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A Survey on Smart Water Quality Monitoring System based on IoT

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***Abstract*: Water is vital for both nature and human beings. Initially we have to realize the origin of the water pollutants to maintain the quality of water. The system to monitor the quality of water needs a cluster of instances to analyze but it takes a long time to get the results. Hence an active system for monitoring water quality is essential. The Water monitoring System based on Internet of Things (IoT) is a system by embedding Wireless Sensor Network (WSN) , water parameters such as Temperature, pH, Dissolved oxygen ,conduction and Turbidity. The system collects data from the sensors and upload to the web server using advanced technologies. Thus the system provides guidance to the fields which depends on the quality of water.**

***Keywords*: Internet of Things, Wireless Sensor Network, Water Quality Monitoring, Remote data Sensors.**

1. Introduction

The current water monitoring system has 3 steps they are 1) Water sampling, 2) Testing Samples, 3) Investigative analysis. The system is quite expensive, time consuming and less efficient. With the advance of technology, smart water quality monitoring system can be developed rather than depending on manual process. The government introduced an organization called "Central Pollution Control Board "to maintain and monitor the water quality. This institution established a monitoring system on water resources to maintain the quality of water. So that, the organizations are able to maintain the water quality. It is necessary to control the extent of pollution and precautions has to be taken to control the pollution.

Internet of Things (IOT) is the concurrence of technologies, real – time analytics, sensors, machine learning. IoT mainly concerns on the expanding system of substantial gadgets having internet protocol address for connectivity of internet. The exchanging of information takes place in between the gadgets using IP address, internet authorized equipment's and systems. Examples for IOT combines connected security systems, thermostats, cars, electronic appliances and so on.

Wireless sensor network (WSN) is a cluster of contiguously distributed and autonomous sensors to record the current context of the environment. The environmental context or conditions are temperature, pollution levels, humidity, pressure etc. The sensors unitedly collect the information and transfers the same to the main location through a network. Wireless ad hoc network and WSN both have a resemblance that rely on wireless connectivity and the networks are created automatically. The automatic formation of network happens to exchange the collected information between the sensors. While comparing the network with the modern network, the modern network is bi-directional that facilitates the activity of sensors. The military applications like battlefield surveillance provoked the evolution of wireless sensor networks. In this modernized world these networks are adopted by clients or end user and industrial applications like machine health monitoring, environmental monitoring, industrial process monitoring and control and so on. Some of the applications of WSN are area monitoring, health care monitoring, air pollution monitoring, water quality monitoring etc. WSN in Water quality monitoring converges evaluating the water bodies like underground water reservoir, dams, lakes, oceans and rivers. The sensors that are wireless establishes the exact status of water and concedes stable categorization of monitoring stations to access without the need of manual data retrieval.

A device which notices and reacts to any kind of input data or signal from the physical environment is called a sensor. The inputted data may be in the form of light, heat, moisture or the other environmental phenomena. The output is in the form of a signal which is converted to human understandable display at the location.

Sensors on the other hand can be explained as the experienced devices which intermittently notices and reacts to optical or electrical signals. The physical parameters such as blood pressure, speed, humidity, temperature are converted into signal that can be measured by the sensors. The sensors used in water quality monitoring system are PH sensors, Conductivity Sensors, Temperature sensors, Turbidity sensors, Oxidation Reduction Potential Sensors.

PH is an important measure in water quality monitoring. pH sensors can also be used for measuring pH in water bodies. The ability of water to carry an electrical current is measured by electrical conductivity sensors. The process of calculating water temperature is known as temperature testing. The rate of photosynthesis, oxygen dissolved in water, metabolic rates are affected by temperature. The suspended solids distribute the extent of light in water and they are measured using turbidity sensors. For the treatment of waste water, gaging of stream and rivers, sediment research, monitoring of river turbidity sensors

are used.

The system maintains several modules to measure water quality, such as temperature module, module for PH value, module for turbidity value. WSN uploads the data to internet after getting the information about water quality from the cooperative sensors that work together. The system is of low cost, regional and real time. The water quality information i.e, percentages of pollutants will be recorded from the analysis of data obtained through internet from the remote data centers [9].

2. Literature survey

The monitoring of water quality technique is a distinct operation implemented by the organizations to maintain the quality of water that could be utilized by living organisms. The authors Kamarul Hafiz Kamaludin and Widad Ismail proposed a Water Monitoring system that involves Radio Frequency Identification (RFID), Wireless Sensor Network (WSN) based communication for water quality monitoring. It involves PH value, Dissolved oxygen, temperature as parameters to measure water quality. Most of the IOT based Water quality monitoring system involves device- to –cloud approach for data string and online monitoring. WSN is a fundamental element of IOT, which provides machine to machine(M@M) communication when transmitting information. The Digimesh protocol is used to monitor water quality in vegetation sector [1].

