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# Smart Iot System Based Water Quality Monitoring Prediction Using Sequential Learning Neural Network Strategy

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**ABSTRACT**

*Water is one of the essential elements for the existence of life. The safety and accessibility of drinking-water are major concerns throughout the globe. Health risks may arise from consumption of water contaminated with infectious agents, toxic chemicals etc. In this research, a system is proposed to check the water quality and warn the user before it gets contaminated. There are different parameters that can contaminate the water. These parameters are taken into account and used for predicting when to clean the water. The system uses technologies such as IoT and Machine Learning. It consists of the physical and chemical sensor to measure pH, conductivity in the water, the turbidity in the water, water level in the tank, temperature, and humidity to check the parameters. The data obtained from the sensors are recorded in the database and further sent for analysis. The Sequential Learning Neural Network (SLNN) algorithm is used for predicting the result. Determining the various parameters associated with neural networks is not straight forward and finding the optimal configuration is a time and memory-consuming process. To reduce the time and memory, the Sequential Learning Neural Network system is used for this work. It is used to obtain a non-linear relationship for predicted output. The system sends the alert message to the user when any parameters are lower than the standard values. This helps the user to know beforehand about the contamination of water in their residential tanks. This technique can be limited up to residential tanks and can also be used in water treatment plants and industries.*

**Problem Statement**

From the review of various methods based on water quality measures for the cloud environment, the several issues identified related to the proposed work as listed below.

- A lack of water quality issues and professional knowledge for people is the most common obstacle to a polluted environment. People in most of the areas are either blind to advanced technology and complying with minimum mandatory requirements.
- Water quality monitoring must be performed at the nearby water resources such as the freshwater canal and an open well. Each water resource must be tested in a laboratory to identify the harmful content to the people's health. So, the monitoring system consists of heterogeneous sensors for each of the water sources.
- In the rainy season, the water pollution level adversely increases as the water combines with the waste dumping and eventually leaches out to the nearest water resources and the soil. This leaching causes the rapid spread of various epidemics and related health issues, as reported in infants and adults.
- Due to the waste dumping, the water resources and soil in the dumping area become polluted. Thus, we have to monitor the water and the soil to analyze the pollutants because they become adversely

affected by these pollutants. Hence, an integrated system must be deployed to correlate the soil-water pollutants to the area's diseases.

- ❖ It must also be capable of integrating more than one communication technology as the sensors will use different communication technologies to communicate with the platform and the gateway.
- ❖ To enhance the monitoring and controls, computers in the cloud are configured to use every bit of its computing power to run various user applications simultaneously.
- ❖ The wirelessly measured sensitive information may be lost or modified so, while the cloud is an attractive option to local trusted computational resources to adopt this innovative prototype fully.

**Objectives**

The following are the motivating factors that determine the need to develop water quality measures and security issues in a cloud environment. With the implementation of the proposed model, the following objects can be achieved:

i. Develop a new Sequential Learning Neural Network (SLNN) based Control and IoT script monitoring algorithm to authorize water quality, integrity, and authenticity in cloud data storage.
ii. To design and develop an IoT-based system that can sense the Water quality parameters and effectively deliver information on the level of contamination and water quality.
iii. To monitor water excellence by measuring different water excellence parameters such as PH, Temperature, Turbidity, conductivity, and water level through assorted sensors.
iv. To identify the regions in which the water sample can take corrective and preventive actions to strengthen its performance quality.
v. To develop the prototype that stores the measured water quality parameters and monitors those parameters on any internet facility device.

**Proposed System**

The proposed work suggests control and monitoring based on sequential learning neural network method to improve the effective water quality measurement and performance of real time data estimation. This section provides the technical water quality measures with IoT system architecture, system requirements and its detailed description of new algorithm implementation with the necessary steps and flow diagrams:

