

WATER ENVIRONMENT MORITORING SYSTEM BASED ON WSN

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Abstract— Due to the speed of economic development we can see the resulting speeding up the contamination and damage to the water environment, people also responsible who throw the garbage material in water due to which the water get polluted. To overcome all this problem we have developed water quality monitoring system based on wireless sensor network. This system consists of three parts data monitoring node, Wireless sensing node and remote monitoring station. Our aim is to design the low-cost system, which is easy to implement and it takes less steps for its operation. The system is designed using ATmega 328, 8bit micro controller, glass electrode has been used as a pH sensor and wireless communication is achieved by using IEEE 802.15.4 compatible wireless transceiver. This system is used to identify the characteristics of water like pH and temperature.

Index Terms—Glass Electrode, Two way wireless transceiver, arduino (ATmega 328 micro-controller).

I. INTRODUCTION

Now a day there are many peoples who lack access to safe drinking water in the whole world. Also the good water is essential for our aquatic ecosystems. So water quality monitoring has become a decisive question around whole world for that different water environment monitoring systems were developed using WSN. This system is useful for the large complex scale water environment monitoring such as lake, reservoir shallow, underground water, quagmire etc. This system is consist of three parts i) Data based station ii) Data monitoring nodes iii) Remote monitoring centre.

Data based station is unit of data monitoring nodes which consist of pH electrode and temperature sensor and two way wireless transceiver. Data base station transfer the result of pH electrode and temperature sensor through two way transceiver to the remote monitoring centre.

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Water quality monitoring is essential to control the physical, chemical and biological characteristics of water because it gives information about the health of the water that whether the water body meets the designed used and how to change it over time. The aim of this project is to design a wireless sensor network system that helps to monitor the quality of water. The wireless sensor network based on Zigbee technology is developed to solve the problem of water contamination. In this system, all the data is transmitted in wireless node. Wireless sensor networks have been growing rapidly in the last few years. Lots of research has been done on WSN communications, WSN power conservation and WSN routing algorithms. However, most research mainly focuses on terrestrial sensor networks. Researches on underground water sensor networks are limited. It's very important to conduct research on the underwater sensor networks because they can Benefit many areas of science and industry such as water quality monitoring, ocean graphic whole collection of data, Disaster detection and the prevention, oilfield monitoring.

A wireless sensor network consists of spatially distributed autonomous sensors to monitor physical or environmental situations, and to cooperatively pass their data through the network to a main location. . The wireless protocol you select depends on your application requirements. Some of the available standards include 2.4 GHz radio frequency based on either IEEE 802.15.4 or IEEE 802.11 standards.

Factors Responsible for water pollution and their causes:

The work of Industrial and agricultural involves the use of chemical that can run-off into water and pollute it.

Metal and solvents from industrial work can pollute rivers or lakes. These are very poisonous to many forms of aquatic life and may slow their development, make them infertile or even result in the death of aquatic animal.

Pesticides are used in farming to control weed, insects and fungi. Run-offs these pesticides can cause water pollution and poison aquatic life. Subsequently, birds, humans and other animal may be poisoned if the eat infected fish.

Petroleum is another form of chemical pollutant that usually contaminates water through oil spills when a ship ruptures. Oil spills usually have a localised affect on wildlife but can spread for miles. The oil may cause the death of many fish and stick to the feathers of sea birds causing them to lose the ability to fly.

To provide quality services to agriculture, water environment using ZigBee platform and sensor network. Based on the foreign existing sensor(temperature sensor, pH sensors, oxygen sensor, copper ion sensor and iron ion sensor).

III. RELATED WORKS

Design of Automatic monitoring & reporting of water quality monitoring by using WSN Technology & different routing methods. The system takes ARM 7 as a main processor to develop the system. They have used master slaves and routing method & provide the online auto-monitoring of water temperature, turbidity, water level & salinity values [1].

This system has developed the sensor network based intelligent water quality monitoring system. In intelligent system that combines in monitoring and actuations capabilities is designed. The major technical challenges such as sensor selection and control over wireless networks are discuss. Appropriate algorithms are adopted based on system design requirement [2].

This paper proposed the system “A sensor web model & web service for drinking water distribution management”. In this system WSN has been deployed for monitoring the water distribution, using five different types of sensors, namely pH, conductivity, temperature, oxidation reduction potential (ORP) and developed oxygen sensors, an experimental result demonstrate the ability of the sensor network to collect the sensor data in real time, store them over long period of time and display them graphically on website [3].

