A Review on WSN based Water Quality Monitoring System

Akansha Rai[1], Swati Verma[2]

[1,2]Dept. of Communication, Shri Shankaracharya Group of Institutions, Durg, C.G., India

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Abstract:- A wireless sensor node principally consists of a microcontroller, a storage unit, A/D converters, a radio transceiver module, a battery, and sensors for measuring different environmental parameters. It converts data frames carrying measurements to radio messages and sends these frames to a gateway, generally called "sink". A wireless sensor network (WSN) is composed of several wireless sensor nodes distributed over an area in order to observe some phenomenon. In WSNs, nodes automatically establish and maintain connectivity by using mesh-networking protocols. The sensor gateway and its associated middleware enable the WSN to communicate with the outside world. In this study, water quality parameters including EC, DO, pH, temperature, turbidity and nitrate are monitored by a WSN. In this system, portable water quality monitoring nodes with probes for water analyses mounted on buoys monitor water quality at specified time intervals. The nodes form a WSN and send their measurements to the web server through the gateway. Similar to the system proposed in [12], the gateway provides connection between the WSN and a web server which is located at the control center of a utility provider. The web server provides a data repository to store the measurements and render the measurements available to Internet users.

Key words: Water quality, WSN-based water quality monitoring, web-based online interface

Literature Survey

Mohd Fauzi Othman et al. (2012) proposed that development in the technology of sensor such as Micro Electro Mechanical Systems (MEMS), wireless communications, embedded systems, distributed processing and wireless sensor applications have contributed a large transformation in Wireless Sensor Network (WSN) recently. It assists and improves work performance both in the field of industry and our daily life. Wireless Sensor Network has been widely used in many areas especially for surveillance and monitoring in agriculture and habitat monitoring. Environment monitoring has become an important field of control and protection, providing real-time system and control communication with the physical world. An intelligent and smart Wireless Sensor Network system can gather and process a large amount of data from the beginning of the monitoring and manage air quality, the conditions of traffic, to weather situations. In this paper, we discuss and review wireless sensor network applications for environmental monitoring. In order to implement a good monitoring system, there are several requirements to be followed. From the studies, it has been proved to be an alternative way to replace the conventional method that uses men force to monitor the environment. It is also proven that these approaches can improve the system performance, provide a convenient and efficient method and can also fulfill functional requirements.

Gurkan Tuna et al. (2015) proposed that water is vital for both nature and human beings. The construction of dams and embankments, the irrigation practices, and the anthropogenic activities influence water quality. In order to control water quality, it is essential to understand the sources of pollutants. Water quality monitoring requires the collection of large numbers of samples and long delays until the results are available. Therefore, rapid monitoring of water quality is very important. In this respect, numerous systems exist for this kind of automatic monitoring. In this study, we propose a wireless sensor network (WSN)-based monitoring system controlled by a web-based online interface which allows the remote monitoring via Internet. This brings advantages over traditional monitoring systems in terms of cost effectiveness, portability and applicability. Field tests in the water reservoir of Kirklareli (Kirklareli dam), Turkey, are in progress.

Ashwini Doni et al. (2015) The degradation of water resources and air pollution has become a common problem. The conventional methods of monitoring involve the manual collection of water and air sample from different locations. These samples are tested in the laboratory using the rigorous skills. Such approaches are time consuming and are no longer to be considered to be efficient. Moreover, the current methodologies include analyzing various kinds of parameters of quality such as physical and chemical. The old method of quality detection and communication is time consuming, low precision and costly. Therefore, there is a need for continuous monitoring of water and air quality parameters in real time. By focusing on the above issues, a low cost monitoring system is using that can monitor air and water quality in real time using IoT. Each device has a unique identification and must be able to capture real-time data autonomously. Basic building blocks of IoT consist of sensors, processors, gateways, and applications. In the system, water quality parameters are measured by different sensors such as pH, turbidity, dissolved oxygen, temperature, CO2 level and Air quality for communicating data onto a platform via microcontroller based system.