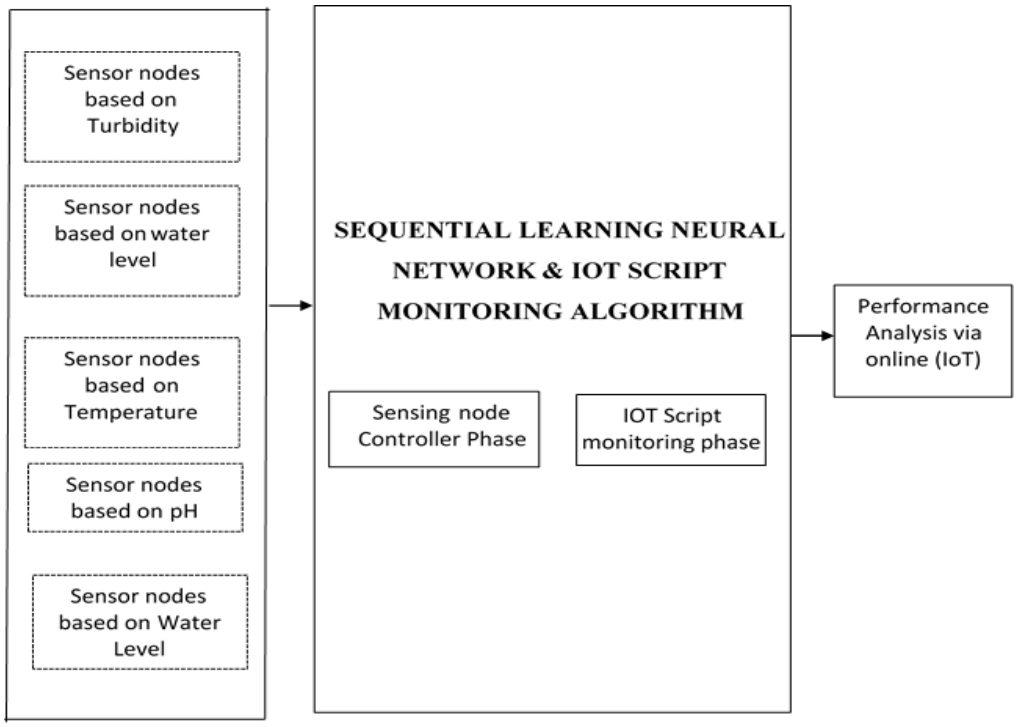


**Figure 1. Block Diagram of Proposed System**

Figure 1 shows the IoT service design made out of implantable sensor hubs. These sensors collect the data on water quality parameters and forward them to a data processing server unit coordinator. Furthermore, when the server identifies any variations from the norm, it gives an immediate alert to the particular area's server team. The IoT data acquisition interface is composed of sensors and various data collection terminals.

**SEQUENTIAL LEARNING NEURAL NETWORK FOR WATER QUALITY MONITORING**

The water quality measurement and control implemented by using the proposed Sequential Learning Neural Network method with diverse groupings. The SLNN method controls the water quality measurement error along with the threshold value. The SLNN strategy from the Arduino controller selects the predicted logic of error. The SLNN set algorithm is presented below.

| **Procedure: Sequential Learning Neural Network-based water quality Monitoring system** |
|---|
| Input: Port values<br>Output: digital values of Sensors (T - Temperature,PH - pH sensor,Turb - Turbidity, Cond - Conductivity)<br>Start to begin<br>**While (1)**<br>Read the values of sensors at t= 10 sec<br>Load D=sensors.<br>Case 1:<br>if (T > threshold value) then<br>TX=A, // Transfer T value to system |

