A GSM Based Water Quality Monitoring System using Arduino

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S.Gokulanathan
Department of ECE, Sri Vidya College of Engineering & Technology
Virudhunagar, Tamil Nadu, India

P.Manivasagam
Department of ECE, Sri Vidya College of Engineering & Technology
Virudhunagar, Tamil Nadu, India

N.Prabu
Department of ECE, Sri Vidya College of Engineering & Technology
Virudhunagar, Tamil Nadu, India

T.Venkatesh
Assistant Professor, Department of ECE
Sri Vidya College of Engineering & Technology, Virudhunagar, Tamil Nadu, India

Abstract
This paper investigates about water quality monitoring system through a wireless sensor network. Due to the rapid development and urbanization, the quality of water is getting degrade over year by year, and it leads to water-borne diseases, and it creates a bad impact. Water plays a vital role in our human society and India 65% of the drinking water comes from underground sources, so it is mandatory to check the quality of the water. In this model used to test the water samples and through the data it analyses the quality of the water. This paper delivers a power efficient, effective solution in the domain of water quality monitoring it also provides an alarm to a remote user, if there is any deviation of water quality parameters.
Keywords: Water Quality, pH, Conductivity, GSM, EC sensor, Temperature Sensor, Wimax, Arduino.

Introduction

Water is one of the essential natural resources that has been gifted to mankind. But the rapid development of the society and numerous human activities speeded up the contamination and deteriorated the water resources. For above water quality monitoring is necessary to identify any changes in water quality parameters from time-to-time to make sure its safety in real time. The Central Pollution Control Board (CPCB) has established a series of monitoring stations on water bodies across the country which monitor the water quality on either a monthly or yearly basis. This is done to ensure that the water quality is being maintained orrestored at the desired level. It is important that it is monitored on regular basis. Water quality monitoring helps in evaluating the nature and extent of pollution control required, and effectiveness of pollution control measures. All the stations will operate in real time, and central station can access data from any of the abovestations using GPRS/GSM or 3G cellular services.

Water quality monitoring systems need to quickly identify any changes in the quality of water and report the same to the officials for immediate action. The system is designed for continuous onsite sensing and real-time reporting of water quality data where the officials can access the data on the Smart phone/PC through the Internet. Our proposed system employs the use of multiple sensors to measure the parameters, measures the quality of water in real-time for effective action, and is economical, accurate, and required less manpower.

Research Methodology

1. This paper is review based study– this paper is done to overcome the man power needed in the previous paper.
2. The period of the study – the study has been started in august 10th, 2018 and result and conclusion has been done in January 29th , 2019.
3. Result comparison– in the previous published study the man power is highly needed, to overcome that limitations is experiment is done.
4. In future we use IOT concept in this project. Detecting the more parameters for most secure purpose. Increase the parameters by addition of multiple sensors. By interfacing relay we controls the supply of water.
5. The power efficient – due to high power is not used.

Literature Survey

The available water resources are getting depleted and water quality is deteriorated due to the rapid increase in population and needs to meet the demands of human beings for agriculture, industrial, and personal use. The quality of ground water is also affected by pesticides and insecticides. The rivers in India are getting polluted due to industrial waste and discharge of untreated sewage. In order to eliminate problems associated with manual water quality monitoring, CPCB has planned to go hi-tech and plans to establish 'Real-Time Water Quality Monitoring (WQM) Network' across Ganga Basin. Stephen Brosna, 2007 [3] investigated a wireless sensor network (WSN) to collect real-time water quality parameters (WQP). Quoi Tie-Zahn, 2010 [4] developed an online water quality monitoring system based on GPRS/GSM. The information was sent usinga GPRS network, which helped to check remotely the WQP. Kamal Alamo, 2011[5] presented web-based WSN for monitoring water pollution using Sigsbee and Imax networks. The system measured various WQP. It collected, processed measured data from sensors, and directed through Sigsbee gateway to the web server using Imax network to monitor the quality of water from large distances. The system was capable of monitoring water pollution in real-time. Dong He, 2012 [6] developed a WQM system based on WSN [7]. The remote sensor was based on Sigsbee network. WSN tested WQP and sent data to the Internet using GPRS. With the help of the Web, information was gathered at a remote server. Kulkarni Amruta, 2013 [8] created solar-powered WQM utilizing remote sensor network. The Base station (BS) gathered information from distant remote sensors. The BS associated with Sigsbee module was powered by sunlight baseboard (Energy harvesting). Brinda Das, P.C. Jain 2017 [9] The conventional method of testing water quality is to gather samples of water manually and send to the lab to test and analyze.

