LITERATURE SURVEY
Real-Time River Water Quality Monitoring And Control System

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Introduction

With the advent of this new era of water crisis, save water is the cry all over. Water sources are encroached from every existence on Earth. Saving water needs a systematic monitoring approach to determine its quality. Availability of Internet of Things (IoT) and remote sensing techniques mark the ease of congregating, analyzing and handling of real time data to further accelerate measures taken upon. Real-time water quality monitoring and management initiates prompt alarm ensuring timely response to water contamination in protecting and conserving the aquatic habitat, improving crop production by controlling quality of irrigated water, etc. This paper upheavals the water quality parameters required due consideration for monitoring real time water quality along with the available remote sensors. Also it briefs the review of parameters covered so far. Further it proposes the methodology suitable to the needs of detecting real time water contaminations based on the challenges of existing management system and IoT.

1) IoT Based Real-time River Water Quality Monitoring System

Author: Mohammad Salah Uddin Chowdurya, Talha Bin Emranb, Subhasish Ghosha, Abhijit Pathaka† , Mohd. Manjur Alama , Nurul Absara , Karl Anderssonc , Mohammad Shahadat Hossaind
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Current water quality monitoring system is a manual system with a monotonous process and is very time-consuming. This paper proposes a sensor-based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a microcontroller for processing the system, communication system for inter and intra node communication and several sensors. Real-time data access can be done by using remote monitoring and Internet of Things (IoT) technology. Data collected at the apart site can be displayed in a visual format on a server PC with the help of Spark streaming analysis through Spark MLlib, Deep learning neural network models, Belief Rule Based (BRB) system and is also compared with standard values. If the acquired value is above the threshold value automated warning SMS alert will be sent to the agent. The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility, and low powered.

In this paper, we depict the design of Wireless Sensor Network (WSN) [4-7] that assists to monitor the quality of water with the support of information sensed by the sensors dipped in water. Using different sensors, this system can collect various parameters from water, such as pH, dissolved oxygen, turbidity, conductivity, temperature, and so on. The rapid development of WSN technology provides a novel approach to real-time data acquisition, transmission, and processing. The clients can get ongoing water quality information from far away.

2) Water Quality Monitoring Using Wireless Sensor Networks: Current Trends and Future Research Directions

Author : Kofi Sarpong Adu-Manu, Cristiano Tapparello, Wendi Heinzelman, Ferdinand Apietu Katsriku, and JamalDeen Abdulai.
Year : 2017.
Link : http://dx.doi.org/10.1145/3005719

Water is essential for human survival. Although approximately 71% of the world is covered in water, only 2.5% of this is fresh water hence, fresh water is a valuable resource that must be carefully monitored and maintained. In developing countries, 80% of people are without access to potable water. Cholera is still reported in more than 50 countries. In Africa, 75% of the drinking water comes from underground sources, which makes water monitoring an issue of key concern, as water monitoring can be used to track water quality changes over time, identify existing or emerging problems, and design effective intervention programs to remedy water pollution. It is important to have detailed knowledge of potable water quality to enable proper treatment and also prevent contamination. In this article, we review methods for water quality monitoring (WQM) from traditional manual methods to more technologically advanced methods employing wireless sensor networks (WSNs) for in situ WQM. In particular, we highlight recent developments in the sensor devices, data acquisition procedures, communication and network architectures, and power management schemes to maintain a long-lived operational WQM system. Finally, we discuss open issues that need to be addressed to further advance automatic WQM using WSNs.

