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Wireless Sensor Technology for Water Quality Monitoring

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***Abstract*— Based on the wireless sensor network (WSN), this paper designs data collecting nodes in water, which realize communication and organization by means of different sensing techniques; and then it adds data collecting nodes which automatically form networks by means of Zigbee system from network in every water region. The water quality monitoring monitoring and management parameters are pH level, turbidity and Dissolved Oxygen, is measured by the sensors in real time that send the data to the base station. As the monitoring and management intended to be carried outing remote area with limited access, signal from the sensor unit will then transmitted wirelessly to the base monitoring station The use of wireless system for monitoring purpose will reduce the overall monitoring system cost and the facilitate setup and labour cost, but will also provide flexibility for the distance or location. The development of Graphical User Interface (GUI) for the monitoring purpose should be display the parameters which are monitored continuously in real time. The GUI platform using MATLAB is cost-effective and allows more customization.**

Keywords-*GUI, WaterQualityMonitoring, Wireless Sensor Network, ZigBee.*

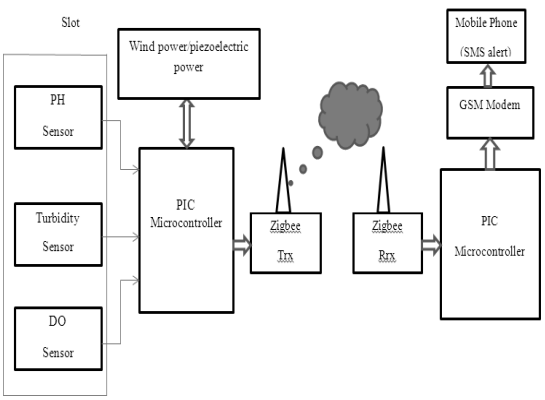
I.INTRODUCTION

Water is the source of human life, water environment monitoring is the management and protection of water resources is an important means of our country, the shortage of water resources, water pollution is serious, how much efficient, real-time access to water parameters, the research and development of new monitoring method of water environment, water environment management and protection has become an important task of water, environment monitoring is essential. People lived on the water environment automatic monitoring indicators improve; monitoring environment is increasingly complex background. The wireless sensor network technology into the solution of water water environment automatic monitoring and management of an ideal scheme. Wireless Sensor network is a kind of important network monitoring systems depends to environment independent completion of various monitoring task ‘smart’ system. Wireless sensor network based on the water environment monitoring and management system has the advantages of: 1,low cost;2,monitoring point distribution range;3, flexible network structure;4,little influence on the surrounding ecological environment etc..

The wireless sensor network (WSN) contains of spatially distributed autonomous sensor to monitor physical or environmental conditions, such as ph, turbidity, pollutants and to a main location. The more modern networks are bi-directional, also which enables control of sensor activity. The WSN is built to nodes from a few to several hundreds, where each node is connected to any sensor. Such sensor node has typically several parts radio transceiver with an internal antenna system or connection to an external antenna system, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery system or an embedded type form of energy harvesting.

II.SYSTEM ARCHITECTURE

The system architecture consist of various water quality monitoring sensors such as pH,turbidity, and Dissolved Oxygen,ADC, microcontroller,GSM module and LCD display etc. The sensor then measures the corresponding values of the water. Since the outputs of the sensor are analog in nature and microcontroller can handle only digital signals hence there is a need of device which convert analog signals to digital signals.The system makes use of ADC for this purpose. So ADC converts converts the analog signal into digital signal. The digital signal is given to microcontroller system uses



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GSM module for communication. Microcontroller sends the measured value to the monitoring centre in the form of SMS via GSM module. Since it is a real time system, hence the microcontroller sends the measured value to the monitoring station. The microcontroller displays the values of the measured quantities on the LCD.

Fig.1 Block diagram for transreciever

In this paper discussed a multi sensor real time water monitoring system using the parameters like ph, turbidity, and dissolved oxygen. Environment water quality also called ambient water quality relates to lakes, rivers and oceans. Water quality standards for surface waters vary significantly environment conditions, eco-systems, and intended human uses. The details of different water quality monitoring sensors are given below.