A.N.Prasad et al. (2016) Nowadays Internet of Things (IoT) and Remote Sensing (RS) techniques are used in different area of research for monitoring, collecting and analysis data from remote locations. Due to the vast increase in global industrial output, rural to urban drift and the over-utilization of land and sea resources, the quality of water available to people has deteriorated greatly. The high use of fertilizers in farms and also other chemicals in sectors such as mining and construction have contributed immensely to the overall reduction of water quality globally. Water is an essential need for human survival and therefore there must be mechanisms put in place to vigorously test the quality of water that made available for drinking in town and city articulated supplies and as well as the rivers, creeks and shoreline that surround our towns and cities. The availability of good quality water is paramount in preventing outbreaks of water-borne diseases as well as improving the quality of life. Fiji Islands are located in the vast Pacific Ocean which requires a frequent data collecting network for the water quality monitoring and IoT and RS can improve the existing measurement. This paper presents a smart water quality monitoring system for Fiji, using IoT and remote sensing technology.

Jayti Bhatt et al. (2016) To ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this paper, we present the design of IOT based water quality monitoring system that monitor the quality of water in real time. This system consists some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller and this processed values are transmitted remotely to the core controller that is raspberry pi using Zigbee protocol. Finally, sensors data can view on internet browser application using cloud computing.

Li Li et al. (2016) The Internet of Things(IoT) and Smart Grid are of great importance in promoting the IoT develops rapidly, but due to the special requirements of some applications, the existing technology can not meet them very good. Much research work is doing to build IoT. WiFi-based Wireless Sensor Network(WSN) has the features of high bandwidth and rate, non-line-transmission ability, large-scale data collection and high cost-effective, and it has the capability of video monitoring, which can not be realized with ZigBee. The research on WiFi-based WSN and its application has high practical significance to the development of the Internet of Things and Smart Grid. Based on the current research work of applications in the Internet of Things and the characteristics of WiFi-based WSN, this paper discusses the application of WiFi-based WSN in Internet of Things, which includes Smart Grid, Smart Agriculture and Intelligent environment protection.

Dr.B.B.M.Krishna Kanth (2017) In most recent years, the usage of internet and its applications has grown rapidly. As everyone's work is dependent on it, without internet it would be difficult. As well as Now a day's wireless sensor networks are widely used and these are low power devices with a processor, storage, power supply, and a transceiver and with one or more sensors. In this project, we are going to combine to these both for the purpose of to reach about to collect the data from water environment) and is displayed on the webpage using wireless networks. Internet of things (IoT) is a network of devices with local intelligence (sensors, lights, gas pumps), which share access & control mechanisms to push and pull status and command information from the networked world. In this paper, a system is proposed for monitoring the weather changes in the environment. Embedded controlled sensor networks have proved as a reliable solution in providing remote control and sensing for environmental monitoring systems. The sensors are integrated with the system to monitor and compute the level of existence of gas, temperature and fire in atmosphere by using the information and communication technologies. The sensor data is uploading in the WEBPAGE using IoT. That's what, the paper is going to deal. So the principal objective is to monitoring the thing of parameters from anywhere in the world. The paper is not aimed to integrate entire world of things right now but dedicated to Water is a limited resource and is essential for agriculture, industry and for creatures existence on earth including human beings. Lots of people don't realize the true importance of drinking enough water every day. More water is wasted by many uncontrolled ways. The microcontroller (ARM 7) based Water level monitoring is used to indicate the level of water in the tank to agent. Sensor Based Water Pollution Detection, it will check the water quality by using these parameters such as the water level, turbidity, gas and temperature are measured in real time by the sensors and it will be monitoring by an agent. This Paper is our motivation to prevent the water wastage by using technology and monitoring the system as a daily life device like laptop or mobile phone.

Kofi Sarpong et al. (2017) 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 keyconcern, 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.

Vaishnavi V. Daigavane et al. (2017) Water pollution is one of the biggest fears for the green globalization. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).The system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system.

Tha. Sugapriyaa et al. (2018) 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.

Imran .B et al. (2018) To ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this project, we present the design of IOT based water quality monitoring system that monitor the quality of water in real time. This system consists some sensors which measure the water quality parameter such as pH, turbidity, hazardous Gas, dissolved oxygen, water Level. The measured values from the sensors are processed by microcontroller and these processed values are transmitted remotely to the core controller that is PIC Microcontroller using IOT protocol. Finally, sensors data can view on internet browser application using cloud computing. Our project also incorporated with an android application to monitor and control of quality of the water via IOT.