3) Sensor based water quality monitoring system

Author : Paul, Bishwajit.
Year : 2018.
Link : http://dspace.bracu.ac.bd/xmlui/handle/10361/10840

According to Human Rights Watch, twenty million people in our country are still drinking water contaminated with arsenic. The World health Organization (WHO) has also stated this crisis as "the largest mass poisoning of a population in history". To reduce the water related diseases and prevent water population, we have to measure water parameters such as pH, turbidity, conductivity, temperature etc. Traditional methodology of water monitoring requires collecting data from various sources manually. Afterwards samples will be sending to laboratory for testing and analyzing. In order to save time consumption and decrease manual effort my testing equipment's will be placed in any water source. As a result, this model can detect pollution remotely and take necessary actions. The main goal of this paper to build a Sensorbased Water Quality Monitoring System. Arduino Mega 2560 act as a base station and data from sensor nodes will be send to it. For the academic purpose, this paper presents a small prototype of sensor networks consisting of temperature, water level, flow and ph. Then ph. and temperature sensor values were sent cloud platform (ARTIK cloud) and displayed as graphical representation on a local PC. Moreover, GSM shield (SIM808) is connected to Arduino Mega which compares sensor values to threshold values and sends a text alert to the agent if the obtained value is above or below the threshold value. The results of this project are discussed in the result section of the paper. We tested three water samples from three different water sources (such as industrial water, tap water and swimming pool water). Three water samples collected from three different swimming pools. pH value found in rest of the samples were in normal range explains our project findings in detail.

4) **Real-time water quality monitoring using Internet of Things in SCADA**

Author : K. Saravanan, E. Anusuya, Raghvendra Kumar & Le Hoang
Year : 2018.
Link : https://link.springer.com/article/10.1007/s10661-018-6914-x

Water pollution is the root cause for many diseases in the world. It is necessary to measure water quality using sensors for prevention of water pollution. However, the related works remain the problems of communication, mobility, scalability, and accuracy. In this paper, we propose a new Supervisory Control and Data Acquisition (SCADA) system that integrates with the Internet of Things (IoT) technology for real-time water quality monitoring. It aims to determine the contamination of water, leakage in pipeline, and also automatic measure of parameters (such as temperature sensor, flow sensor, color sensor) in real time using Arduino at mega 368 using Global System for Mobile Communication (GSM) module. The system is applied in the Tirunelveli Corporation (Metro city of Tamil Nādu state, India) for automatic capturing of sensor data (pressure, pH, level, and energy sensors). SCADA system is finetuned with additional sensors and reduced cost. The results show that the proposed system outperforms the existing ones and produces better results. SCADA captures the real-time accurate sensor values of flow, temperature, and color and turbidity through the GSM communication.

5) **Cloud Based Water Reservoir Quality Monitoring System**

Author: Anzar Ahmad Shashi Shekhar, Abhijeet Roy

The research is concentrating on checking stream water quality progressively by using ph value sensor, turbidity sensor, temperature sensor, salinity sensor and Oxygen sensor. In this way, IoT coordinated enormous information examination is have all the earmarks of being a superior arrangement as unwavering quality, versatility, speed, and determination can be givenIt is primarily a cloud approach as an Administration movement model that licenses affiliations, end customers and their application to store, deal with and recover data from the cloud. A cloud database commonly fills in as a standard database game plan that is all things considered execute

through the arrangement of database programming over a register/establishment cloud. It may be authentically found a good pace Internet program or a trader gave application programming interface (API) for application and organization assimilation.

6) **Selection of energy efficient routing protocol for irrigation enabled by wireless sensor network**

Author: Zainal Abedin, Sukanta Paul, Sharmin Akhter

Since WSNs are deployed in constraints environment, the life time of sensors is very crucial for normal operation of the networks. In this regard routing protocol is a prime factor for the prolonged life time of sensors. This research focuses the performances analysis of some clustering based routing protocols to select the best routing protocol. Four algorithms are considered, namely Low Energy Adaptive Clustering Hierarchy (LEACH), Threshold Sensitive Energy Efficient sensor Network (TEEN), Stable Election Protocol (SEP) and Energy Aware Multi Hop Multi Path (EAMMH). The simulation is carried out in Matlab framework by using the mathematical models of those algorithms in heterogeneous environment. The performance metrics which are considered are stability period, network lifetime, number of dead nodes per round, number of cluster heads (CH) per round, throughput and average residual energy of node. The experimental results illustrate that TEEN provides greater stable region and lifetime than others while SEP ensures more throughput.

