ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 2, Issue 12, December 2013

Automatic monitoring & Reporting of water quality by using WSN Technology and different routing methods.

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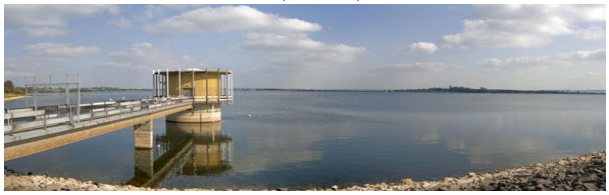
Abstract:-

This paper describes the different data routing methods and WSN technology for monitoring the water data and also provides security for there is no loss of data, due to which it is possible to control water contamination and provides proper water resource management. The Design of Wireless sensor network based on zigbee and arm7.We selected the LAKE as an application of WSN. The important Parameters of water such as Temperature, Turbidity & salinity are responsible for water contamination. We designed a system for a Lake. The system provides the online auto monitoring of water temperature, turbidity, water level, and salinity value environment of an artificial lake by using Zigbee modules. We collected the reading through live graph as well as on LCD display, There is a set point for each parameters when these particular parameter Crosses its set point the alarm is created then we comes to know that water is contaminated or polluted and after every one minute time SMS sends on management mobile which contain the readings of measured water parameters, due to which it is possible for that management person to take Appropriate action in emergency.In this way we can control or reduce water contamination as well as we successfully provides water resource management using WSN Technology. This system provides the reading automatically. The monitoring system thus promises broad applicability prospects.

KEYWORDS: PC based server, wireless sensor network, zigbee, ARM 7, Master, Slaves, Routing methods

I INTRODUCTION

Water quality refers to the chemical, physical and biological characteristics of water. It is a measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose. The most common standards used to assess water quality relate to health of ecosystems, safety of human contact and drinking water. The vast majority of surface water on the planet is neither potable nor toxic In fact; water quality is a complex subject, in part because water is a complex medium intrinsically tied to the ecology of the Earth. Industrial and commercial activities (e.g. manufacturing, mining, construction, Transport) are a major cause of water pollution as are runoff from agricultural areas, urban runoff and Discharge of treated and u the parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for human consumption, industrial use, or in the environment Treated sewage. Environmental water quality, also called ambient water quality, relates to water bodies such as lakes, rivers, and oceans.



Water quality standards for surface waters vary significantly due to different environmental conditions, ecosystems, and intended human uses. Toxic substances and high populations of certain microorganisms can present a health hazard for non-drinking purposes such as irrigation, swimming, fishing, and rafting, boating, and industrial uses. Here we designed the system for lake with one master and two slaves. The two slaves under Pc based Master Supervision. Pc master communicate with slaves via wireless zigbee module. In this system we measured four parameters of water such as Temperature, turbidity, salinity and water level.

II LITERATURE SURVEY

1)Peng jiang and Hongbo xia have proposed the Design of water environment system based on wireless sensor network.This system takes MSP430F1611 main processor to develop automatic water environment monitoring system.In this paper authors proposed a system which the online automonitoring of water parameters like temperature and Ph.

2)O'Flynn,B,Martinez-Catala have developed automated water envirnmment monitoring system using GSM technology, this system sends the online measurement of water parameters directly on mobile phone through GSM technology.

3) Mingfie Zhang, Daolaing Li presents a system framework taking the advantages of the WSN for the real-time monitoring on the water quality in

aquaculture, they design the structure of the wireless sensor network to collect and continuously transmit data to the monitoring software then accomplish the configuration model in the software that enhances the reuse and facility of the monitoring project. This monitoring system has been realization of the digital, intelligent, and effectively ensures the quality of aquaculture water. Practical deployment results are to show the system reliability and real-time characteristics, and to display good effect on environmental monitoring of water quality.

4) At present there are four main methods present for monitoring the water environment each method having its advantages & disadvantages.