A.PH Sensor

pH is a very important parameter to be measured and monitored. The pH of a water indicates how acidic or basic (alkaline) it is. The term pH translates the hudrogen ion values concentration- which ranges between about 1 and 10 x -14 gram-equivalents / litre - into numbers between 0 and 14. A neutral solution such as water has a pH of approximately 7.A pH

The measurement loop is made up of three particles, the sensor; which includes a measuring electrode, a reference electrode, and a temperature sensor; a pre-amplifier section; and an analyzer or transmitter. A pH measurement loop is essentially a battery with positive terminal is the having the measuring electrode and the negative terminal is the reference electrode. The electrode to measure, which is more sensitive to hydrogen.ion, develops a potential (voltage) related to the hydrogen ion concentration of the solution. Reference electrode provides a stable potential against the measuring electrode can be compared. The transfer function of the pH electrode is shown:

(Es-Ex)FpH(X)=pH(X)= pH(S) +RT

pH(X) is the unknown solution(x),pH(S) is the standard solution 7, Es-is the electric potential at reference or standard electrode, F is faraday constant=9.6485309,R is the gas constant =8.314510,T is temperature in Kelvin

.B. Dissolved Oxygen (DO) Sensor

Dissolved Oxygen (DO) is the term used for the measurement of the amount of oxygen dissolved in the unit volume of water. In water quality applications, such as aquaculture and waste water treatment, the level of DO should be kept high. For aquaculture if the DO level becomes too low the fish will do suffocate. In sewage treatment, bacteria decompose the solids. If the DO level is very low, the bacteria will die and then decomposition ceases; if the DO level is too high, energy is wasted in the aeration of the water. DO sensors do not measure the actual amount of oxygen in water, but instead measure partial pressure of oxygen in the water. Oxygen pressure is mainly dependent on both salinity and temperature.

C. Turbidity Sensor

The most important parameters that require monitoring in a wash process is turbidity, a measure of the dirt, food or other particles in the solution. Industrial grade turbid meters are used, for example, at water treatment plants to assess quality of water in the treatment cycle. These meters are very precise and very expensive. Current technology for measure turbidity depends in optical techniques, where water or other fluids pass through a tube or vessel and beam of light is transmits through a cross section of the vessel. As the photons which make up a beam of light pass through the water being tested, some are reflected by the particles suspended in the solution with others pass through unimpeded. The two optical detectors-one positioned head on to the light, the other at an angle of 90° to the light source-measure the transmitted and scattered light photons respectively. The dirtier the water, and less light gets through and the more it is scattered. The turbidity of the water is determined by analysis of the ratio of the scattered light divided by the transmitted light signal.

All the sensors use battery for their operation. The information sensed by the sensors and is then converted into electrical signal and then it is passed to a microcontroller or processor that processes to value understandable by humans. The following diagram shows the major sections of a sensor unit

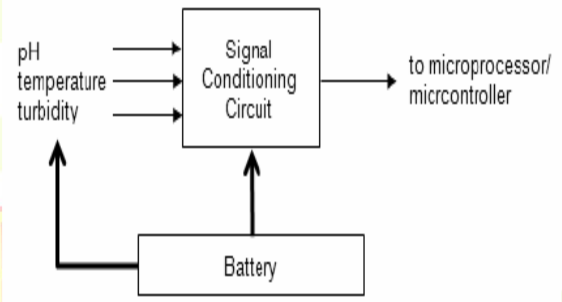

Fig.2Block diagram of sensor unit

D.PIC Microcontroller

A PIC microcontroller is a processor with built in memory with RAM and you can use to control the system. It saves building a circuit which has separate external RAM,ROM and peripheral chips. Simulated signal is given to the PIC microcontroller and there it is changed from analog to digital signal which is transmitted using the Zigbee transmitter

E.The wireless sensor Node-Zig Bee

The application of ZigBee with IEEE802.15.4 are concentrated in: industrial control, wireless sensor detection, personal monitoring equipment, low-power and wireless medical device, high-end toy, electrical network control, wireless consumer devices and lighting control,etc.It has been used in system tracking, logistic management, intelligent

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lighting, remote control, medical care units, and remote meter reading system techniques.