The paper have proposed system is lever-aging on wireless sensors in detecting the water quality and short message service (SMS) technology in delivering alert to the formers upon detection of degradation of water quality [5].

In “water quality monitoring system using Zigbee based wireless sensor network”, they have used high power transmission type ZMN2405HP Zigbee module is using the CC2430 transceiver IC from Texas Instrument for transmitting the wireless data and 8051 micro controller as main processor. This monitoring system can be set up emphasizing or the aspects of low cost, easy ad hoc installation and easy handling and maintenance [6].

HU YUNBING have developed the water quality monitoring using sensor network. This paper designs data collecting nodes under water, which realise communication & organization by means of sound waves; and then it add data collecting nodes which automatically forms networks by means of zigbee system form networks in every water region;

And then it is design to gathered data by wireless network co-coordinator which are transmitted to server by GPRS [7].

This paper proposed the design of water quality monitoring system and building upon the SUNSPOT technology, a prototype implementation of water quality wireless sensor network (WSN) as a solution to the water quality monitoring problems using three layer architecture [8] i.e.

- 1) The wireless sensor Gateway layer
- 2) The wireless sensor Node layer
- 3) The wireless sensor Board layer

This paper proposed the “Water Quality Monitoring system using Wireless Sensor Network”. In this system the water

quality monitoring such as pH levels, turbidity and temperature is measured in real time by the sensors that sends the data to the base station or monitoring room. This system used graphical user interface for the monitoring purposes at the base monitoring station [9].

In this paper they design a low cost autonomous water quality monitoring system. This system uses low cost sensors like pH electrode, light sensor, temperature sensor, an open source hardware ardiouno mega260 to deliver continuous measurement of water quality at substantially reduced cost [10].

IV. PROPOSED SYSTEM:

In this paper, the prototype system is designed. Which continuously monitoring the environment of water. Which consist of three parts i) data base station ii) data monitoring nodes iii) remote monitoring center. Fig. 1.1 shows the overview of our system. The system is designed using ATmega 328, 8bit micro controller, glass electrode has been used as a pH sensor and wireless communication is achieved by using IEEE 802.15.4 compatible wireless transceiver.

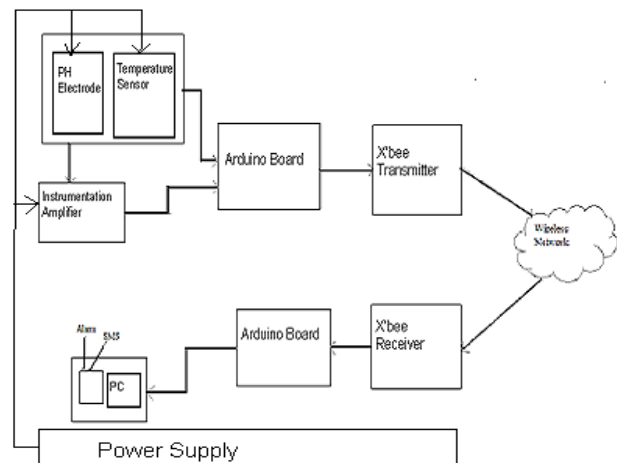


Fig 1.1: Block Diagram

A) Sensor Node:

Arduino AtMega 328 is used as our sensor node to acquire and process sensor data. Arduino AtMega 328 was chosen because it is an open-source product, inexpensive and provides sufficient analogue/digital pins for our applications. The unused pins in our work are meant for addition of hardware and other sensors in future. It operates at 5V using Atmel’s Atmega328 micro-controller with a clock speed of 16 MHz. It has a flash memory of 256 kB and Static Random Access Memory (SRAM) of 8 kB. Of all the Arduino boards, Mega dominates in terms of processing, memory and number of available interconnections. It has 16 analogue pins and 4 serial ports. The one serial ports is connected internally to Universal Serial Bus (USB) port. We have used three analogue pins and all the 4 serial ports for application.

B) Sensors:

This section supplies the information about the sensors used in our system.

1)pH: The system uses pH sensor from equiptronics .It measures the full pH range from 0 to 14 and operates in the temperature range of 0⁰c to 80⁰c. The sensor is terminated via BNC connection. They equiptronics also supplies adaptor to convert BNC to analog voltage after sensing. Using this adaptor, the pH sensor data is acquired at Arduino analog pin.

