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IOT Based Water Quality Management System Using Moringa Seeds

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Abstract:- With escalating population in India, fresh water management is very much crucial which demands an increase in agricultural, industrial and other requisites. A clean and sterling supply of water is necessary to ensure high quality of life and strong economy. Many measures have been taken to improve the quality of water in many areas. Many IOT based water quality monitoring systems has been made developed by using different IOT sensors to know the quality of water on the basis of different parameters. These parameters include pH value, TDS, turbidity, heavy metals, oxygen content and many more. This paper gives an overview of those works where Internet of Things sensors are being used along with different machine learning method and cloud storages to check the contamination of water and store the data in clouds.

Keywords:- *Water quality, pH, TDS, Turbidity, IOT sensors, Temperature, Humidity*.

I. INTRODUCTION

Water is the most essential element of The World. Around 70 percent of the earth is covered with water amongst with only 3 percent of water is used for drinking. This 3 percent of water is also getting contaminated with the increase in industrial and chemical wastes that are being released in lakes or river. This is causing the water crisis all over the India. India's water crisis is constant although India has 16 percent of the World's population, the country possesses. Only 4 percent of the World's freshwater resources. This freshwater crisis is already evident part of India, varying in scale and intensity. Talking about our state Chhattisgarh especially in Durg district, where population is raising rapidly, freshwater management system is very much essential. A clean and reliable supply of water is necessary to ensure high quality of life and strong economy.

Low water quality is a major concern in urban as well as rural areas. Consumption of water containing high concentration of fluoride, arsenic, iron and other heavy metals leads to several health hazards like mental disorder, vision problem and many more. According to water resource information system of India 2017 around 5 million people die because of drinking contaminated water. According to a study over 600 million people in India face high to extreme water stress. With nearly 70 percent being contaminated India is placed at 120th amongst 122 countries in the water quality index. About 2 lakhs people die every year due to inadequate access to safe water. Chhattisgarh has ranked 9th on the state-level performance on water resource management having score 49 according to Composite Water Index scores.

Many researches have been done in this area and several models have been proposed to check the water quality and taking preventive measures. The common parameters to check the water quality are pH level, turbidity, conductivity, oxygen content, fecal chloroform etc. According to World health Organization the acceptable pH level for drinking water is 6.5 to 8.5.and the TDS level should be between 300 to 600 mg. No heavy metals should be present in water.

World Health Organization has defined a Maximum permissible Level and a Desirable Level for all the parameters present in water and there impacts on Health. According to world Health Organization the Maximum Permissible Limit of pH in regular clean water should be 7-8.5. The Desirable amount of Sodium is 500 (mg/l). The maximum permissible limit of Calcium is 75 (mg/l) and the desirable amount is 200(mg/l). Similarly WHO has defined these levels for all the parameters present in water.
The models which have been created till now have used some common sensors for measuring the parameters of the water contamination level. Some of the common sensors are pH sensor, Turbidity sensor, ORP sensor, Conductivity sensor. Let us first know what these sensors are and what they actually do.

A. pH Sensor:

The pH sensor is used to measure the acidity and alkalinity of the water. When used correctly the pH sensors are able to ensure the quality of water. The standard pH value ranges from 0 to 14. The substance having pH value of 7 is considered to be neutral. The substance having pH value below 7 is considered as acidic. And the substance having pH value above 7 is considered as alkaline. According to World Health Organization the standard pH value for drinking water should be 6.5 to 8.5.

B. Turbidity Sensor:

Turbidity sensor measures the amount of light that is scattered by the suspended solids in the water. As the amount of total suspended particles increases the turbidity level increases, which increase the cloudiness or haziness of the water.

C. DHT11 Sensor:

DHT11 sensor is a low-cost digital sensor for sensing the temperature and humidity of the surrounding of the water tanks or containers. This sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. For measuring temperature the sensor use a negative temperature coefficient thermistor, which cause a decrease in resistance with the increase in temperature?