Now a day's water pollution is increasing. Many people are exploring new technologies to maintain the quality of water. The authors Anuradha T, Bhakti, Chaitra R, Pooja D proposed a water quality monitoring system by taking ph, temperature, turbidity sensors as water parameter. They used Raspberry pi as microcontroller and various sensors to ensure the quality of water. The data collected by the sensors is accessed by the Raspberry pi to process the data and it can be viewed in the cloud using ThingSpeak App [2].

This system is applicable in commercial, domestic fields and helpful for water supply agencies. As the proposed system is automatic it reduces the time so it is time efficient, low maintenance and affordable for common people. The system primarily designed for high-quality, real time analysis and accurate water quality analysis.

The challenge is to provide a pure water for drinking and to maintain the quality of water for the other purposes. Hence new approaches are used to monitor the real time water quality. The authors Spandana K and Sheshagiri Rao proposed a system which involves PH level, temperature water level, CO2 as water parameters. After collecting information from nodes or sensors it sends to the web server and the data updated at frequent intervals. The data can be retrieved from any place in the world. The proposed system grants user to monitor the devices from the station through communication like Zigbee, WIFI, RFID and GPRS. Wireless sensor networks are also known as wireless sensor and actuator network (WSAN). WSAN is a tribute media sensor network system that contains physical conditions such as pressure, sound, temperature and more.

Internet of Things (IoT) techniques are used for research like monitoring and analyzing data from remote locations. The research was done at Fiji Islands located in Pacific Ocean. It requires collection of data at regular interval to monitor the water quality. The authors K. A. Mamun, H. Haqva F. R. Islam and A. N. Prasad proposed a water quality monitoring system that uses IOT and remote monitoring(remote sensing technology).The systems uses temperature, ph, conductivity , oxidation reduction potential as parameters for water quality monitoring. The research was taken out for different water resources examined at frequent interval (of 12 hours) to verify the accuracy of the system. GSM technology is applied to send alarm to the user to ensure the water quality. The results from different sources represent the building categories used for water analysis in the form of neural network analysis [3]. The proposed system ensures accurate and consistent data throughput by incorporating IOT techniques for real time water monitoring.

The authors Dong He, Li-Xin Zhang proposed a system based on wireless sensor network. The sensor network is built on with Zigbee. WSN samples quality of water and uploads the analyzed data to browser with the help of Tcp/IP Protocol. It provides guidance to the industries which depends on water quality conditions. The system includes WSN and Remote data center. The water quality data is collected by WSN and sends data to remote data center with the help of GPRS.

Zigbee is a low power consumption, low data rate network technology and it is used for wireless connections. The Zigbee protocol is a stack that includes the physical layer, the MAC layer, the network layer, the security layer and the application layer. Combining control and data processing in Remote Data Centers, this system can be a long-term, stable(powerful) and real-time regional(local) monitor of water quality [9].

With the advance in technology a smart water quality monitoring with sensor interface device in internet of things. The authors Nikhil R, Rajender R, Dushyantha, M. N. S. Khadri, Jagadevi N. Kalshetty proposed a system which involves design board, sensors, Wi-Fi module and personal computer. The proposed system consists of five water parameters like water pH, water level, turbidity, conductivity and temperature of water with high speed from various sensors. The management software is developed using Arduino software platform. The smart water quality monitoring system is a rearranged sensor coherence device which incorporates data storage, processing of data and transformation of data [7]. The proposed system is an application that elaborates to download a file from cloud and the login module checks for an authorized user or not. If the user is an authorized user, then he/she can share a file means he can upload a file to the cloud using an encrypted key generated. If any other user wants to download a file, then decryption occurs and they can access the file.

3. Methodology

Initially we have to decide the parameters of water that

supports close evident for pollution of water. The usual parameters are pH, oxidation and reduction potential, temperature, turbidity conductivity sensors. The second step was to prefer the area. The areas would be industrial areas, marine etc. The third step is data logging which has to be in acceptable form. The solution was developed on a local network. A cloud server is used for data storage and data retrieval to access the data by the user. The data in the text format that is easy to read by all users. The final step is to determine an acceptable, experienced and accurate analysis. This in turn leads to false claims. From time to time, collective measurement results must be consistent in order to be considered a potential threat. To overcome these obstacles, an intelligent analysis system must be developed as a model of a Neural network.