2)Temperature: The temperature sensor used is the system is from Texas Instruments[15]. It has a wide temperature range of -55 to 150 degree C, with 0.5 accuracy and operates from 4V to 30V. This was chosen because the LM35 series are precision integrated-circuit temperature device with an output voltage linearly centigrade temperature. This sensor is interfaced directly to Arduino analogue pin.

A)Data monitoring node:

Data monitoring node consist of several types of sensors which is used to indicate the parameter that indicate the water quality. In our system two types of sensors, pH sensor that sense acidity or alkalinity of the water, temperature sensor (LM35) which is used to measure the temperature of water as shown in fig.1.2.All the sensor uses power supply for their operation. The information means the input from sensor is being sensed by the sensors are then converted into electrical signal and go through the signal conditioning circuit that functions to make sure the voltage or current produced by the sensors is proportional to the actual values of parameters being sensed. Then it is passed to a microcontroller that processes it to the value understandable by human.

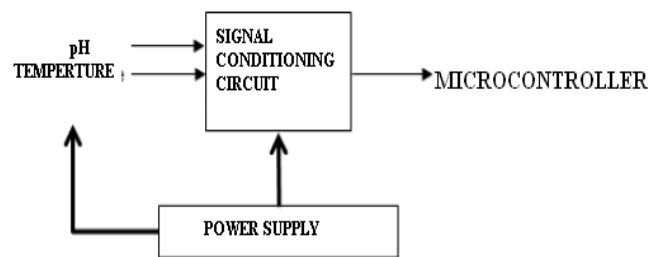


Fig1.2 : Block diagram of data monitoring node

B)Wireless sensing node:

In the wireless sensing node , data monitoring node is combine with the zigbee module(cc2500). It consist of the zigbee transmitter which works based on the frequency of 2.4GHz which is standardised by IEEE 802.15.4 and can give the range upto 1.6Kms.Serial data from the transmitter line is given to the zigbee transmitter which is configured to maintain the Baud rate of 9600 bauds. The transmission of the serial data is continuous in nature so that the user on the remote display device can view the current pH level of the water Bodies as shown in fig.1.3.

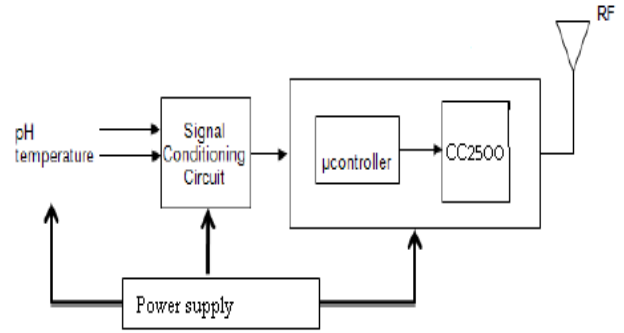


Fig1. : Block diagram of zigbee based wireless sensor network

C)Remote monitoring station:

The receiver section consist of a zigbee receiver which is configured to receive the serial data transmitted by the zigbee Transmitter. This data is given to the Receiver line of the ATmega 328 which is configured to receive the data at the rate of 9600 bauds. The ATmega 328 has a look up table with the help of which the corresponding pH value can be displayed according to the value of the serial data received. The system will generate the error signal if the measured pH value does not come in the range of preset value which can be set wirelessly as shown in fig.1.4.

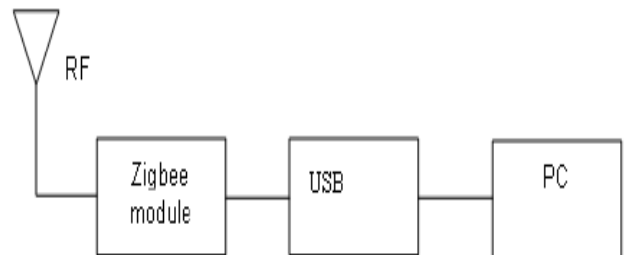


Fig1.4 : Block diagram of remote monitoring station

IV. Hardware design:



Fig 1.5: Hardware setup

Fig 1.5 show the hardware setup of designed system

Table 1.1 : Results for the inverting amplifier:

Parameters	Basic water	Acidic water
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pH	0v	-1.4 to -4.3
temperature	29 to 31 ⁰ C	29 to 31 ⁰ C

Table 1.2 : Results for the non-inverting amplifier:

parameters	Basic water	Acidic water
pH	0.3v	2.6v
temperature	29 to 31 ⁰ C	29 to 31 ⁰ C

V. Software

Arduino AtMega 328 was programmed using Arduino IDE. The functions and the structures are similar to C and C++. There are some special string functions available dedicated to Arduino.