Implementation

This system makes use of three sensors (pH, conductivity, and temperature), processing module Arduino, and two data transmission modules Arduino and GSM. The three sensors capture the data in the form of analog signals. The ADC converts these signals into the digital format. These digital signals are sent to the Arduino via a GSM module. The microcontroller will process the digital information, analyze it, and further communication is done by the GSM module, which sends an SMS with the water quality parameters onto the smart phone/PC, which also displayed on the LCD of the Arduino. Fig. 1 shows the water quality monitoring system. Arduino accepts and processes the data collected from the sensors to the Web page via GSM module. This is carried out with the help of coding.The code is written in C-programming and using the Arduino software to simulate the code. We have used an evaluation version of Arduino for C programming.

System Design

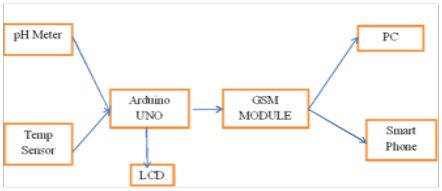

Fig. 1 Water Quality Monitoring System
Source: Primary Data

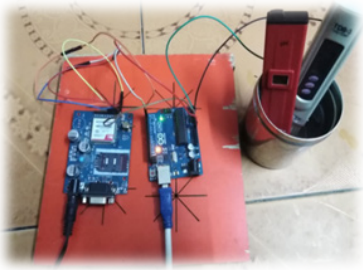

Fig. 2 Water Quality Monitoring System Implementation
Source: Primary Data

Arduino Uno Board

The Arduino Uno is microcontroller board based on the ATmega 328 It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 an analog inputs, a 16 MHz crystal oscillator, a power jack, an ICSP header, and a rest button.It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable power it with an AC – to – DC adapter or battery to get started.

USB-to-serial driver chip. Instead, it features the Atmega 8U2 programmed as a USB –to – serial converter. The UNO and version 1.0 will be the reference versions of Arduino, moving forward.The UNO is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

GSM MODEM

A GSM modem is specialized type of modem which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone..A new version of now SMS is available that supports the ability to use Android phones as GSM modem devices for both sending and receiving SMS and MMS messages.GSM is an open and digital cellular technology used for transmitting mobile voice and data services operate at the 850MHz, 900MHz,1800MHz and 1900MHz frequency bands.

Sensors

A sensor is a transducer device to detect events or changes in its environment, and then provide a corresponding electrical output. The most important characteristics of a sensor are precision, resolution, linearity, and speed. Sensor calibration improves sensor performance. The performance can be enhanced by removing structural errors in the sensor outputs. Above repeatable errors calculated during calibration are compensated in real time during measurements carried out by sensors.

pH Sensor

pH is a measure of how acidic or basic alkaline the water? It is defined as the negative log of the hydrogen ion concentration. The pH scale is logarithmic and goes from 0 to 14. It is low for acidic and high for alkaline solutions. A natural source of water pH is around 7. For each increase in a number of pHs, the hydrogen ion concentration decreases ten-fold and water becomes less acidic. A pH sensor has to measuring electrode and a reference electrode. A battery positive terminal connected to the measuring electrode and negative terminal to the reference electrode. The reference electrode provides fixed potential and when the pH sensor immersed in the solution, the reference electrode does not change with changing hydrogen ion concentration. The differential voltage of electrodes changes with the temperature, so a temperature sensor is also necessary to correct the change in voltage.

