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Water Disease Prediction Device

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Abstract: The paper is based on the prediction of various water borne diseases like Cholera and Typhoid. To do this we are using pH and temperature sensor. This will help us to save many lives due to water borne diseases. We are taking the inputs from the sensor and passes it to the device to analyze the quality of water and predict the percentage of people can be affected by various diseases with the help of machine learning algorithms.

Index Terms **- Sensors, IoT, Drinking water, Water Disease classification, Dataset, Machine learning.**

I. INTRODUCTION

In most part of the world, availability of drinking water is a major concern. Over 2 billion people uses water from contaminated source. Several factors like calcium can affect the water quality that exists in water sources like industrial waste, rocks, and sewage that leads to lower the quality of water. It is difficult for any governing body to keep track of water parameters and various water borne disease. Ultimately, there is a need for much faster water testing techniques to be implemented. Water-borne diseases spread at a certain water parameter.

II. LITERATURE SURVEY

Ming Yang et al [1] For this project water samples were collected from around 21 sites. Those samples were tested in the lab using various chemical methods thus concluding to the results. The results have revealed that rotavirus amplicons have a positive control and thus environmental water samples can be noticed as a specific band in agarose gel thus after electrophores is, which also suggested that virus particles are recovered from water samples using sodium chloride, aluminum chloride precipitation method, and also using the RT nest PCR method it was effective to detect the rota-virus present in water samples.

Mohan Krishna Varma N et al [2] This Project is known as Underwater acoustic sensor network that can collect the ocean, river, lake data such as salt contain, temperature, pH, turbidity and also oxidation in the water supplies. In this, they are adding pre-processing and rule-based engine functionalities to the underwater surface gateway thus to send the warning message to the local healthcare center. Government healthcare centers receive the data from the underwater surface gateway via the internet and the equivalent data can be processed using big data analysis for water-borne disease protection and its management.

S. Jayalakshmi et al [3] The main aim of this paper is to recognize the grade of water using the IOT. In this project executing a system for measuring the water value through devices like TDS meter, DC motor, LM35 temperature sensor, GSM. Micro-controller Avenue is the significance that is checked by using sensors. The recorded data is gathered in the centralized database server and if the water value is below the TDS meter values, a caution message is sent to owners using GSM. This atmosphere can have adjustable good water. In the proposed paper, the water quality is checked using the Turbidity sensor and also the motor's temperature using sensors.

Asma Al Khaili et al [4] In the following proposed project work, a system is projected to remotely sense, record, and determine the value of drinking water kept in domestic tanks. Various different sensors are used to determine the pH, turbidity, oxidation and temperature values present in the water. Three separate temperature sensors are used to check the temperature of the water, and also temperature inside and outside of the tank are checked. The system sends a caution messages to the landowner and the local establishments or societies (if they set), when one of the values is lower than the normal values.

Ms. Ch. Sowmya et al [5] The main objective of this project is to examine the quality of the water in the overhead tanks in society simultaneously with help of using the 3 calculating devices like pH, conductivity, and temperature sensors. The Application of Wireless Sensor Network technology is used for examination of instant water quality. In this proposed project work the system design and implementation of WSN is presented in detail. In this WSN is used for checking water quality the gathered amount of sensor nodes with ability of networking, which is deployed at various overhead tanks and water bodies in a particular surrounding.

L. Nirmala Devi et al [6] In the proposed paper 3 different sensors, micro-controllers and GPRS module are used. Data gathered by the device is sent to a centralized system. Which monitors all the accepted data from servers. These used sensors are pH, turbidity and temperature.

Yafra Khan et al [7] In the proposed paper, they deployed artificial neural network and the time series analysis. They accepted the data from the United States Geological Surveys. Four indexes are used for ensuring the quality of water. It analyzes on the four indexes like Dissolved Oxygen, Chlorophyll, Specific Conductance and Turbidity.