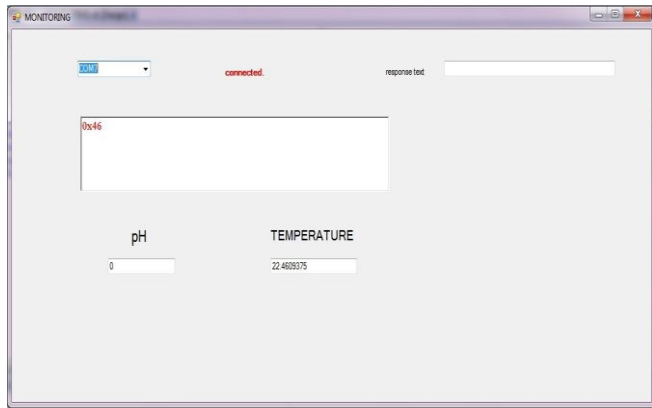


Fig 1.6 : Software Design part

Programming language:

a)Software: various software used in this project such as follows

1.1 SMS gateway:

sms gateway sent the appropriate information about parameters like pH and temperature to the computer or the other devices e.g mobile

1.2 Programming language:

to create the user interface as well as to implement the data processing feature of the system by using visual basic software

VI.CONCLUSION & FUTURE SCOPE

We have designed a system to measure the pH level of the water bodies which is cost effective and reliable with the ease of operation and can be implemented in any geographical location with simple modification. As this is a wireless system so it can be used as a Remote sensing Ph measuring device. Our designed system is helpful in many location where the wired system cannot be implemented. Not only had the measurement of the pH value of this system can also indicate if the pH value process some preset value. If the data was transmitted or displayed successfully but there was tolerated amount of repeatability error of the system. Using such technique one can develop the measurement of

different parameters of water without using costly sensors and methods. By having such methods for measuring other parameters also like BOD(Biochemical oxygen demand),COD(chemical oxygen demand),turbidity etc.

VI. REFERENCES

[1]A. C. Khetre, Prof.S.G.Hate, “Automatic monitoring & reporting of water quality by using WSN Technology and different routing methods. IJAR CET,Volume 2,Issue 12, December 2013

[2]Li Zhenan, Wang Kai, Liu Bo, “ Sensor- Network based Intelligent Water Quality Monitoring and Control, International journal of Advanced Research in Computer Engineering & Technology(IJARCET),volume 2, Issue 4, April 2013

[3]T. Ravi Kumar,Dr.K..Raghava Rao,A sensor Web Model and Service for drinking Water Distribution Management , International Journal of Advanced Research in Computer Science and Software Engineering, September 2012

[4] Karl, H. and A. Willig, Protocols and architectures for wireless sensor networks. 2007: Wiley. com.

[5]Nazilleni, Samiha Haron, Mohd Khuzaimi, Izzatain Abdul Aziz & Mazlina Mehat, Remote Water Quality Monitoring System using Wireless Sensors proceedings of the 8th WSEAS Int. Conf. On Electronics, Hardware, Wireless and Optical Communications.

[6]Zalhani Rasin and Mohd Rizal Abdullah ,“water quality monitoring system using Zigbee based wireless sensor network”. International Journal of Engineering & Technology IJET-IJENS vol:09 No:10.

[7]HU YUNBING, The water quality monitoring using sensor network, Journal of Theoretical and Application Information Technology, 10th March 2013, Vol.49.No.1

[8]Marco Zennaro, Athencisios Floros, Antoine Bagula, On the design on water quality wireless sensor network an application to water quality monitoring in Malawai.

[9]Shruti Shridharam, “Water Quality Monitoring system using Wireless Sensor Network”, International Journal of Advanced Research in Electronics and Communication Engineering(IJARECE), Volume 3, Issue 4, April 2014

[10]Arvinnda S. Rao, Stephen Marshali and Vincent Prettigrove “design a low cost autonomous water quality monitoring system”.