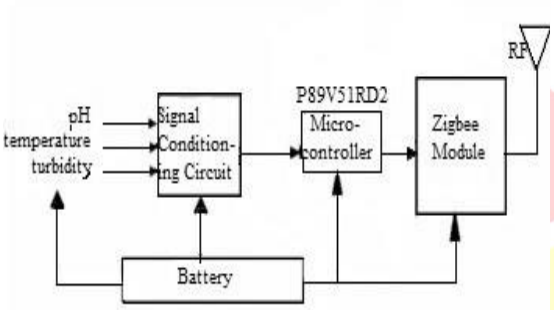

Fig.3 Block diagram of zigbee based wireless sensor node

ZigBee is a specification suite of high level communication protocol using small, low-power digital radios, with many application which require short-range wireless transfer of data at relatively low rates.. ZigBee require low data rate, long battery life. Zigbee provides secure networking for the system an

D. Introduction to ZigBee 802.15.4

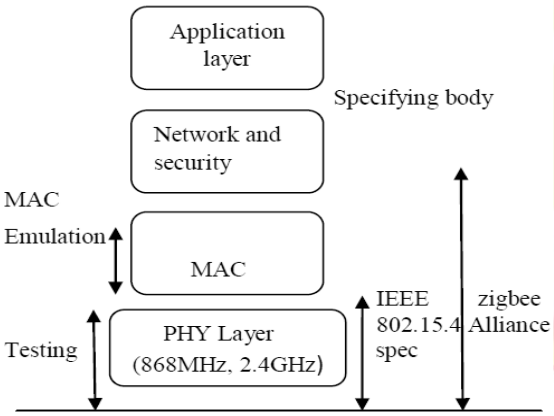

Fig 4:-Zigbee 802.15.4 Protocol stack

IEEE802.15.4 is a good standard which specifies the Media Access Controller(MAC) and Physical networking layers for packet data protocols. Its licence free frequency bands are follows:-2.4 GHz-16 channels with baud rate of 250kps and902 MHz -928 MHz-10 channels with baud rate of 40kps.It uses carrier sense multiple access with collision avoidance for channel access.

IV. Base Monitoring Station

Base Monitoring Station consist of the same ZigBee module programmed as a coordinator which receives the data sent from the sensor nodes i.e. end device and routers, wirelessly. The co-ordinator is mains powered. Data received from the end device nodes is sent the computer using the RS232 protocol and the data received is displayed.

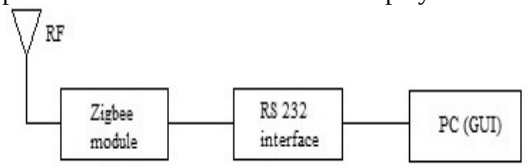

Fig.5 Block diagram of components in base station

V. System Software

Microcontroller accepts the values measured by different sensors via Analog-to-Digital convertor and send these values to the Base monitoring station via ZigBee module. This is done by with the help of coding with embedded C. The Graphical User Interface software should able to display the parameters being monitored continuously in real time. The GUI platform was developed by using the MATLAB software that was able to interact with the hardware at the base monitoring station.

Once the battery loaded sensor node is turned on, the temperature, pH and turbidity sensors immersed in water which sensing the corresponding data. Different push buttons are provided for reading the temperature, pH and turbidity values. Once the user press on any of the push buttons of the panel the Zigbee transceiver in the receiver sends a signal to the zigbee transmitter on the transmitter side giving the corresponding data values to be sent. Once the values plotted, it is saved and stored in MS Excel Database, which can be accessed by clicking on the „Database" tab.

VI. Conclusion And Future Work

The main issue that is being addressed in this project is about developing an effective wireless sensor network (WSN) depnds on water quality monitoring system, that examines „water quality, an important factor now, irrigation, environmental,domestic purposes, industries, etc are concerned. Overall, the proposed implementation of high power Zigbee based wireless sensor network for water quality monitoring system gives low power consumption, and long battery life is presented. The use of high power WSN is effective for activities in industries involving large area monitoring like manufacturing, environmental, constructing, mining etc. The other important fact of this system is the easy installation of the system where the base station could placed at the local places close to the target area and the monitoring task can done ith less training at the beginning of the system installation. Wireless Sensor Networks represent a great opportunity for scientists. They promise different abilities to observe and understand large-scale, real-world phenomena at a fine spatial-temporal resolution. These application in Developing Countries is even more interesting: they can help

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solve problems that affect communities. With the automatic monitoring system, scientists can now understand much better the dynamics of water quality.

Finally, long wireless links provide a low-cost and convenient way to extend the range of a WSN. The most interesting thing usually happen in remote places,and long wireless links can be used to connect the gateway collecting data from the remotes to the Internet. Through deployments, we have demonstrated that these very long links are feasible

A. Future work

Future work will include looking for alternatives to extend the access network and other aspects not considered in the report. Here explain some future research topics:

• *Delay Tolerant Network on Mobile Phones*. For remote sensor installations, data can be saved by the gateway and transmitted to a nearby phone via WiFi. The phone, following its owner, moves to a region which has a stable infrastructure is available and via WiFi transfers the information. In this way even remote regions which will never going to be connected in different ways will be able to provide sensed data. A possible application is in the field of climate change monitoring.

