International Journal of Pure and Applied Mathematics
Volume 118 No. 20 2018, 1363-1369
ISSN: 1311-8080 (printed version); ISSN: 1314-3395 (on-line version)
url: http://www.ijpam.eu
Special Issue

SMART WATER QUALITY MONITORING SYSTEM FOR REAL TIME APPLICATIONS

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Abstract: The monitoring of the water standard is a complex process as it has several laboratory testing methods and time consuming. To overcome this difficulty, a real time monitoring of water goodness by using IoT has been proposed. Internet of things together with the Sensor water meters for the effectiveness, govern the quality of water. Here we are executing, system for monitoring the water goodness through different sensors -turbidity, pH, temperature, conductivity. The controller accesses the information which is monitored by the use of sensors. The accessed data are controlled by the usage of Arduino controller. By using an IoT, the information is collected and the water pollution can be enquired, by a strict mechanism. To the addition, this system states an alert to the public and concerned subdivision or unit about the water. The atmosphere can have adaptable good water.

Keywords: IoT, Water quality, [=conductivity, PH, turbidity, temperature.]

1. Introduction

Water is a fuel for all life and no lives can survey without water on this planet. Hazardous of various category are collapsed with the drinking water which arrives through industrialization, globalization, urbanization, agriculture etc. It is a need to check the water regularly using agile technologies. From our project we assure that water quality measuring is done automatically. The Central Pollution Control Board (CPCB) had established many continuous monitoring stations on water body across the country, which checks the quality of water either monthly or yearly. This is to make sure that the water standard is being maintained in desired level. Also It has significance that it is monitored on daily basis. The pollution controlling requirement and the measures for the effectiveness of pollution control in water is finished by using Water quality monitoring. CPCB have plans to develop the water standard monitoring network across Ganga river valley. All the stations are operating in real time and central site can acquire data from several of the above stations using GPRS/GSM or 3G cellular serviceability. And the price of the system differs in proportion to the components used. Our proposed model consists of various sensors which compute the standard of water in real-time for effective action, and is economical, accurate, and only less manpower required. In this paper, section 2 examine about the literature survey on surveillance of water quality while section 3 discusses on Internet of Things. Section 4 discusses implementation of water standard surveillance system, and results acquired by way of the system are discussed in section 5. Section 6 concludes the paper.

Totally there are 50 lakh public water sources in our country. Including unreported, totally there are 60 lakh water sources Which is tested twice/year for bacterial analysis. And once/year for chemical analysis. According to NRDWP 120 lakh water samples to be tested/year. And water testing method was started in the year 1988, from 1988 to 1991 Substrate technique was used to identify the target bacteria. And in 1996 Epidemiological method was used to recognize the water quality but in this method many water borne diseases were missed. And from 1995 to 2007 the number of observed specimen with BOD values less than 3mg/I were between 57-69%.

2. Literature Survey

The rapid growth of population has the outcome in the depletion of available means of water and falloff in the water quality. Also the quality of underground water has been infected by weed-killer and fungicides. The rivers in India are getting polluted owing to industrial waste and discharge of untreated sewage.

In 2013, Nivit Yadav, “CPCB Real Time Water Quality Monitoring Maintenance”. In this method the quality of water in Ganges and Yamuna river is tested by using sensors. since they are the most polluted river in our country CPCB plans for analysing the water standards. And this method is more expensive.

In 2007, Tuan Le Dinh, Wen Hu, Pavan Sikka, Peter Corke, L. Overs, Stephen Brosman, [4] “Design

and Deployment of a Remote Robust Sensor" which gives a brief explain about the specialities and designing's of sensors.

In 2010, Quio Tie-Zhn [5] briefed the online water quality monitoring system based on GPRS/GSM. The module collects and sends the data to monitoring centre through GPRS. It is an artificial method hence collection of data and other process will be done slowly.

In 2003, Pavlos Papa Georgiou, [7] "Literature Survey on Wireless Sensor Networks", has analysed about the various wireless modes, configurations and networks. It analyses the protocols and layers in Wireless networks.

In 2011, Satish Turken, Amruta Kulkarni, [8] "Solar Powered Water Quality Monitoring System using Wireless Sensor Network", The Base station (BS) gathered information from distant remote sensors. The BS associated with ZigBee module was powered by sunlight baseboard (Energy harvesting).

In 2015, Liang Hu, Feng Wang, Jin Zhou and Kuo Zhao [9] "A Survey from the

Perspective of Evolutionary Process in the Internet of Things", in this the new arrival and evolution in the internet is made clear to use the internet of things and The different techniques were explained.

