH data routed to a base station. Figure 4 shows the structure of data monitoring node which can be divided in to five modules power module, transmitter, processing module sensing module and Zig-bee RF module. out of this the sensing module is placed on water proof cabin floating on to a water surface The sensing module is in the water connected to the water proof cabin via cable. All the modules have pass through a water proofing process. The sensors collect the parameters such as temperature, water level and pH of target water area, then transmitter converts the all signals in to proper format in 4-20mA signals. The processing modules processes and memorizes all measured parameters then transfer them via Zigbee module to the base station, the power modules provide the electricity to the transmitter and Zigbee module. Each node connected and controlled by the base station by the Zigbee communication protocol. [4]
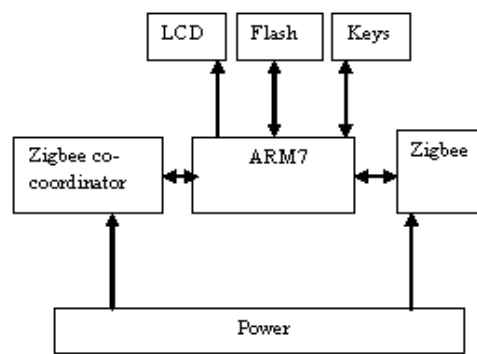
Data Base Station

Figure 5: Hardware for Data Base Station

The processor is main hardware for data base station. It also uses the co-processor to transmit monitoring data based on the Zig-bee protocol between data base station and data monitoring sub-network, a Zigbee module is used to realize remote data communication between data monitoring center and data base station. The Flash memory is used to store the historical data and also provided with man-machine interface. The main hardware processor improves the real time performance of the system. [4]

Remote Monitoring Center

The remote monitoring center consists of two parts: the Zigbee module and the data center. The Zigbee module is responsible for receiving water environmental parameters and the data center connects with the Zigbee module through the serial port. Remote monitoring center also consist of database and monitoring software. The monitoring software provides a complete monitoring interface to carry out historical data queries, display real time data analysis and create alarm in non-normal status and sends the message to the management mobile number. The whole remote monitoring center is responsible for monitoring the environmental changes, generation of alarm in emergency conditions controlling and administering the on-site implementation and rapid environment changes in real-time. Remote monitoring center actually full of software for controlling the water environmental parameters. [4]

Sensor Node

The sensor node is capable of performing some processing, gathering sensory information and communicating with the other nodes which are connected in a network. The processor performs the task processes data control's functionality of other component's in the senor node, low power consumption. Tran receiver is a combination of both transmitter and receiver; the possible choices of wireless transmission are Radio frequency (RF), infrared and optical communication .out of this infrared communication required no antenna but they having limited broadcasting capacity, and

optical communication is to much sensitive to the environmental changes therefore Radio frequency communication widely use in WSN's with the limited license free communication frequency 173,433,868 & 915 MHz it uses the flash memory due to it's high storage capacity and low cost. The sensor node consumes Power for sensing, communicating & data processing, it require more energy for data communication than any other processes power is either store in capacitors or batteries. Both rechargeable & non-rechargeable batteries are source of power for wireless sensor network. [5]
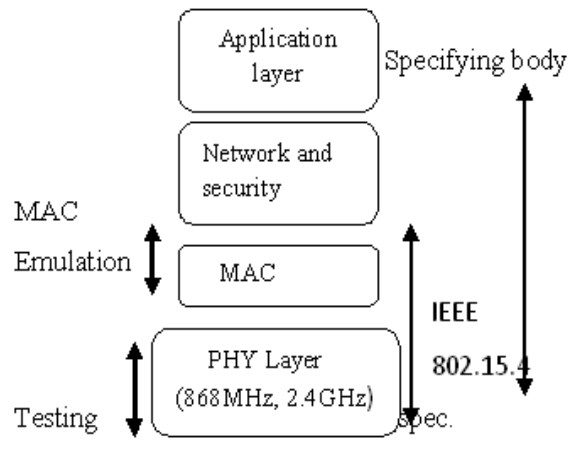
Zigbee Protocol Stack

Figure 6: Zigbee 802.15.4 Protocol Stack

The Zigbee pro RF modules manufactured by digi are use to provide required wireless RF communication link among sensor nodes. ZigBee is intended for wireless application that requires low data rate, low power consumption, low cost and secure networking. ZigBee layered on top of IEEE 802.15.4 standard which defines the physical layer and Medium access control (MAC) Layer. Zigbee Alliance itself defines the application and security layer specifications. The stack is drawn as shown in figure. The IEEE 802.15.4/Zigbee standard defines dual PHY layer, which are 2.4 GHz and 868/915 MHz

Information Transmission Module

GSM module is information transmission module.GSM module generally consist of GSM RF, baseband processor, flash, power, antenna and antenna jack.
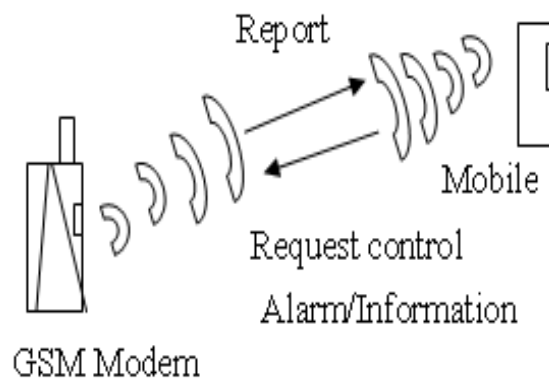

Figure 7: GSM Transmission Module

This module provide standard at command interface for different users and its working voltage is 3.3V and 5.5V and this module having lower power consumption. In this system for every parameter there is a set point & when that parameter crosses its set point & through the GSM module SMS sends on a management mobile and in this way GSM module actually transmits the different water parameter information. [6]

CONCLUSIONS & DISCUSSIONS

A wireless sensor network is developed in the hope of tracking with the problem of the lack of a water environment monitoring system. This monitoring system consists of three parts data base station, data monitoring node & remote monitoring center. It provides a useful feature's such as large monitoring ranges, low power consumption, flexible configuration, very small damage to the natural environment and low cost. This paper is actually explaining the new design of water environment monitoring system, based on wireless sensor network. The system successfully provides on-line auto monitoring of the turbidity, water level, temperature and pH. This system monitoring the changes of water environment controlling, generating alarm for pollution emergencies and rapid environment changes in real time & sends message to the management mobile and it is possible for that management person to take appropriate action for controlling water pollution. This is a proposed system & expecting results are live graph of reading for different water parameters. Different sensors for water quality installed at the node to meet the monitoring demands in different water environments and to obtain different parameter there is a respective graph for there readings for turbidity, pH, water level and temperature of water to be monitored. Once any water parameter crosses its set point the alarm is created and sms sends on management mobile that emergency is occurred, & through the graph we also see the reading of each and every parameters. Hence by using this monitoring system we decrease the water contamination and also provide the water resource management, this monitoring system thus promises large applicability. Future scope is also so good for this system by connecting number of station together to form a network together variety of parameters such as conductivity, dissolved oxygen in water is also possible to measure.

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