Along with different hardware software are also used to store the data collected from the samples. The most common software that are used to store data are ThingSpeak, Google excel sheet. E-mail and SMS services are also used to send the data or alert about the contamination of water.

II. LITERATURE REVIEW

Water quality monitoring system is an important step towards the purification of water and providing people of rural as well as urban areas the water which is suitable to drink and use of other purposes. Several models has been proposed in this area and everyone has used different sensors to measure the contamination of water and different methods to store the data and to alert people about the quality of water.

Bineet et al.[1]. Did their work in two phases where there first phase was a survey about the recent water quality management system and in their second phase they develop a cloud-based water quality monitoring system. The parameters they used to check the quality was turbidity, TDS, conductivity, B.O.D, fecal coliform, nitrate, and pH value. A water level sensor and flow sensor was also used to check the water flow and leakage in the pipe. Vaishnavi et al.[2]. Presented a theory on the IOT based real time monitoring system and identified a suitable implementation model that consists of different sensor devices and other modules, their functionalities. In this they use ATMEGA 328 and Wi-Fi module. Along with it they used an inbuilt ADC which converts the corresponding sensor readings to its digital value. They also explained the sensors and other hardware. Shraddha et al.[3].Estimated the water quality of Shivnath River based on the physiochemical and biological factors. They collected the water samples from different parts of durg district and check and analyze the physiochemical parameters like Temperature, Turbidity, color and chemical properties like BOD, COD, DO, Total hardness, pH, total solids. In this study they found that the most of the parameters are not under the permitted limit of BIS and WHO. Most parameters have exceeded the permissible level making the water unfit for domestic usage. Jakir et al.[4].Did a study to trace elements like Arsenic, Copper, Chromium, Mercury, Iron, Cadmium, Lead, Nickel, and Zinc in the surface water of Mahanadi River and its tributaries to measure their geospatial metal distribution and extent of contamination. They collected total seventy five samples from seventeen different inter-distant sites and analyze them for the concentration of trace metals in the dissolved phases using atomic absorption spectrophotometer. In their study they found that the concentrations of several metals are higher than the permissible limits prescribed by World Health Organization. Further they did Pearson's Coefficient analysis to study the intermetal relationships between the studied metals. Their statistical analysis revealed that the industrial wastes and municipal wastes are the primary contributing factor for most of the metals dissolved in Mahanadi River. Sheetal et al.[5].did a study to analyze the yeasts and filamentous fungi in drinking water as well as their correlation with the indicator bacteria of faecal pollution. The results obtained by them shows that the yeasts are the dominating organisms in the tested water samples followed by filamentous fungi and coliforms. The result indicates that the water sample from the tested area was below the legal standard. It also displays the fungal form which may cause the fungal infection. Their study shows that the water is contaminated and is not fit for domestic usage as the consumption of this water can lead to severe diseases. Mohammad Salal et al.[6]. Developed an IOT based real time River water quality monitoring system. The main components of their models were Wireless Sensor Network which include microcontroller, communication system and several sensors. Real time data access was done by Remote sensing and Internet of Things technology. Data collected was displayed on server PC with the help of Spark MLlib, Deep learning neural network models and Belief Rule Based system. A warning system was also created by sending the SMS to the agent if the acquired value obtain is greater than the threshold value. A.N.Prasad et al.[7].Developed a Smart Water Quality Monitoring System for Fiji Island using Internet of Things and Remote Sensing technology. They measured the parameters like pH, Oxidation Reduction Potential Conductivity and Temperature. They collected the water samples from seawater, tap water, surface water and polluted creek water. They took the readings at an interval of 1 hour for a total period of 12 hours. In their result the Conductivity of sea water was the highest with the value of 58000 uS/cm and the tap water was having the lowest conductivity having value 58 uS/cm. They compare the quality of all the samples with each other and found that the polluted water has low conductivity and low ORP compare to other samples. S.Geetha et al.[8].developed an in-pipe water quality monitoring system based on Internet of Things. The data is collected over the internet and the model also provides an alert to the user when there is a deviation in the value of parameters. The key parameters of their model were turbidity, conductivity, water level and pH. In their work they used TI CC3200 which is a single chip microcontroller with in-built Wi-Fi module and ARM cortex M4 core, which can be used to connect to nearest Wi-Fi hotspot. The setup is connected to the ubidots platform.