Electric Conductivity Sensor

Salts dissolve in water breaks into positive and negative ions. Dissolved ions are the conductors and conductivity is the ability of water to conduct an electrical current. The major positively charged ions are sodium, calcium, potassium, and magnesium and the major negatively charged ions are chloride, sulfate, carbonate, and bicarbonate. Nitrates and phosphates are minor charged ions to the conductivity. Electric conductivity is measured with the help of a probe and a meter. The probe

consists of two metal electrodes spaced 1 cm apart (unit: millimeter - or micro-Siemens per cm). The dissolved salts concentration is directly proportional to electrical conductivity. TDS in water is determined by multiplying the conductivity by a factor of 0.67.

Temperature Sensor

To analyze the coldness or hotness of a product, the Temperature sensor is designed. This sensor does not possess more than 0.1 °C temperature rise in the air which is still. It has low self-heating. The range for operating temperature is from -55°C to 150°C.

Result

To demonstrate the quality of water, the pH sensor and EC sensor is put into a container filled with tap water, to which 3- 4 drops of acid is added. We can see that the pH of the water remains at around 3 to 4.5 means the water is acidic in nature. The temperature of the surrounding stays between 32 to 34 degrees. The conductivity of water is at 7 to 9 micro Siemens/centimeter. Total Dissolved Solids are 0.67*electrical conductivity which can be measured from the experimental results, the pH value for drinking water was obtained in the range 6.7-7.2 which was found to be within the range prescribed by the Indian Standards Institution i.e. 6.5-8.5. The monitored values for rain water and lemon juice were found to be in the range 5.6-6.4 and 2.2-2.9 respectively.

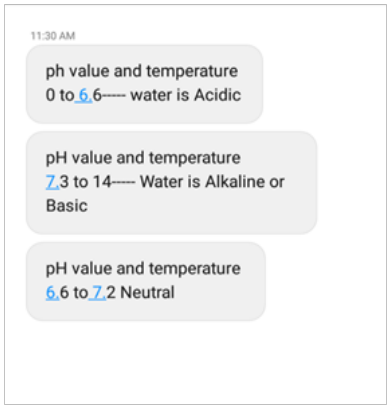

Fig 3.Output Message in WQM System

Conclusions and Future Work

The real-time water quality monitoring system for real-time applications which is efficient and low cost,has been tested after the implementation. This can help in preventing diseases caused due topolluted water and the presence of metals. It has a positive meaning to strengthen environmental protection.It also has a positive meaning to improve environmental performance throughout the community. Three parameters are monitored in this system which is pH, temperature and dissolved oxygen. The diseases that are caused due to the presence of metals and pollutants in the water can be protected by this system. The task of monitoring can be done by using less trained individuals. The installation of the system can be done easily when it is near the target area. To ensure the portability of the device, a self-mode, small size Arduino microcontroller is used.The results of the test for all times have been successful. We conclude that all the objectives of the proposed system have been achieved. To test more parameters of the water quality for some applications, other sensors can be included in the system.The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters. The operation is simple. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on.

Man power is reduced. The number of parameters to be sensed can be increased by the addition of multiple sensors to measure dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), ammonia nitrogen, nitrate, nitrite, phosphate. The system can be further upgraded using wireless sensor networks.

- In future we use IOT concept in this project
- Detecting the more parameters for most secure purpose
- Increase the parameters by addition of multiple sensors
- By interfacing relay we controls the supply of water

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Author Details

S.Gokulanathan, *Student, Department of ECE, Sri Vidya College of Engineering & Technology, Virudhunagar, Tamil Nadu, India.* ***Email ID:*** *gokulpro7@gmail.com*

P.Manivasagam, *Student, Department of ECE, Sri Vidya College of Engineering & Technology, Virudhunagar, Tamil Nadu, India*. ***Email ID:*** *vassdevpro@gmail.com*

N.Prabu, *Student, Department of ECE, Sri Vidya College of Engineering & Technology, Virudhunagar, Tamil Nadu, India.* ***Email ID:*** *prabu08041998@gmail.com*

T.Venkatesh, *Guide*, *Assistant Professor, Department of ECE, Sri Vidya College of Engineering & Technology, Virudhunagar, Tamil Nadu, India*. ***Email ID:*** *venkatt87@gmail.com*