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            end if
    Case 2:
    If (PH > threshold value), then
      TX=B,(send PH value to the system
    End if
    Case 3:
    if (Turb> threshold value), then
        TX=C // Transfer Turb value to the system
    End if
    Case 4:
    if (Cond> threshold value) then
    TX=D // Transfer Cond value to the system
    End if
              else
               TX=NULL // Values not transferred
              End case
         End while
      End
```

The different sensor (e.g., Temperature, PH, and Turbidity) senses the water quality parameters and sends the data to the cloud-enabled system using Arduino. The board's microcontrollers are programmed using Arduino programming language based on wiring and Arduino development based on the processing. In the AQUA CARE-IoT framework, the services are composed of different parts like Sensor Devices, Agent Servers, Agent Clients and Hosts as applications.

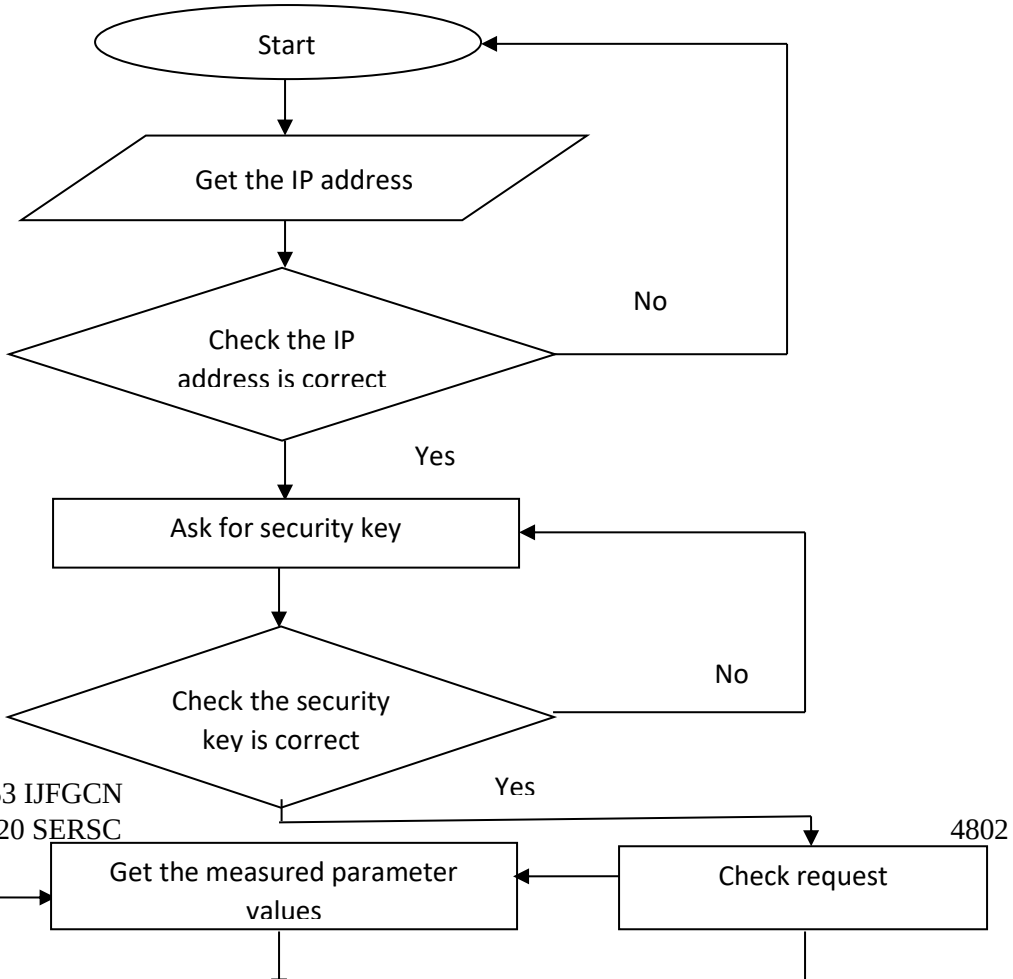

**Figure 2. Flow Diagram of Proposed System**

**Expected outcome**

The prototype developed for water quality maintenance is very beneficial for safeguarding public health and adds to the clean environment. The automation of this water monitoring, cleaning, and control process removes manual labor and saves time and money. The automation of the system makes the control and monitoring process more efficient and effective. This system could also be implemented in various industrial processes.

**References**

1. Lorena Parra, Sandra Sendra "Design and Deployment of Low-Cost Sensors for Monitoring the Water Quality and Fish Behavior in Aquaculture Tanks during the Feeding Process" Sensors 2018, 18, 750; doi:10.3390/s18030750
2. Ch. Pavan kumar, S. Praveenkumar "air and water quality monitoring through IoT by using Aquatic surface drone" International Journal of Pure and Applied Mathematics, Volume 118 No. 22 2018, 51-55
3. Himanshu Jindal and Sharad Saxena "sustainable multi-parametric sensors network topology for river water quality monitoring" Wireless Networks, November 2018, Volume 24, Issue 8, pp 3241–3265
4. Zhang Yuan; Qi Lan "Design of water quality monitoring system based on WSN and ZigBee" International Journal of Intelligent Systems Technologies and Applications 2018 Vol.17 No.4
5. Maroli, A.A., Narwane, V.S., Raut, R.D. *et al.* Framework for the implementation of an Internet of Things (IoT)-based water distribution and management system. *Clean Techn Environ Policy* **23,** 271–283 (2021). https://doi.org/10.1007/s10098-020-01975-z
6. Chowdury, Mohammad & Emran, Talha & Ghosh, Subhasish & Pathak, Abhijit & Alam, Mohd & Absar, Nurul & Andersson, Karl & Hossain, Mohammad. (2019). IoT Based Real-time River Water

Quality Monitoring System. Procedia Computer Science. 155. 161-168. 10.1016/j.procs.2019.08.025.

7. Fuentes, H., Mauricio, D. Smart water consumption measurement system for houses using IoT and cloud computing. *Environ Monit Assess* **192,** 602 (2020). https://doi.org/10.1007/s10661-020-08535-4
8. Adi, E., Anwar, A., Baig, Z. *et al.* Machine learning and data analytics for the IoT. *Neural Comput & Applic* **32,** 16205–16233 (2020). https://doi.org/10.1007/s00521-020-04874-y
9. Pujar, P.M., Kenchannavar, H.H., Kulkarni, R.M. *et al.* Real-time water quality monitoring through Internet of Things and ANOVA-based analysis: a case study on river Krishna. *Appl Water Sci* **10,** 22 (2020). https://doi.org/10.1007/s13201-019-1111-9
10. Barzegar, R., Aalami, M.T. & Adamowski, J. Short-term water quality variable prediction using a hybrid CNN–LSTM deep learning model. *Stoch Environ Res Risk Assess* **34,** 415–433 (2020). https://doi.org/10.1007/s00477-020-01776-2
11. Jha, Bineet. (2020). Cloud-Based Smart Water Quality Monitoring System using IoT Sensors and Machine Learning. International Journal of Advanced Trends in Computer Science and Engineering. 9. 3403-3409. 10.30534/ijatcse/2020/141932020.
12. Geetha, S. & Gouthami, Shiramshetty. (2017). Internet of things enabled real time water quality monitoring system. Smart Water. 2. 1. 10.1186/s40713-017-0005-y.
13. Arif Istiaq Arafat , Tasmima Akter , Md. Ferdous Ahammed , Md Younus Ali , Abdullah-Al Nahid A dataset for internet of things based fish farm monitoring and notification system, Data in Brief Volume 33, December 2020, 106457
14. Cloete, Niel & Malekian, Reza & Nair, Lakshmi. (2016). Design of Smart Sensors for Real-Time Water Quality Monitoring. IEEE Access. 4. 1-1. 10.1109/ACCESS.2016.2592958.
15. 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