IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Outlier Detection And Prediction Of Ph Value And TDS Value In Aquarium Water To Save The Fish

[1]Jeyadevan S, [2]Subha V, [3] Dr. Rama Krishna Amaravadi, [4] Dr. Ganganagunta Srinivas
[1]Lecturer, Computer Engineering, University of Technology and Applied Sciences-Ibra, Oman
[3]Lecturer, Engineering Department, University of Technology and Applied Sciences-Ibra, Oman
[4]Lecturer, Engineering Department, University of Technology and Applied Sciences-Ibra, Oman

***Abstract:*** The degree of acidity(pH) and total dissolved solids (TDS) is very important for the fish's health. The Fish in the aquarium release their waste in the form of ammonia. Ammonia is toxic to all other aquatic organisms. The high level of ammonia in water will affect the pH and TDS levels of water. If pH and TDS levels in the water are not good then it will affect the fish's health. Usually, the pH sensor and TDS sensor are used to monitor the pH value and TDS value. The fish requires a 7-7.5 pH value and 400ppm-450ppm of TDS value. If these sensors are not working properly, then it will affect the fish in the aquarium. This proposed system stores these sensor values for one day in a CSV file(dataset). The isolation forest algorithm is used for detecting the outlier in the dataset. The Linear regression algorithm is used for predicting the pH value and TDS value range. Based on the prediction, the pH level and TDS level of water can be checked once again and then can be changed. By detecting the outlier we can identify the hardware faults in the system. By predicting the pH value and TDS value, the water can be changed on time to save the aquatic organisms.

Keywords: Prediction, TDS value, outlier detection

## I. INTRODUCTION

All living things on earth need water to function, and this is a basic requirement. 71% of our planet is made up of water, and 29% is made up of land. Only 3% of the water in that 71% is freshwater; the rest is seawater. Glaciers and ice make up the majority of the freshwater supply. We can purify water by preserving existing natural water sources or by implementing novel techniques to turn salt water into potable water.[1]

In the aquarium, the pH value ad TDS level of water is very important for fish. The water quality is very important to the fish. The water quality will come down by the waste of fish, feed of the fish, etc... The sensors are used to monitor the water quality. The pH sensor is used to monitor the pH value of the water. The TDS sensor is used to monitor the TDS level of the water. But the fault of the sensor can not be notified easily. The prediction of the TDS and pH value is also not notified in the existing system.

The raspberry pi is used in this project. It receives the sensor data for one day and stores it as a CSV file. This dataset will be analyzed for outlier detection and prediction of the pH value and TDS value.

## II. LITERATURE SURVEY

The gardening method known as aquaponics combines the raising of fish and plants. For optimum fish and vegetable growth, the pH and total dissolved solids (TDS) levels must be regulated. In this study, an automated fish feeding system based on schedule and amount of need was developed, together with a pH and TDS monitoring system for aquaponics. An Android-based application is used to automate fish feeding while also monitoring pH and TDS. Fish feeding is done on a timetable with a certain amount of feed. The pH and TDS monitoring systems operate in real-time. An analog TDS sensor and a pH sensor were both employed in this study to measure total TDS and pH values, respectively. IoT technology is the foundation of the communication system in use. According to the test results, there is an average discrepancy of 0.66% between the pH sensor and pH meter readings and a difference of 2.588% between the TDS sensor and TDS meter values. With an error rate of just 1%, the system has been able to automatically distribute fish feed on a predetermined schedule with the appropriate feed weight.[2]

Degradation of the environment, particularly in the quality of surface water or groundwater, is a result of population growth and the speed of development. This condition occurs downstream or in densely populated urban regions. The main problem in providing clean water in Indonesia is the tendency for raw water quality to deteriorate. The quality of groundwater and river water as potable water healthy for people with less education, and even in some regions, is not worth drinking, varies greatly across the country. The impoverished were compelled by these circumstances to continue using the water for their everyday requirements, which could affect their health. Standard indicators for potable water include physical, chemical, and biological markers. The degree of acidity (pH), total dissolved solids (TDS), transparency or turbidity, and water temperature are the variables utilized to calculate these indicators. By utilizing the four aforementioned characteristics, this study creates a water quality detection tool. The threshold values for pH, TDS, and turbidity are 6.5 to 8.5, 1000 ppm for TDS and 5 NTU for turbidity, and 3 C for water temperature relative to air temperature. The accuracy of each sensor has been tested, and the average percentage error for the pH sensor is 1.46%, the TDS sensor is 1:09%, the turbidity sensor is 2:00%, and the water temperature sensor is 0.83%. [3]