In some methods:-

a)Automatic and continuous monitoring of water environment parameters by an automatic monitoring system consisting of monitors & control centers, as well as several monitoring stations .data can be remotely and automatically transferred .each station provides its real time water environment parameters These systems can be costly and have a great Influence on the surrounding ecological environment

b) Artificial sampling with portable water quality detecting devices and subsequent lab analysis this method applies only to samplings on cross-sections of rivers and lakes with sampling frequency ranging from several times a day to monthly.

c) Water quality monitoring technology realized using some sensitivity of aquatic organisms to the presence of poisonous substances in water bodies by measuring or analyzing the change of activities of different organisms in different water environments then coming to the qualitative evaluation report of the water quality Basic measuring methods of this type being practiced include fish measuring beach louse measuring. These methods can by no means be expected to reach high accuracy for water environment monitoring.

d) Water environment monitoring with remote sensing technology namely detecting the spectrum specifics of an electromagnetic wave (radiation, reflection and scattering) in non contacting methods with respect to the water bodies after the processing of the Information from the collection of illustrative spectra, its physics and chemical characteristics are to be identified. This method provides low accuracy and it is also hard to perform real time monitoring.

Comparing with all these methods constructing a monitoring system based on WSN's (wireless sensor network) with advantages arrangements, collection of variety of parameters high detection accuracy and high accountability of the monitoring network, etc. A WSN's is a Ad-hoc network composed of great number of tiny low cost and low power consumption sensing nodes which are capable of sensing, calculating and communicating data .This paper develops water environment monitoring system based on wireless s which is applied to artificial lake to realize remote and automatic online monitoring of temperature, turbidity, water level, and Ph of lake water.

III SYSTEM MODELLING

A. System flow:-

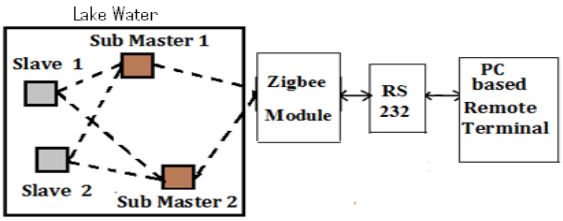


Fig.1:- Block Diagram of System

Here we designed a network; under that network we connected two slaves. Means Slave 1 is lake 1 and slave 2 is Lake 2.These Slaves are implemented using zigbee and ARM 7 combination. It will work as wsn. Various Sensors are connected to Arm 7 via inbuilt ADC and output of sensor is nothing but the measured parameters from respective slaves. Both slaves placed inside the water to acquire the different parameters. The arm 7 is connected to the zigbee module through RS 232.The Zigbee module have its range 30 meter from the slaves. By selecting the different zigbee module we can increase the distance between Master and the Slaves.

B. Slave's Design:-

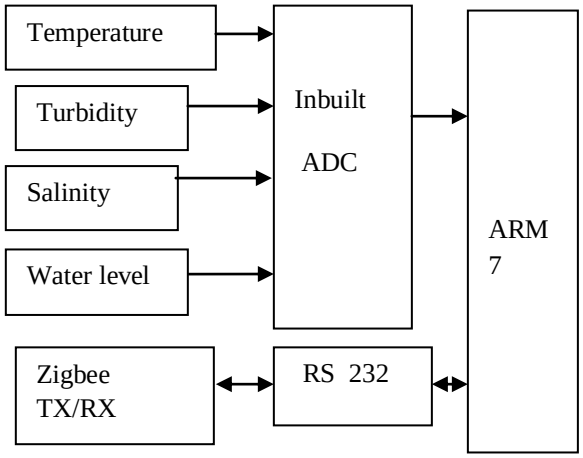


Fig. 2 - Slave1 & slave2 same design

Entire system contains four sensors to measure four parameters of water. Temperature, turbidity, salinity & water level .These sensors are installed at each node in target area. Measured parameters are analog in nature we converted it in digital form by using inbuilt ADC.