In 2016, M N Barabde, [11] the System is used for determining the physiochemical factors of water quality such as motion, temperature, PH, conductivity, and oxidation lowering potential using ZigBee.

In 2016, Pavana N R, Dr. M.C. Padma [12] composed the water quality factors by investigating Wireless sensor networks(WSN) and by using the raspberry Pi module which is used with the Linux version.

In2002, W. Ye, J. Heidemann, D. Estrin, measured about [13] "An Energy-Efficient MAC Protocol for Wireless Sensor Networks" which describes about the connection of sensors and the environmental monitoring applications and it mainly says about the minimum energy consuming in the wireless network applications.

In 2002 J. Hill, D. Culler, [19] "Mica analysed a wireless platform for deeply embedded networks", it clearly explains about the communication of data over multiple networks and the use of embedded networks without predefined protocols.

In 2008, Bergant, A., Tusseling, A.S., Vitkovsky, J.P., Covas, D.I.C., Simpson, A.R., Lambert, M.F[17] analysed the Parameters that affecting the flow and the pressure of water-hammer wave attenuation in different networks by using the classical theory of water.

In 2011, Allen, M., Preis, A., Iqbal, M., Srirangarajan, S., Lim, H. B., Girod, L., Whittle, A.J. [20] "Real-time in- network distribution system monitoring to improve operational efficiency,". It says about the deployment of wireless water sentinel project by using online hydraulic modelling, it ensures the continuous delivery of an essential resource in the various networks.

Fig 1, says about the various levels of purity in different years

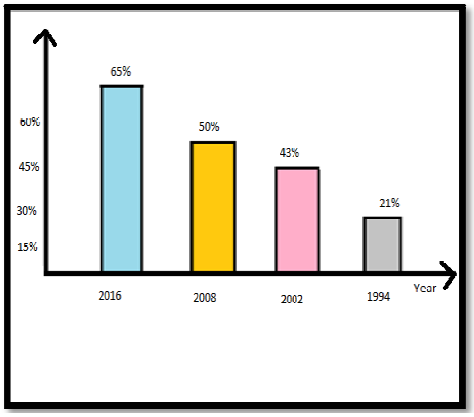

Figure 1. Analysis of Purity

3. Internet of Things

Internet of Things (IoT) is determined as the network of environmental objects or items which includes devices, vehicles, buildings which are embedded with sensor, micro-controller, and network associativity. It enables these items to get together and interchange data to the various environment. The IoT is a wide and big web of objects which are submerged and designed with different built-in wireless telecommunications. By using the existing internet framework, the IoT can be linked with any infra framework and can be monitored and glanced. All the devices have its unique peculiarity; it helps to capture the real-time data automatically. The IoT have sensors, processors and portal which are the main basic building batch. By 2020 it says that 50 billion 'things' will together to the Internet [9]. Wireless technologies such as, Wireless Personal Area Network RFID, 6LoWPAN (IPv6 Low power) Wi-Fi, Bluetooth and ZigBee permit the devices to associated with each other and to the network by the way of servers. The facts associated by the sensors are saved and analysed by the cloud services. People are allowed to take a proper decision for the collected data.

At the present day, Smart phones have become the lectern for communication and estimating field. As Mobile phones grow to be a comfort to use, and cheaper it can be used for transmitting various types of information. Due to the distribute of mobile phones, various mobile data administration applications are being expanded. The report of the water standard monitoring can be very efficient as well as with good accuracy for analysing the data when the sensor technology is combined along with the mobile data

application. Mobile devices, PC and tablets have the display and keypad unit sensors which are embedded in it. By using an IP address in the internet, the Phones may be joined together easily with the Internet (IoT devices satisfies every requirement). In IoT mobile devices act as hub/cellular network. smart things are part of the Internet in Ubiquitous Network Architecture; hence authorized users have approach for information. The data are collected from each objects by using servers which acts as sink.

A. Related work

The function of an IOT applications open source Web page is to store and retrieve data from sensors or things using Local Area Network (LAN) or HTTP over Internet. Using the web page one can create applications like store and retrieve data from sensors or things using Local Area Network (LAN) or HTTP over Internet. Applications like sensor logging, location tracking, and social network of things with status updates can be created by using the created web page. Numeric data such as averaging, median, summing, rounding and time scaling is processed by using API of the web page tool. The created application channel endures 8 data fields such as inclination, latitude, longitude, and status. The function of thing speak is to send sensors data to cloud to save information in a channel using sensors and websites. Easy approach to the saved data is provided by the cloud. The web page can be analysed, visualized and can sum the new data, or interact with web sites and social devices by the help of web application one can calculate new data, and visualize data in the form of plots, charts, and gauges using analytical tools online. Also the application can access the MATLAB to give sensor data. And here effects are communicated by using tools. The application responds to both raw data and new data in a channel. And it also helps devices execute by queuing the commands.