Jun Li et al [8] In this paper, they used artificial neural networks to calculate the number of people affected by Kaschin-Beck disease in Sichuan district in china. The method used in this is named "trial and error". This model uses the MATLAB library to determine the affected number of people. It shows the Co-relation between drinking water and Kaschin-Beck disease.

Hadi Mohammed et al [9] This paper consists of an Adaptive Neuro-Fuzzy Inference System which is established, for projection of the total number of Norovirus contents in untreated surface water in terms of water grade parameters such as water pH, turbidity, conductivity, temperature, and amount of rain. This ANFIS model integrates in a transparent manner for the symbolic representations of fuzzy logic and the learning abilities of artificial neural networks. It also provides an automatic rule creation and parameter optimization process that clarifies the complicated process of model evolution and finally creates a transparent solution that is anticipated to offer meaningful insights into the physical processes intricate or the resultant modeling mechanisms. It is related to the research of unprocessed water specimens from the Nedre Romerike water storage plant.

Sankhadeep Chatterjee et al [10] In the proposed paper, an artificial neural network uses a multi-objective genetic algorithm to improve the quality of performance. The data is gathered from near the Hooghly River from various municipal areas. In this paper the accuracy of the algorithm is increased considering the previous technologies used. As the water quality accuracy has been increased it has been predicted up to 97.22% accuracy.

III. PROBLEM DEFINITION

To predict water related various diseases using a hardware device that will analyze the quality of water with the help of ml and eliminate the risk at an early stage.

IV. PROPOSED WORK

Water Quality Classification Module

This will help us to predict various water diseases thus avoiding contaminated water and using the available water resource in a healthy manner. Thus, to implement this, sensors like pH and temperature are used. Here the sensors will work accordingly, the pH sensor provides us the pH of water while the water temperature sensor provides the temperature of water. Here we are taking the analog input from the sensor to Arduino which then further passes it to the device for further analysis purpose with the help of different dataset available on device.

Flow Diagram

At first, we are collecting the water-related data with the help of sensors like pH and Temperature, thus collected data will be processed to the raspberry pi.

We need to train the data for that purpose accurate dataset is required (Water and diseases dataset is easily available on website data.gov.in and kaggle.com).

After training and testing of data, we are using machine learning algorithms like Polynomial regression.

Lastly, the device will be able to predict the population affected by various diseases using the water source.

Block Diagram of Water Prediction Module.

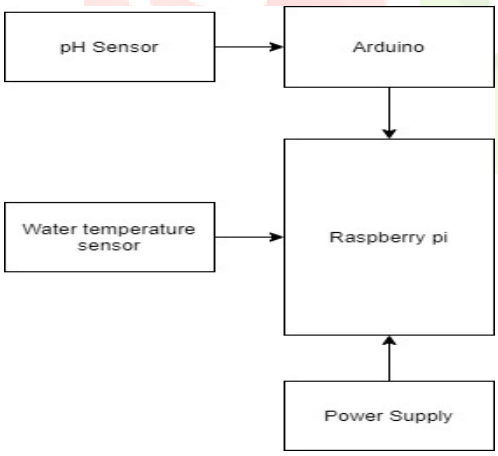

Fig No.1.1 Block Diagram of Water Prediction Module

1. Software working module.

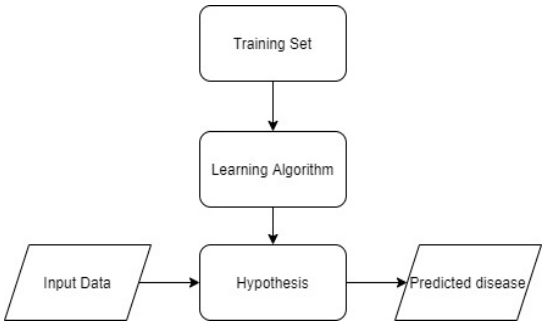

Fig No. 1.2 Software working module.