C. Sensors used

1) **Temperature sensor**: -

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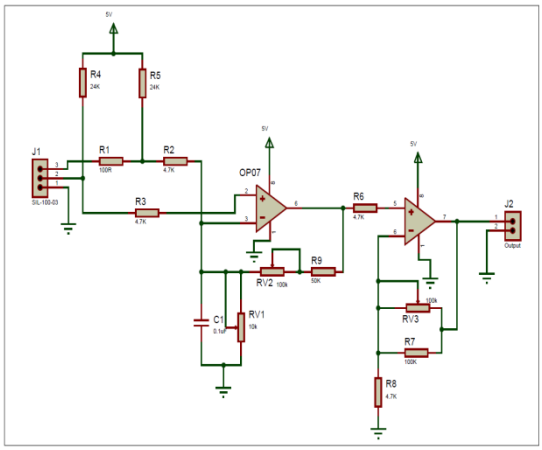


Fig.3:- PT100 temperature sensor

Temperature sensor is used to sense the temperature parameter. We have used a Temperature sensor called PT100. This temperature sensor can sense the temperature of the atmosphere around it also the temperature of any machine to which it is connected or even can give the temperature of the human body in case if used. So, irrespective of the application to which it is used, it gives the reading of the temperature accurately. Temperature sensor is an analog sensor and gives the output into form of analog signal. This signal is feed to ADC which will convert it into digital forms. Once converted into analog form the principle of operation is to measure the resistance of a platinum element. The most common type (PT100) has a resistance of 100 ohms at 0 °C and 138.4 ohms at 100 °C. There are also PT1000sensors that have a resistance of 1000 ohms at 0 °C.

2) **Light Sensor (Turbidity)**:- Photo resistors or Light Dependent Resistors (LDR) which change resistance according to light intensity. Normally the resistance of Photo resistor (LDR) decreases with increasing intensity of light falling on it. Photomultiplier tubes containing a photocathode which emits electrons when illuminated, the electrons are then amplified by a chain of dynodes.

3) **Water level (float sensor)**: - A water level is typically used to measure the depth/level of liquid in the container. As the water rises and reaches the level of the water level switch, it begins to water level going from the vertical to the horizontal level. When the water level values exceed the set point and the microcontroller continuously scans for the water level and water level will sense the particular parameters, and these parameters are in mill volts(0-1v), than ADC converts these parameters i.e. analog voltage (given by the water level) it uses the technique of successive approximation of (8bit) into digital hex format. This digital signal is then given to Microcontroller LPC2138. The µc then receives the signals and converts it into corresponding BCD format (binary coded decimal) which is then displayed on the LCD (liquid crystal display).

4) **Salinity (water salt):** - It is measurement of present of salt in water. Rain water contains some amount of salt in it and also due to the garbage material thrown by people's waters salinity increases. To monitor salt in water we used this sensor

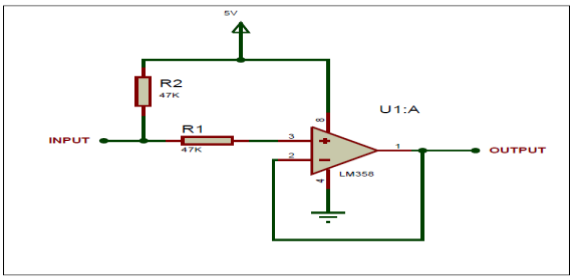


Fig.4:-water salt sensor

Actually it measures conductivity of the water. High salt in water less conductivity of water

IV. SYSTEM ORGANIZATION

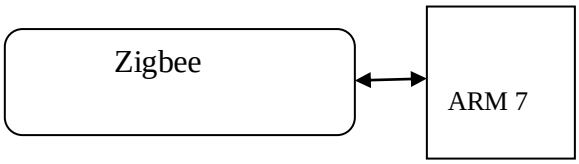


Fig.5:- Master design

In this system we used
1) Master Pc terminal
2) Slave Terminals

A. PC master:-

Here we provided Master & Slave structure for the application. In the main PC master terminal there is Vb installed on it. The pc Master terminal is used to monitor the status of both the slaves from the lake.

B. Relay:-

It is on/off switch. Which uses 12V supply, It is use make the switch on or off. Here we use 12v single change over relay. These relays are connected to the µC via a relay driver. The relays require a current of 50 Ma at the time of switching. The µC cannot provide that much amount of current that's why we connect a relay driver in between so that the current requirement can be fulfilled easily. It operates in two modes:

- Normally Open
- Normally Closed

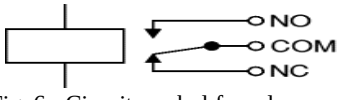


Fig. 6:- Circuit symbol for relay

Different devices can be controlled i.e. they can be turned On/Off whenever required. The relay's switch connections are usually labeled COM, NC and NO:

COM = Common, always connect to this, it is the moving part of the switch
NC = Normally Closed, COM is connected to this when the relay coil is off.
NO = Normally Open, COM is connected to this when the relay coil is on.