Water is a vital component of life for humans. The goal of this initiative is to both monitor and treat water pollution. The population density within a watershed, the land use (agricultural, forestry, urbanization, etc.), and societal norms are only a few of the many variables that affect water pollution. We chose this project since everyone is aware of how much fresh water is beneficial to health. The system may gather data on multiple water parameter values using several sensors, including temperature, water hardness, turbidity, pH, and others. A GSM module delivers the data (as a normal message) to the officer after the collected data is first compared with the predefined range. Additionally, a buzzer and light indication will notify the nearby residents of the reservoir if the water is not fit for drinking. It makes it simple to determine whether the water being supplied in a given region is fit for human consumption or not. These would simplify and ease the process of simple automation. Because this technology is essential for the current environment, users will find it simple to deal with. Because of its compact size, the device is also excellent for water tanks and other DIY products.[4]

A crucial resource is a water. Find out whether the water is clean or contaminated to determine the quality of the water. Water quality needs to be continuously monitored to ensure a secure supply of drinking water, which is why a novel approach-based water quality testing has been developed. The Raspberry Pi is used to build the framework and provide low-power water quality testing. To obtain a water quality file, the results are divided into two categories based on the various pH and TDS values.[5]

## III. PROPOSED SYSTEM

In this section, the hardware and software system design of the proposed system will be discussed. The following Figure 3.1 shows the proposed system architecture. The sensors are connected to the raspberry pi. The data received from the sensors are stored as a CSV file. The CSV file is considered as a dataset. The isolation forest algorithm will find the outlier. The linear regression will predict the pH value and TDS value.

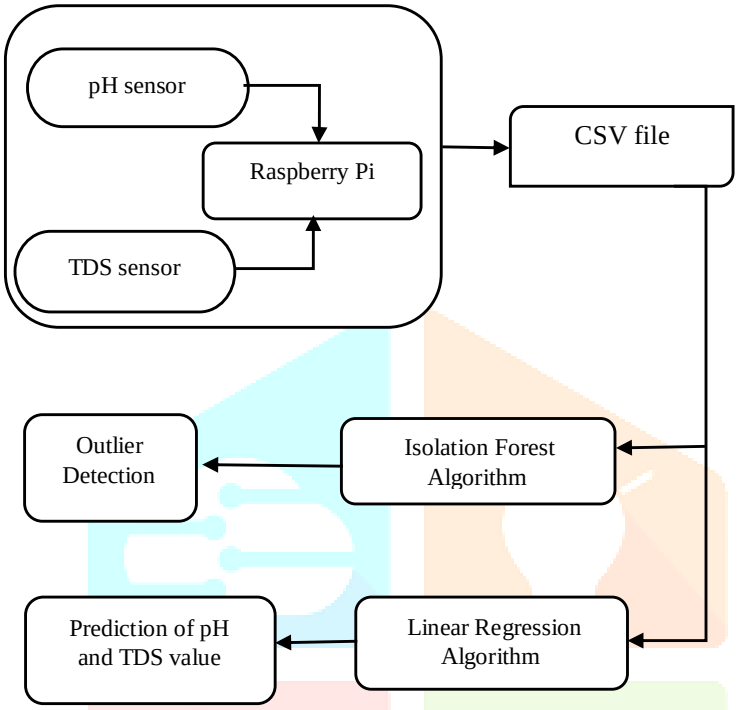


Figure 3.1 Proposed System Architecture

### A. Gravity Analog pH sensor

The pH scale is a way for us to gauge how acidic a substance is. The negative log of the concentration of hydrogen ions is what is referred to as "H." From 0 to 14, the pH scale can have several values. Since pure water has a pH of exactly 7, a pH value of 7 is considered neutral. Acidic levels fall below 7 and basic or alkaline values fall above 7. A solution's pH value can be determined using an analog pH sensor, which also displays the substance's acidity or alkalinity. It is frequently utilized for a variety of purposes, including farming, wastewater treatment, industry, environmental monitoring, etc. The module contains a built-in voltage regulator chip that supports a wide range of DC voltages from 3.3 to 5.5V, making it compatible with the 5V and 3.3V of any Arduino-compatible control board. Low jitter hardware is used to filter the output signal.[6]