•*GPRS-based motes*. Some new motes can be quipped with GPRS modules that permit to sending SMS and connecting to the Internet via GPRS. The drawbackis the cost of the service and the limited availability of GSM rangein some areas. The advantage is that motes can be placed anywhere (where there is GSM rangeof course) and can send data anywhere.

•*IPv6-based motes*. New motes use IP networking communication. Plenty of them use a version of IPv6 called 6lowpan designed for low-power radios.Developing Countries lag behind different other regions in technology may actually serve to ensure a faster IPv6 adoption.

references

[1] Zulhani Rasin and Mohd Abdullah International Journal Engineering & Technology ,"Water Quality Monitoring System Using Zigbee Based Wireless Sensor Network", IJET Vol:9 No:10, http://www.ijens.org/91410-7575%20ijet-ijens.pdf

[2] Johan Lonn and Jonas Olsson, "Zigbee for Wireless Networking", March 15, 2005, http://webstaff.itn.liu.se/~shago/Exjobb/ZigBee.pdf

[3] J Goldman and D Estrin ,"Distributed Sensing System for Water Quality Assessment and Management", Feb 1, 2007, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.138.7945&rep=rep1&type=pdf

[4] R R.Lakhe, "Wireless Network Using Zigbee" , International Journal of Engineering research and Applications (IJERA), http://www.ijera.com/special_issue/VNCET_Mar_2012/55.pdf

[5] Zigbee,Wikipedia,http://en.wikipedia.org/wiki/ZigBee

[6] (2009) The Zigbee Alliance website [Online] http: //www.zigbee.org/

[7] Estuary Ethier, Bedard, Jeannette " Development of a Real-Time Water Quality Buoy" for The Fraser River Estuary http://axystechnologies.com/wp-content/uploads/2013/11/Development-of-a-real-time-water-quality-buoy-for-the-fraser-river-estuary.pdf

[8] http://rfwireless-world.com/images/zigbee_network.jpg

[9] Peng Jiang,Zheming Wang,"Design of water environment monitoring system based on wireless sensor network"IEEE 2nd International Conference on Industrial and Information Systems, pp., 2010

[10] The CSIRO ICT Center.wireless Sensor Network Devices.Available online at http:/www.ict.sciro.au/page.pHp

[11] Seders,L.A,Shea,c.a,Lemmon,Md,Maurice,P.A;Tally,J.W.;LakeNet:an integated Sensor network for environment sensing in lakes environments.Eng.sci 2008,24,183-191

[12] Jin,Liu,Y-W An overview of the water Environment water resource.2009,27,33-36,Chinese

[13] J. Hall et al., "On-line water quality parameters as indicators of distribution system contamination,"J.Amer. Water Works Assoc.,vol. 99,no. 1, pp. 66–77, 2007.

[14] T. P. Lambrou, C. G. Panayiotou, and C. C. Anastasiou, "A low-cost system for real time monitoring and assessment of potable waterquality at consumer sites," in Proc. IEEE Sensors, Oct. 2012, pp. 1–4.

[15] C. C. Anastasiou, P. Grafias, T. P. Lambrou, A. Kalli, and C. Onisiphorou, "Use of holding tanks and their effect on the quality of potable

[16] R. Szewczyk, J. Polastre, A. Mainwaring, and D. Culler, *Lessons from a sensor network expedition*, in proceedings of 1st European Workshop on Wireless Sensor Networks (EWSN '04), 2004.[5] D. M. Doolin and N. Sitar, *Wireless sensors*

[17] D. M. Doolin and N. Sitar, *Wireless sensors for wildfire monitoring*, in proceedings of SPIE Symposium on Smart Structures and Materials/ NDE 2005,2005.

[18] M. Zennaro, A. Bagula, H. Ntareme, G. Inggs and S. Scott, *On the relevance of open wireless sensors for NGN*, in proceedings of Innovations for Digital Inclusions 2009 (ITU-T Kaleidoscope), 2009.[20]

[19] ZigBee/Mesh modules,Available at:http://www. digi.com /products/wireless/zigbee-mesh/(Accessed: 31 October 2010).