C. Zigbee Module:-

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area networks. ZigBee devices are often used in mesh networks form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones, cost is very less compare to other routing methods. This allows ZigBee networks to be formed ad-hoc, with no centralized control or high-power transmitter/receiver able to reach all of the devices. Any ZigBee device can be tasked with running the network. ZigBee is targeted at applications that require a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250 kbit/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device.

D. Introduction to ieee 802.15.4 :-

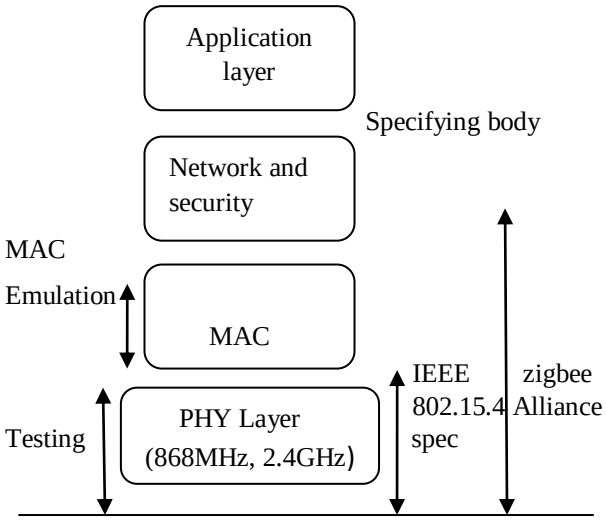


Fig 7:-Zigbee 802.15.4 Protocol stack

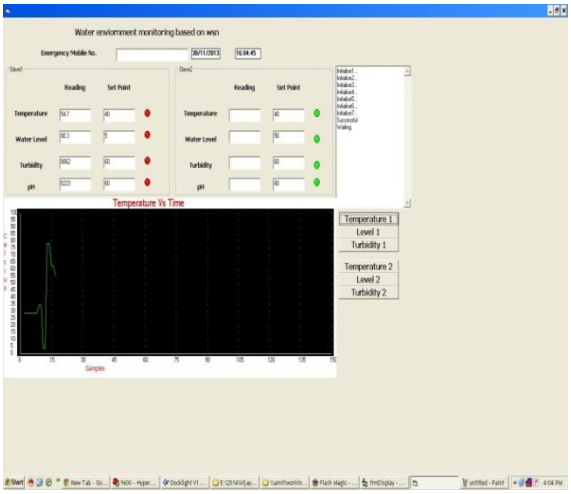
Ieee 802.15.4 is a simple standard that specifies the media access controller (Mac) and physical (phy) networking layers for packet data protocols. Its license free frequency bands are as follows:-
2.4 ghz (16 channels with baud rate of 250 kps)
902 mhz - 928 mhz (10 channels with baud rate of 40 kps)
868 MHz - 870 MHz (1 channel with baud rate of 20 kps).North America, Europe, Australia and new Zealand use the sub 1 ghz bands whereas the rest of the world uses 2.4 ghz bands. It uses carrier sense multiple access with collision avoidance for channel access.

V RESULTS

A wireless sensor network is developed in the hope of tracking with the problem of the lack of a water environment monitoring system. In this system we measured four parameters of water and these are the readings for that one

1) Temperature:-
Temperature is an important water quality parameter that is relatively easy to measure and has a direct impact on the organisms living in the water. Many aquatic organisms are sensitive to changes in water temperature, especially because water temperature changes will affect other water quality parameters, such as dissolved oxygen and salinity. Water bodies will naturally show changes in temperature seasonally and daily; however any changes to stream water temperature outside of the normal upper and lower bounds for that particular area will affect the ability of fish to reproduce. Many lake and rivers will exhibit vertical temperature gradients (thermal stratification) as the sun warms the upper water during the day while deeper water will remain cooler.