2. Working Device.

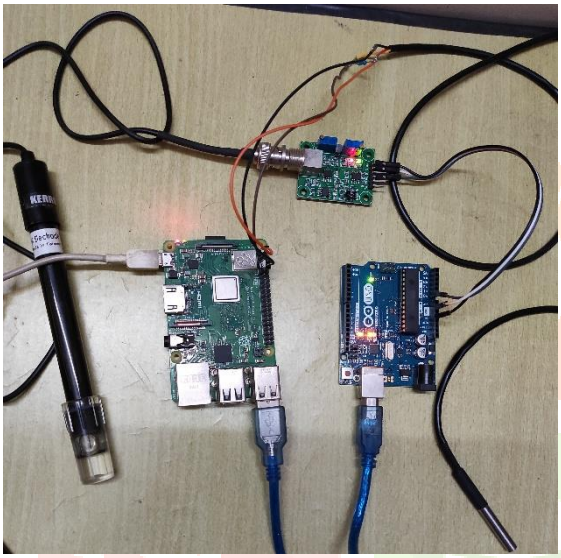

Fig No. 2.1 Working Device.

Output screenshot.

```
PH value: 6.57
Temperature (°C): 33.5
% of people can be affected by Cholera: 0
% of people can be affected by Typhoid: 0.2421618483172132
>>>
```

Fig No. 2.2 Output of working device.

3. The screenshot shows the value of pH and temperature followed by the % of people can be affected by the diseases. In which the positive value of % shows the population at risk using that source of water while negative value shows the water is safe from that disease.

Software Libraries:

1. Python – It's an interpreted general – purpose high-level language.
2. Arduino IDE – An open-source software for compiling and uploading program to Arduino board.
3. Pandas-It is used for the purpose of analysis and data manipulation.
4. Scikit-learn -It is used for various regression, classification and clustering algorithms.

Hardware:

1. Arduino Uno - It is a type of microcontroller board, based on the ATmega328P. It has 14 digital and 6 analog pins for input and output purpose.

2. Raspberry pi – It's a low-cost small sized computer that runs on Linux. It has 40 pins in which 26 are GPIO pins and the others are power and ground pins.

3. pH Sensor – A pH sensor is helpful tool which is used for the measurement of pH level of water.

4. Water temperature sensor- It is a sensor used for the measurement of the temperature of water

V. CONCLUSION

Quality of water influences the health and economy of any region. It is important to ensure safe water quality for public health. Therefore, the testing of water sources is important on regular basis which needs a lot of money to be spent which is practically not possible. The prediction model accuracy is important so that no misleading outcomes ensue. Thus, it's possible to predict water diseases at low cost by avoiding any harmful chemicals coming in contact.

State/UT	Ph	Temp(°C)	Cholera(in %)	Prediction(in %)	Typhoid(in %)	Prediction(in %)
Andhra Pradesh	7.8	22.95	6.27698E-05	0	0.519285	0.531121
Bihar	7.7	22.47	0	0	0.251482	0.407901
Himachal Pradesh	7.47	20.6	0	0	0.540862	0.658797
Manipur	7.515	29.2	0	0.000239	0.382626	0.082055
Meghalaya	6.92	20.76	0	0	0.307865	0.391117
Tripura	7.7	27.5	0	0.00017	0.349736	0.150348
West Bengal	7.8	27.255	0.000131	0.000119	0.119084	0.147478
Odisha	7.905	27.255	0	0	0.143748	0.120978
MAPE(Mean accuracy percentage error)				13.66		36.07

Table 1 Result of water disease prediction of different Indian states

VI. FUTURE SCOPE

1. This project has more positive outcomes in the future as well, currently the project is being developed using two sensors but more sensors will be used for more precise outcomes.
2. As the project uses both raspberry pi and Arduino for no analog sensor built in raspberry pi. It can be further implemented on single chip to reduce cost.
3. This project can now only predict for Cholera and Typhoid. More disease can be predicted after adding more datasets.
4. This project can also be integrated with android phones by creating sensor modules which can be attached to android phone and prediction part will handled by android app.

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