4. Implementation

In this system it makes use of four sensors (Turbidity, temperature, pH, conductivity) and the Arduino controller connected with internet of things. The Processing module microcontroller, and the transmission module GSM. The four sensors capture the data in the analogy signals. The ADC converter which converts the four signals information's into the digital format. The digital signals are passed to the Arduino controller which is together with the transmission module. The microcontroller in Arduino will examine itself and course the digital information, and here the available GPRS/GSM module is for next communication in the channel, the GSM model will send the water quality factors to the smartphone/PC by the SMS, which can be viewed on the LCD. Fig. 1 display the water quality monitoring system. Microcontroller in the Arduino accepts the information and processes the information which are collected from the sensors to the Web page via GSM module. With the help of coding the transmission is performed. The Embedded-C language is used for writing the code and Keil u vision software is used to simulate the program. For C programming we have used evaluation version of MDK-ARM v4. A software tool called Flash Magic is used for burning the. Hex files to NXP Controllers.

System Design

The water quality monitoring system employs sensors such as pH, temperature, Electric Conductivity (EC) and turbidity to get the data parameters. These sensors are positioned in the water will analyse the quality of the water resources. The verified content is used to prophesy the quality of water.

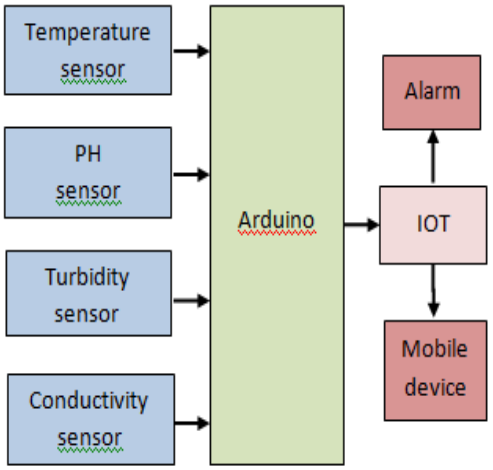

Figure 2. Water quality monitoring system

The analysed data is processed through the microcontroller in the Arduino module and transferred through the GSM/Wi-Fi module using the data communication module to the central server. By giving a user id and password to the user they can view the data which is collected, processed, transmitted and analysed. The collected data is displayed in real time. The microcontroller in the Arduino is based on supporting the embedded trace & emulation through real time. It also supports the high speed flash memory in the embedded system. Hence the size is considered as the main requirement for the point of scaling applications and for controlling the access provided to the consumers it is good to use and it also consumes less power. It also suitable for providing the low resolution image with high processing power and by

providing the protocol modifiers for communication in soft modems & in communications and providing paths with large buffer size [11]. The Wi-Fi or GSM module used is merely low cost with chips in it. The TCP/IP protocol stack and the microcontrollers are manufactured by M/s Espruino [12].

The wireless local area network provides service for offloading the other processor applications with Wi-Fi network functions or it also can host the various applications. The applications in this boots up from the external flash directly during hosting. Due to its integrated cache, the memory requirement is minimized and the system performance has been improved. Based on the type of interfaces like the UART interface or the CPU AHB bridge design, the microcontrollers can be accessed with the wireless internet access, it can be done when the Wi-Fi adapter works similar to the Wi-Fi module.

To send and receive data in Ethernet buffers, the Wi-Fi module uses the transceiver(Tx/Rx) which is in serial format. In the Wi-Fi module to change and query the configurations of Wi-Fi, serial commands are used. For the communications between a Wi-Fi module and the microcontroller it requires only two wires for the transmission and reception. Making the code very light weighted it allows the microcontroller to perform offload Wi-Fi related tasks on the module. To build an Internet of Things applications very easy, SPI and UART interfaces are addressable over the Wi-Fi module.

To connect the TCP connections which is open and the Wi-Fi network we use the AT commands. The open TCP connections do not need any protocols like TCP/IP stack running in the microcontroller. The factors can be pushed to the internet (server) by the regular connections to the microcontroller.

5. Sensors

A sensor gives a corresponding electrical data by discovering the events or modifications in its environment. A sensor is a transducer device. The Performance of the sensor is increased by the sensor calibration. Speed, accuracy, resolution and linearity are the most important quality of the sensor. The activities can be enhanced & removing of errors due to frame are deleted in the sensor results which makes it enhance. The difference between the wanted output and the obtained output of the sensor makes way to identify the mistakes due to structure. During the real time measures in the sensor, the repeatable mistakes are compensated during the measured standards.