Snap 1:-Temperature measurement on LCD display

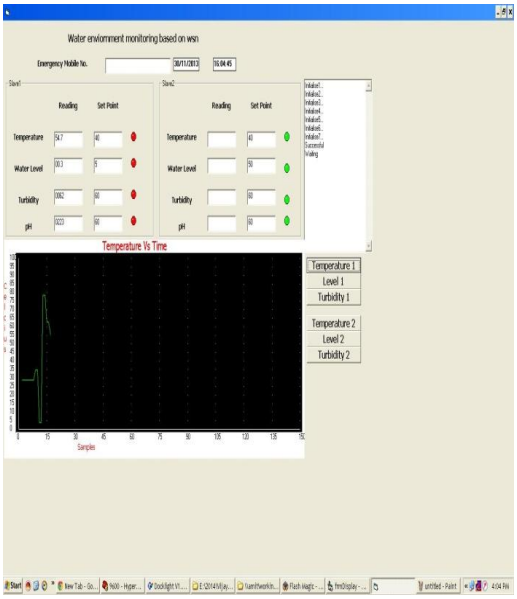


Snap 2:-Temp measurement by live graph on VB window

2) Turbidity (Led+Light):-
Turbidity is amount of suspended particles in the water. it is actual measurement of transparency of water. Normal turbidity of water is 5 NTU. In following

reading we measured the turbidity of very turbid water that why it counts 30.6 NTU

Snap3:-Turbidity measurement on LCD display

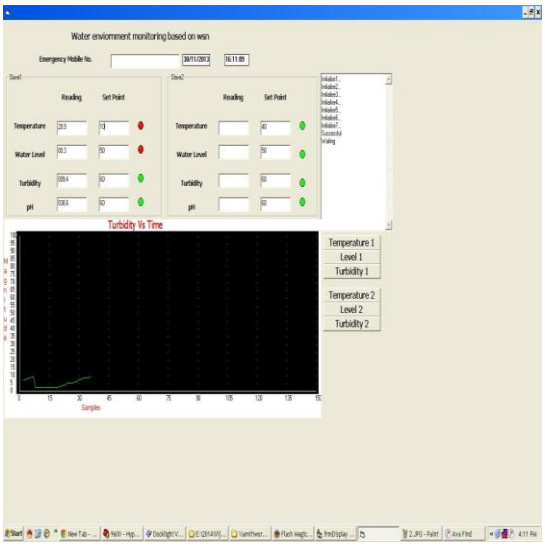


Snap 4:- Turbidity measurement by Live Graph

3) Water Level :-(Float)

In this system we measured the water level, it helps for the proper water resource management, as per the capacity of different lakes we can use the water level sensor to calculate water level.

Snap 5:-Water Level reading on LCD display



Snap 6:-Water level reading by graph

V CONCLUSION

A wireless sensor network is designed in the hope of tracking with the problem of the lack of a water environment monitoring system. It provides a useful feature's such as large monitoring ranges, low cost , low power consumption, flexible configuration and very small damage to the natural environment. The system successfully provides on-line auto monitoring of the temperature, turbidity, water level, and salinity. In this way we successfully measured the different water parameters, we provided live graph reading for all parameters and using this reading we concluded that whether water is contaminated or not it also provides the proper water resource management. 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. At any moment when water parameter crosses its set point the alarm is created and sms sends on management mobile that emergency is occurred, & through the graph of various parameters 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. It is also possible to measure deep under ground water parameters also. 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.

Applications:

1) Data logging in hazardous application such as nuclear plants, gas plants, chemical plants etc.
2) Wireless communication over long distances such as oil rigs, lakes, rivers, dams, oceans

Advantages:

1) Efficient way for wireless data logging of hazardous applications
2) Less time delays
3) Quick response time
4) Fully automate system
5) Robust system
6) Low power requirement

ACKNOWLEDGMENT

A dissertation work of such a great significance is not possible without the help of several people, directly or indirectly. First and foremost I have immense happiness in expressing my sincere thanks to my guide, **Mr.S.G.HATE** for his valuable suggestions, co-operation and continuous guidance. I am very much thankful to all my faculty members whose presence always inspires me to do better. My happiness culminates, when I recall the co-operation extended by my friends during the completion of this dissertation work. A final and heartily thanks go to my parents

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