The water quality maintaining system consists of three subsystems:

- The subsystem that includes the application is Data Management subsystem used to access the data from cloud and displays the retrieved data to the client or end user.
- The subsystem of Data Transmission involves collection of data from various sensors and sends data to the microcontroller which would be Raspberry pi, Arduino board. The microcontroller transmits the data to the storage cloud.
- The Data Collection subsystem includes multiple sensors like ph, temperature, turbidity, oxidation reduction etc. A micro controller gathers the data from the sensors and process the data.
- The system based on zigbee technology involves the following modules:
- Router module: The main function of this module is to transfer the data. It acts as a bridge between sensor node and controller i.e, Raspberry pi and Arduino board. The function of this module is to access the data and forward the data.

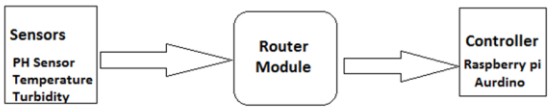

Fig. 1. Router module

- *Sensor module:* Most of the time, the sensor node is in low power consumption mode. This module has following responsibility: boot up the sensor modules to measure PH value, water temperature, turbidity, and pollutants.

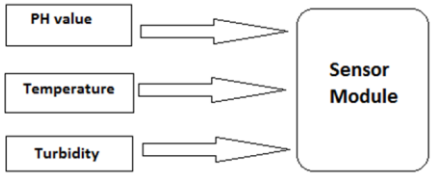

Fig. 2. Sensor module

- *Remote Data Center:* This module involves the application software, a database and a system [PC]. The application analyses, processes and records the data by retrieving the quality of water from browser or internet. The processed and recorded data will provide guidance for industrial and agricultural production.

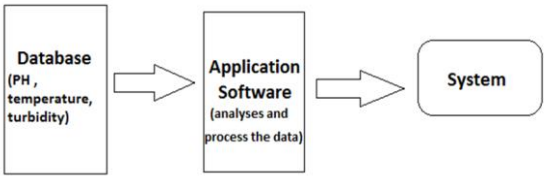

Fig. 3. Remote data center

4. Conclusion

Selection of sensors plays a vital role in water quality monitoring system. We have to select the sensors that are suitable to measure the parameters of water to monitor the water quality. The water quality monitoring system measures Temperature, Turbidity, Dissolved Oxygen and pH values of water with the help of RFID and Arduino board and various Sensors. Using the system to monitor the water quality, the government organizations can record the level of pollutants existing in the resources of water and send instant life-threatening cautions to the society or public. The systems are stable, real time, reliable and regional water quality monitor. Anyone can view the information of water quality in browser or internet which was uploaded by the remote data centers after analyzing and processing the data collected from the various sensors in the network. The benefit of water quality monitoring system is one can access the data anywhere in the world. Thus, creates an awareness in the society.

References

[1] Kamarul Hafiz Kamaludin, Widad Ismail "Water Quality Monitoring with Internet of Things" 2017 IEEE Conference on Systems, Process and Control (ICSPC 2017), 15–17 December 2017, Melaka, Malaysia
[2] Anuradha T, Bhakti, Chaitra R, Pooja D "IoT Based Low Cost System for Monitoring of Water Quality," IRJET Volume 05 Issue 05, May-2018
[3] A. N. Prasad, K. A. Mamun, F. R. Islam, H. Haqva "Smart Water Quality Monitoring System," December 2015.
[4] Mourvika Shirode, Monika Adaling, Jyoti Biradar, Trupti Mate, "IoT Based Water Quality Monitoring System," in International Journal of Scientific Research in Computer Science, Engineering and Information Technology, Volume 3, Issue 1, 2018
[5] S. Geeta, S. Goutami, "Internet of Things enabled real time water quality monitoring system," Springer Open journal, Vol. 5, pp. 1-19, 2017.
[6] K. Spandana, V. R. Seshagiri Rao, "IoT based Smart Water Quality Monitoring System," in International Journal of Engineering & Technology, 2018.
[7] Nikhil R, Rajender R, Dushyantha G. R, M. N. S. Khadri, Jagadevi N Kalshetty, "Smart Water Quality Monitoring System Using IoT Environment," in International Journal of Innovations in Engineering and Technology, Volume 10, Issue 4, July 2018.
[8] Satish Turken, Amruta Kulkarni, "Solar Powered Water Quality Monitoring System using Wireless Sensor Network," IEEE Conf. on Automation, Computing, communication, control, and compressed sensing, pp. 281-285, 2013.

[9] Donge He, Li-Xin Zhang, "The Water Quality Monitoring System based on Wireless Sensor Network," China University of Geo- Science, Wu Hen, China, 2012.
[10] Atzori, Luigi, Antonio Iera, and Giacomo Morabito, "The internet of things: A survey," Computer networks, vol. 54, no. 15, pp. 2787-2805, 2010.