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K.Rajalashmi et al.[9].Performed a water quality monitoring in the water treatment plant which was responsible for polluting the water flow in the plant. They used different sensors to measure the contamination level of the water. The sensors they used were pH sensor, dissolved oxygen sensor and turbidity sensor. They purified the water based on the results they get from the analysis. Different purification methods were used by them to purify the water and make it suitable for domestic use. Dr. Nageswara et al.[10].Developed a Smart Water Quality Monitoring System. The sensors they used were pH sensor, dissolved ions, turbidity. All these sensors are connected to the arduino board. The result was displayed in the LCD display. There model shows the quality of the water sample which they collected. They send the data to the cloud for global monitoring of the water quality. Farmanullah et al.[11].There study presented a review on IoT based water quality monitoring system of domestic water. In their paper they first introduce the freshwater crisis along with their origin, pollution, depletion of underground water, seawater. They also gave the details of water quality index recommended by WHO. They also show the detailed evolution of water monitoring from traditional to smart water monitoring. it presents a comprehensive survey of contemporary IoT-WQMS for domestic water. They also offer an in-depth technical discussion and analysis related to IoT-WQMS. They also suggested useful recommendation to design an efficient IoT-WQMS for domestic water. K.Saravanan et al.[12].propose a new Supervisory Control and Data Acquisition(SCADA) system that integrates with the Internet of Things technology for real time water quality monitoring system. The parameters they used were pH, turbidity, temperature, flow, color. They applied the system in Tirunelveli Corporation for automatic capturing of sensor data. They used Arduino Atmega 368 board integrated with IoT GPRS. Ajith et al.[13].Proposed an IOT based Smart Water quality monitoring system using cloud and Deep Learning to monitor the quality of water in water bodies. In their model they used NodeMCU with in-built Wi-Fi module attached to it which transfers the measured data from sensors to the Cloud. Deep Learning method is used to predict whether the water is suitable for use or not. Rolf Altenburger et al.[14].Did a study on complex chemicals and contaminants that are present in water and also describe their effect on the ecosystem. They found different complex biochemical in the water which is not suitable for the health and can cause severe diseases like mental disorder, diarrhea, bones weakness and many more. Ashenaf Delelegn el al.[15].Performs a study which shows that Moringa seed is the natural purifying agent which can purify the water without adding any chemical or chlorine to it. Result of their study shows that Moringa seed powder reduces the turbidity and coliform count of the contaminated water making it fit for use.

III. PROBLEM STATEMENT

After going through all the articles we came to know that researchers developed different models to check the quality of water. But we do not have any natural solution to clean the water. Along with turbidity value we also need to study the variation of pH value. Because we need to understand whether Moringa seeds are capable of maintaining the correct pH value of water? We also need to understand the behavior Moringa seeds with the change in surrounding temperature.

IV. PROPOSED WORK

Our proposed work is to study the purification ability of Moringa seeds. We are going to check how much pure the water will become after adding a weighted quantity of Moringa seeds powder. For our study we are going to take the readings of pH value, turbidity value, and surrounding temperature and humidity. We are going to check the variations in this values one the Moringa seeds are added it the muddy water.