1)Temperature Sensor

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

2)PH Sensor

It measures the acidic & basic alkaline in the water. It can be defined by using the hydrogen ion concentration with the negative logarithmic. The pH scale range is from 0 to 14, it is logarithmic. The concentration of hydrogen ion values is translated using Ph. The hydrogen ion concentration is small for acidic and if it shows high it is for alkaline solutions. The PH around 7 is the natural source water. The water becomes less acidic as the concentration of hydrogen ion decreases for ten-fold for the increases in the number of PH.

A reference electrode & a measuring electrode are enclosed in the pH sensor. The measuring electrode is connected to the positive end of the battery where the reference electrode is connected to the negative terminal. When the pH sensor is immersed in the solution, the reference electrode has its fixed potential. The change in the hydrogen ion concentration does not change the reference electrode. A potential is developed when hydrogen ion concentration is related to the hydrogen ions which is sensitive to the measuring electrodes. The temperature sensor is necessary to correct any variations in the voltage, as the electrodes differential voltage changes with the temperature.

3)Electric Conductivity Sensor

The salts in water breaks into positive and negative ions when it is dissolved. The transmitters in the water are the dissolved in it and the electrical current is conducted by the conductivity. The calcium, sodium, potassium and magnesium are the major positively charged ions, and bicarbonate, sulfate, chloride, carbonate, are the major negatively charged ions. The minor charged ions are phosphates and nitrates for the conductivity. With the help of a probe and a meter, the electrical conductivity is standardized. The pair of metal electrodes, in the probe which is spaced 1 80cm apart (unit: milli or micro-Siemens per cm). The electrodes have the constant volts. The electrical conductivity is measured by the concentration of dissolved ions which is proportional to the current flow. The dissolved salts concentration is directly proportional to electrical conductivity. The amount of minerals and salts that resides within the water is resulted by the total dissolved solid (TDS). By multiplying the conductivity by a factor of 0.67. B the TDS of water can be determined.

4)Turbidity sensor

Turbidity is the cloudiness or haziness of a fluid which is produced by a large number of independent particles that are generally invisible to the visible eye, like smoke in air. Turbidity is the main method to measure the quality of water.

The light that is scattered due to the suspended solids in water is measured by the help of turbidity sensor. When the amount of total suspended solids (TSS) in water increases simultaneously the water's turbidity level (and cloudiness or haziness) also increases.

To monitor the turbidity level of water, turbidity sensor is preferred. The gravity Arduino turbidity sensor is preferred to identify the water standard by measuring the states of turbidity. The sensor uses light to detect suspended particles in water by calibrating the light transmittance and scattering rate and it changes with the quality of total suspended solids (TSS) in water. When the TTS increases by the way the liquid turbidity level also increases.

Turbidity sensor is used in measuring the standard of water in rivers and streams, wastewater and the efficient measurements, managing instrumentation for settling ponds, sediment transportation research are also in the laboratory measurements.

The analog and digitized signal result modes are given by the liquid sensor . The threshold signal is adjustable when it is in digital signal mode.

6. Results

By logging on the website the official users can access the data. On a web page, the required parameters are shown in real-time.

To determine the quality of water, the pH sensor and EC sensor is put into a container which is filled with tap water and 34 drops of acidic is mixed to it. when the pH of water is still around 3 - 4.5 range then the water is acidic in nature. And the surrounding temperature still between 32 to 34 degrees. The waters conductivity is 7 to 9 micro Siemens/centimeter. The total Dissolved Solids are 0.67*electrical conductivity which is measured from the graph.

7. Conclusions

The real time water quality monitoring system for real time applications which is efficient and low cost, has been tested after the implementation. The level of pollutions in the water bodies are governed and the sudden warnings are send to the public through messages and alarm. The diseases that are caused due to the presence of metals and pollutants in the water can be protected by this system. The severe level of pollutants in the Ganges and Yamuna rivers can be taken immediate actions. The task of monitoring can be done by using the less trained individuals. The installation of the system can be done easily when it is near the target area.

Internet of Things (IoT) and its services are has become a part of our everyday life, ways of working, and business. The research is going on, in developing crucial building blocks and models for the next generation. Internet services are supported by a plethora of connected things and with the help of efficient and intelligent mobile network usage IoT has revolutionized the world. IoT is changing the future of technologies and how objects behave around us. Hence we can access any kind of information and command objects at the touch of fingertips.

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