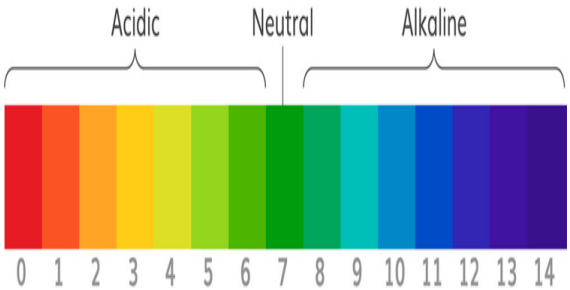


Figure 3.2 pH value

Figure 3.3 pH sensor

B. Gravity analog TDS sensor

The term TDS (Total Dissolved Solids) describes the amount of soluble solids that are dissolved in one liter of water. In general, the more soluble solids that are dissolved in water, and the lower the water's purity, the greater the TDS value. In order to indicate the cleanliness of the water, the TDS value might be utilized as one benchmark. This is applicable to home water, hydroponics, and other areas of testing and monitoring water quality. We will connect an Arduino microcontroller to a gravity analog TDS sensor and read the value from a 16x2 LCD display. Because TDS Value is temperature-dependent. To measure the temperature of the water, I will also add a DS18B20 Waterproof Temperature Sensor. The TDS Sensor uses the recorded temperature to make very accurate and calibrated reading corrections. Below are the code, circuit diagram, and other procedures.[7]

Figure 3.4 TDS sensor

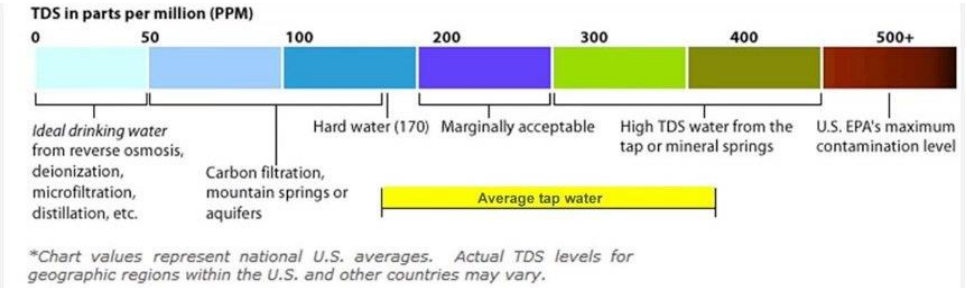


Figure 3.5 TDS Value

C. Raspberry Pi

The Raspberry Pi is a small, inexpensive computer the size of a credit card that connects to a computer monitor or TV and operates with a regular keyboard and mouse. It supports coding languages including Python, C, and Scratch. We are able to browse the internet, watch high-definition videos, create spreadsheets, write documents, and play games just like on a desktop computer. A free operating system based on Debian that is tailored for the Raspberry Pi hardware is called Raspberry Pi OS (formerly Raspbian). Its operating system is 32 bits. The 64-bit operating system's beta version is now accessible.[8]

Figure 3.6 Raspberry Pi

D. Isolation Forest Algorithm

Similar to Random Forests, Isolation Forests (IF) are constructed using decision trees. Additionally, this model is unsupervised because there are no predefined labels present. The foundation of Isolation Forests is the idea that anomalies are the "few and different" data items. Randomly subsampled data is processed in an isolation forest using a tree structure based on randomly chosen attributes. Since it took more cuts to isolate the samples that traveled further into the tree, they are less likely to be abnormalities. Similar to the last example, data that end up on shorter branches tend to be anomalies since the tree found it easier to distinguish them from other observations. As was already mentioned, an ensemble of binary decision trees is all that Isolation Forests outlier detection is. Also known as an Isolation Tree, each tree in an Isolation Forest (iTree). The algorithm begins by creating Isolation Trees to train on the data.[8]