V. METHODOLOGY

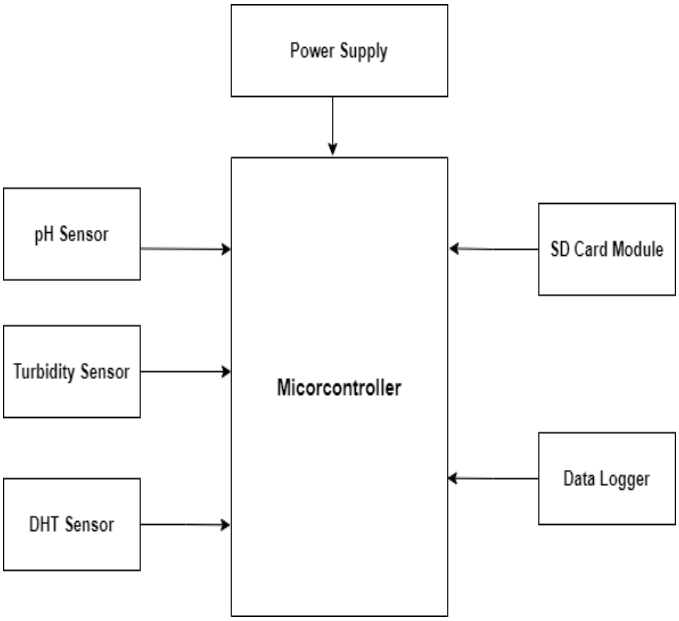

Fig 1 Flow chart of Methodology

In our model we have used ph sensor, Turbidity sensor, DHT sensor, Data logger, SD card reader, and Arduino board. We have connected all the sensors along with SD card reader and Data logger. We are going to compare the samples of water in three parameters that is pH value, turbidity value and surrounding humidity and temperature. We are collecting the records offline by using the SD card module. Once we will power on the system the SD will start capturing the records for all the three parameters. After taking readings for all the samples we will power off the device and insert the SD card in the laptop or computer. One excel file will be created in the system where we can check all the records. We are also using

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data logger. A data logger (data logger or data recorder) is an electronic device that records data over time or in relation to position via built-in or sensors or external devices and sensors. It's not perfect, but it's gradually based on digital processors (or computers) (DDL digital data loggers). Generally small, battery-powered, portable, equipped with a microprocessor, internal memory and sensors for data storage. The turbidity unit is measured in NTUs (Nephelometric Turbidity Units), which are a globally recognized standard. The cloudier the sample is, the higher the turbidity. This A to D converter links the turbidity sensor to the microcontroller through an analogue to digital converter. The analogue and digital output signals can be swapped. In analogue mode, the signal line from the A to D converter is connected to the microcontroller's analogue input pin. The voltage of the output pin represents the turbidity.

VI. RESULT

Water Sample	Moringa Seed powder(gm)	Time(sec)	pH(avg)	TSS(NTU)(avg)	Temperature(avg)	Humidity(avg)
Clear Water	0	100	6.86	0.9	22	85
Muddy Water	0	100	6.86	23.3	23	85
Muddy water	2	10	6.83	606	24	83
Muddy water	2	180	6.87	76	24	82
Muddy water	2	900	6.87	48	24	82
Muddy Water	3	12240	6.86	83	24	82
Muddy Water	4	10	6.46	606	23	84
Muddy Water	4	1650	6.10	110	23	84
Muddy Water	4	12240	6.34	180	23	84
Muddy Water	4	28,280	6.34	83	25	84

Table 1 Data Record of three Sample water

VII. CONCLUSION

After our study we concluded that Moringa seeds are capable of settling down the dust particles of water but it does not purify the water completely. Moringa seeds alone are not enough to make the water clean and reliable for drinking. Along with Moringa seeds we need to perform other purification process to make the water more purified and make it ready to use. But we can include Moringa seeds in our purification method as a natural substance. In our study we also came to know that since Moringa seeds are a natural substance use of it will not cause any health issue or any side effects.

FUTURE SCOPE

Dirty water or chlorinated water are not good for our health. We cannot rely on chlorine to purify the water because excessive use of chlorine can also cause severe health issues. To overcome that issue we have to find an alternative natural process to clean the water. In Future we can study more on Moringa seeds behavior and its ability to purify the muddy water and we can use it as a natural substance to purify water. Also along with parameters like pH, Turbidity and surrounding temperature and Humidity we can check the chlorine content of the water. We can check whether the Moringa seeds are able to reduce the chlorine content of chlorinated water. We can do more research on Moringa seeds and can enhance its ability to purify water.

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