K. Spandana et al. (2018) The economical and effective system of water quality observation is the toughest implementation of impure water. Drinking water could be terribly precious for all people as water utilities face more challenges. These challenges arise due to high population, less water resources etc. So, different methods are used to monitor in the real time water quality. To make sure that safe distribution of water is done, it should be monitored in real time for new approach in IOT based water quality has been projected. Real time water quality observation is monitored by data acquisition, method and transmission with increase in the wireless device network technology in internet of things. The measured values from the sensors are interfaced by microcontroller and the processed values remotely to the core controller ARM with a WI-FI protocol. This projected water quality observation interfaces sensors with quality observation with IOT setting. WQM selects parameters of water like temperature, pH level, water level and CO2 by multiple different device nodes. This methodology sends the information to the web server. The data updated at intervals within the server may be retrieved or accessed from anyplace within the world. If the sensors do not work or get into abnormal conditions then a buzzer will be ON.

Conclusion

This paper presents the details of a WSN-based water quality monitoring system and presents results from simulation studies conducted in order to show the associated design challenges which affect the overall effectiveness of the proposed system. The proposed system eliminates the need for periodical time-consuming water quality analyses and helps the improvement of the quality of the supplied water through continuous monitoring. At the same time, it brings cost advantages to utility providers by eliminating periodical laboratory expenses. The proposed system utilizes a group of portable Sondes with solar panels for energy harvesting and IEEE 802.15.4–based wireless interfaces mounted on buoys. The Sondes form a WSN to communicate over and send their measurements at regular time intervals to a central PC over the WSN. As proven by the presented simulation results, the applicability of the proposed system depends on several parameters such as transmission frequency, transmission power, packet size and node-related parameters. Our future work concerns the conduction of field tests at a drinking water reservoir.

References

1. .Ashwini Doni, Chidananda Murthy. M.V, .Dr MZ Kurian, "SURVEY ON MULTI SENSOR BASED AIR AND WATER QUALITY MONITORING USING IOT" Indian J.Sci.Res. 17(2): 147-153, 2018.

2. Gurkan Tuna1,a, Bilel Nefzi2,b , Orhan Arkoc3,c and Stelios M. Potirakis, "Wireless Sensor Network-based Water Quality Monitoring System", April 2014

3. Imran .B, Shakir Ahmed Sha KS, Pavethra.M, Siva Sankari k, kavitha, "Smart Tank Water Monitoring System using IOT Cloud Server at Home/Office" IJESC, Volume 8 Issue No.4.

4. JAYTI BHATT, 2JIGNESH PATOLIYA, "IOT BASED WATER QUALITY MONITORING SYSTEM" International Journal of Industrial Electronics and Electrical Engineering, ISSN: 2347-6982 Volume-4, Issue-4, Apr.-2016.

5. KOFI SARPONG ADU-MANU, CRISTIANO TAPPARELLO, and WENDI HEINZELMAN, "Water Quality Monitoring Using Wireless Sensor Networks: Current Trends and Future Research Directions" ACM Transactions on Sensor Networks, Vol. 13, No. 1, Article 4, Publication date: January 2017

6. Li Li, Hu Xiaoguang, Chen Ke, "The applications of WiFi-based Wireless Sensor Network in Internet of Things and Smart Grid", 6th IEEE Conference on Industrial Electronics and Applications, 2011.

7. Mohd Fauzi Othman[a]Khairunnisa Shazal, "Wireless Sensor Network Applications: A Study in Environment Monitoring System", Volume 41, 2012, Procedia Engineering Elsevier.

8. Pragati Damor1, Kirtikumar J Sharma, "IoT based Water Monitoring System: A Review", International Journal of Advance Engineering and Research Development Volume 4, Issue 6, June -2017

9. Tha. Sugapriyaa, S. Rakshaya, K. Ramyadevi, M. Ramya, P.G. Rashmi, "SMART WATER QUALITY MONITORING SYSTEM FOR REAL TIME APPLICATIONS", International Journal of Pure and Applied Mathematics Volume 118 No. 20 2018, 1363-1369.

10. Vaishnavi V. Daigavane and Dr. M.A Gaikwad, "Water Quality Monitoring System Based on IOT", Advances in Wireless and Mobile Communications. ISSN 0973-6972 Volume 10, Number 5 (2017), pp. 1107-1116.