E. Linear Regression

The supervised learning subset of machine learning algorithms includes linear regression. While forecasting is used to predict future values based on past data, regression is used to predict continuous values. When attempting to understand the association between input and output numerical variables in the field of statistics, linear regression is frequently employed as a model. Machine learning was used to get this. Method for Implementing Simple Linear Regression Model.[9]

- Determine the mean and variance value
- Determine covariance
- Assess coefficients
- Make Forecast
- Forecast insurance

## IV. RESULT AND ANALYSIS

The Ph and TDS values are monitored every five minutes by using the sensors. The reading has been taken for 3 days. This table shows 3 values for each day. When the pH sensor does not work properly, the data is stored as zero. Similarly, when the TDS sensor does not work properly, the data is stored as zero. The pH value goes down on the third day such as 6. Similarly, the TDS value is increased on the third day. The algorithm detected the outlier and TDS values.

Table 4.1 Sensor value

| Sl.No | Date | Time | pH value | TDS value |
|---|---|---|---|---|
| 1 | 27-oct-2022 | 17:00 | 7.42 | 330ppm |
| 2 | 27-oct-2022 | 17:05 | 7.38 | 325ppm |
| 3 | 27-oct-2022 | 17:10 | 7.41 | 333ppm |
| 4 | 28-oct-2022 | 17:00 | 0.0 | 400ppm |
| 5 | 28-oct-2022 | 17:05 | 6.82 | 405ppm |
| 6 | 28-oct-2022 | 17:10 | 6.78 | 410ppm |
| 7 | 29-oct-2022 | 17:05 | 6.0 | 412ppm |
| 8 | 29-oct-2022 | 17:10 | 5.8 | 475ppm |
| 9 | 29-oct-2022 | 17:15 | 5.9 | 473ppm |
| 10 | 29-oct-2022 | 17:20 | 5.8 | 00ppm |

## V. CONCLUSION

The outlier detection and prediction of the pH value and TDS system are designed and implemented by using the raspberry pi and sensors. The data received from the sensor is stored as a CSV file. This CSV file is considered as a dataset to find outliers and prediction of pH value. The Isolation forest and Linear regression algorithm are used to identify the outlier and predictions.

References

[1] D. Murugesan, S. Valliammai Engineering college, and A. Professor, "REAL TIME WATER QUALITY MONITORING SYSTEM USING IoT," 1231. [Online]. Available: www.irjmets.com

[2] A. Riansyah, R. Mardiati, M. R. Effendi, and N. Ismail, "Fish feeding automation and aquaponics monitoring system base on IoT," in *Proceedings - 2020 6th International Conference on Wireless and Telematics, ICWT 2020*, Sep. 2020. doi: 10.1109/ICWT50448.2020.9243620.

[3] A. Zainudin *et al.*, *Proceedings, 2016 International Electronics Symposium (IES) : Politeknik Elektronika Negeri Surabaya - PENS, Bali, Indonesia, September 29-30th, 2016*.

[4] A. K. Pal[1] and A. P. Singh[2], "Water Quality Monitoring using TDS, Turbidity, Temperature & pH Sensor," *International Research Journal of Engineering and Technology*, [Online]. Available: www.irjet.net

[5] T. Ramprakash, A. Mahalakshmi, M. Shamima, and T. Subhalakshmi, "Smart Home Automation for Monitoring pH and TDS Level in Aquarium & Purifier." [Online]. Available: www.ijert.org

[6] "DIY Arduino pH Meter using Gravity pH Sensor." https://circuitdigest.com/microcontroller-projects/arduino-ph-meter (accessed Dec. 24, 2022).

[7] "TDS Sensor & Arduino Interfacing for Water Quality Monitoring." https://how2electronics.com/tds-sensor-arduino-interfacing-water-quality-monitoring/ (accessed Dec. 24, 2022).

[8] Jeyadevan S and Subha V, "OUTLIER DETECTION IN SMART IRRIGATION SYSTEM USING MACHINE LEARNING," 2022. [Online]. Available: www.ijcrt.org

[9] S. Journal and U. Journal, "International Journal of Innovative Technology and Exploring Engineering (IJITEE)," 2020, doi: 10.35940/ijitee.D1110.029420.