7) Environmental sensor networks in ecological research

Author: Philip W. Rundel ,Eric A. Graham ,Michael F. Allen, Jason C. Fisher, Thomas C. Harmon

Ecological sensor networks with highly developed cyberinfrastructure lie at the core of major new efforts to address fundamental issues of global change and environmental stability. The National Ecological Observatory Network (NEON), nearing implementation in the USA, is an integrated network of 20 regional observatories designed to

gather long-term data on ecological responses of the biosphere to changes in land use and climate, and on feedbacks with the geosphere, hydrosphere and atmosphere.

8)Cross-Layer Support for Energy Efficient Routing in Wireless Sensor Networks

Author: N. Chilamkurti, Zeadally,. Vasilakos, and V. Sharma

The researchers proposed a cross-layer protocol called the MAC-CROSS protocol that operates by exploiting the MAC and network layer information. The MAC-CROSS protocol is based on the S-MAC protocol [14]. The main drawback of the S-MAC protocol is that the listening and the sleep periods are fixed. As a result, once their Network Allocation Vector (NAV) time expires, they wake up thereby wasting energy unnecessarily. The MAC-CROSS protocol overcomes this problem by allowing only nodes which actually take part in the communication to wake up and allowing the rest to be in the sleeping mode. In [15], the authors proposed a protocol called Latency and Energy aware MAC (LE-MAC) based on the cross-layer information obtained from the MAC and the network layer. The main aim of this protocol is to achieve energy efficiency and minimize latency.

9)The use of artificial neural networks for the prediction of water quality parameters

Author: HR Maier, GC Dandy

This paper presents the use of artificial neural networks (ANNs) as a viable means of forecasting water quality parameters. A review of ANNs is given, and a case study is presented in which ANN methods are used to forecast salinity in the River Murray at Murray Bridge (South Australia) 14 days in advance. It is estimated that high salinity levels in the Murray cause $ US 22 million damage per year to water users in Adelaide.

10) The real time monitoring of water quality in IoT environment

Author: N Vijayakumar , R Ramya

The system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, conductivity, dissolved oxygen of the water can be measured. The measured values from the sensors can be processed by the core controller. The raspberry PI B+ model can be used as a core controller. Finally, the sensor data can be viewed on internet using cloud computing.

11) A novel anomaly detection algorithm for sensor data under uncertainty

Author: Raihan Ul Islam, Mohammad Shahadat Hossain & Karl Andersson

The collected sensor data can be used in various expert systems to support decision-making processes or to predict the occurrence of an event such as flooding (Fang et al. 2014). The wireless sensors are considered due to their low power consumption, low cost and protocol standardization

12).Sensor based water quality monitoring system

Author: Paul, Bishwajit

The main goal of this paper to build a Sensor- based Water Quality Monitoring System. Arduino Mega 2560 act as a base station and data from sensor nodes will be send to it. For the academic purpose, this paper presents a small prototype of sensor networks consisting of temperature, water level, flow and ph. Then ph and temperature sensor values were sent cloud platform (ARTIK cloud) and displayed as a graphical representation on a **local PC. Moreover GSM shield** (SIM808) is connected to Arduino Mega which compares sensor values to threshold values and sends a text alert to the agent if the obtained value is above or below the threshold value.

13)Near Real-Time Scour Monitoring System: Application to Indian River Inlet, Delaware

Author: Jesse T. Hayden , Jack A. Puleo

The present bridge piers within the Indian River Inlet, Delaware, are adjacent to deep scour holes that threaten the bridge. A new scour monitoring system (SM) using two three-dimensional profiling sonars was installed on the Indian River Inlet Bridge to observe more than 19,000 m2 of bathymetry daily. The system components, configuration, and operation are described and example data are presented. Bathymetric data collected by the SM compare favorably with historic high-quality multibeam data from the U.S. Army Corps of Engineers. Quantitative correlations with temporally consistent data from a single-beam personal watercraft survey vessel yield an r2 correlation coefficient of 0.84 with 93% of the absolute value of elevation differences between the two data sets less than 3 m