ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 9, September 2019

Water Quality Monitoring System using Internet of Things and SWQM Framework

Ketulkumar Govindbhai Chaudhari

Department of Information Technology, University of The Potomac, USA

ABSTRACT: The ordinary strategy for testing water quality is to assemble tests of water physically and send to the lab to test and break down. This strategy is tedious, wastage of labour, and not conservative. The water quality was estimating framework that we have executed checks the nature of water continuously through different sensors (one for every boundary: pH, Conductivity, Temperature, Turbidity) to gauge the nature of water. As a variety in the estimation of this boundary focuses on the presence of pollutants. The Wifi module in the framework moves information gathered by the sensors to the microcontroller andtransfers the information to the smartphone/PC. This framework can keep an exacting mind the contamination of the water assets and have the option to give a situation to safe drinking water.

KEYWORDS: Internet of things, pH, Electric Conductivity

I. INTRODUCTION

The effect of water on any living creatures is a past portrayal. With the fast increment of the total populace, water, the board turns into a significant issue uncommonly in industrial, farming and different parts. The vast majority of the individuals around the globe need behind drinkable water. Consistently numerous individuals are experiencing other deadly sicknesses caused by water contamination. The examination has discovered that around 5 million passing is caused merely because of drinking unsafe water. Analysis by WHO (World Health Organization) shows that practically 1.4 million of youngster demise can be forestalled by giving drinkable water to them [1]. The essential target of this venture is to present a smart water quality observing framework in IoT (Internet of Things) stage which would help to watch distinct physical boundaries of the drinkable water as opposed to depending on the manual cycle. Also, IoT is an arrangement of collaboration among different gadgets and the skill of extradition information over the framework [2]. Cost of the framework relies upon the number of boundaries to be estimated. Water quality observing frameworks need to rapidly recognize any adjustments like water and report the equivalent to the officials for individual fire activity. The framework is intended for persistent location detecting and constant detailing of water quality information where the officials can get to the information on the advanced mobile phone/PC through the Internet [3]. Several research works have been led in later times to create a wise framework to recognize and screen water boundaries. For ongoing checking of water quality also, conveyance, an in-pipe checking framework dependent on sensor nodes. Their proposed design centred on the ease, lightweight execution, pipeline electrochemical framework and the sensors that are utilized for this design are optical sensors. This framework is proper for huge sum orders empowering a way to deal with water buyer, water distributers and water matchless qualities. Creators in has built up a dealer less design structure for both distributer and endorser for observing water quality.

II. HARDWARE USED

The objective of this examination is to build up a smart water quality monitoring (SWQM) framework utilizing the IoT stage. Four physical boundaries: temperature, pH, Conductivity and Turbidity of various water tests are estimated using four separate sensors outfitted with Arduino Uno[4]. The extricated sensor information is examined utilizing the quick woods double classifier.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 9, September 2019

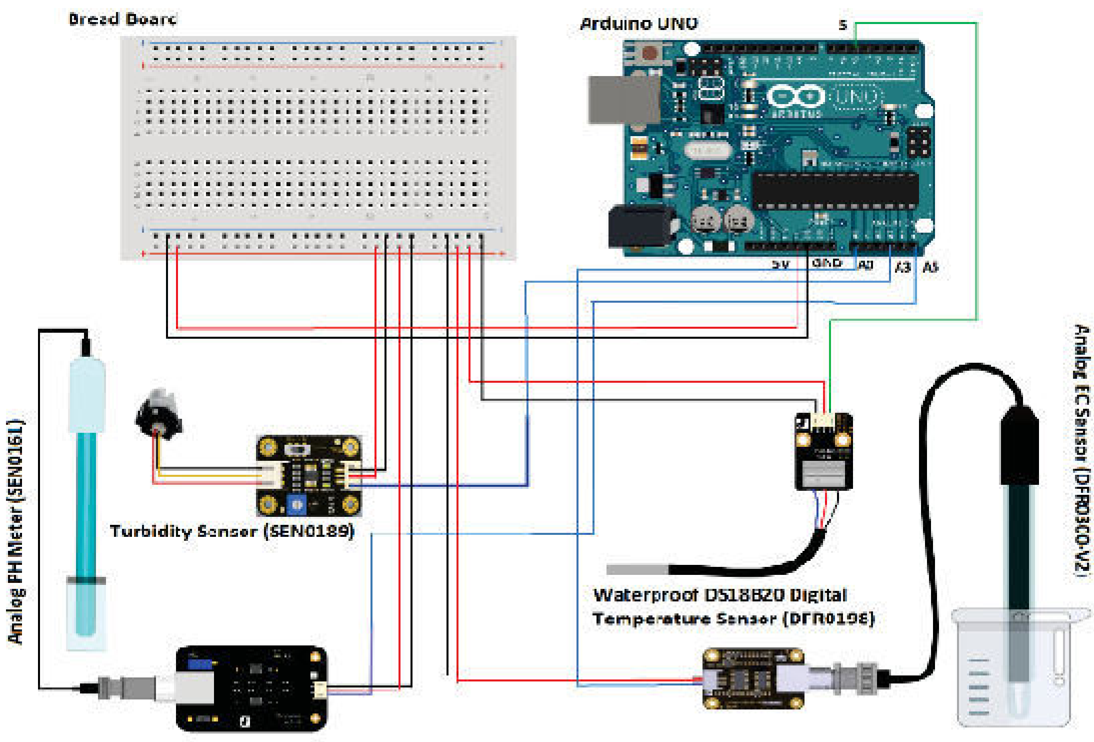

Fig 1: Circuit diagram of the hardware of the SWQM system

ARDUINO UNO:

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics.

Figure 2: Arduino Uno

Our digital temperature sensors provide the high accuracy, low power consumption and ease-of-use required for any temperature sensing application, while taking up the smallest packaging footprint. Offering a variety of interface options, our digital temperature sensors integrate seamlessly into your design.

Digital temperature sensor:

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 9, September 2019

Figure 3: Digital temperature sensor

The Analog pH Sensor Kit is specially designed for Arduino controllers and has a built-in simple, convenient, and practical connection and features. It has an LED that works as the Power Indicator, a BNC connector, and a PH2.0 sensor interface. To use it, just connect the pH sensor with the BND connector, and plug the PH2.0 interface into the analog input port of any Arduino controller. If pre-programmed, you will get the pH value easily. Comes in a compact plastic box with foams for better mobile storage. Applications are Water quality testing, Aquaculture.

Analog pH meter:
A pH meter is an instrument used to measure acidity or alkalinity of a solution - also known as pH. pH is the unit of measure that describes the degree of acidity or alkalinity. It is measured on a scale of 0 to 14.
The quantitative information provided by the pH measurement expresses the degree of the activity of an acid or base in terms of hydrogen ion activity. The pH value of a substance is directly related to the ratio of the hydrogen ion [H+] and the hydroxyl ion [OH-] concentrations. If the H+ concentration is greater than OH-, the material is acidic; i.e., the pH measurement is less than 7. If the OH- concentration is greater than H+, the material is basic, with a pH value greater than 7.

Figure 4: Analog pH meter

EC (electrical conductivity) Sensor:
The conduction of current through a water solution is primarily dependent on the concentration of dissolved ionic substances such as salt. Since most fresh water derives from relatively clean rainfall, variations in EC provide a way to track the chemical and hydrological processes the water has been subjected to over time. High amounts of dissolved substances (usually referred to as salinity) can prevent the use of waters for irrigation and drinking, so conductivity ranks as one of the most important inorganic water quality parameters.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 9, September 2019

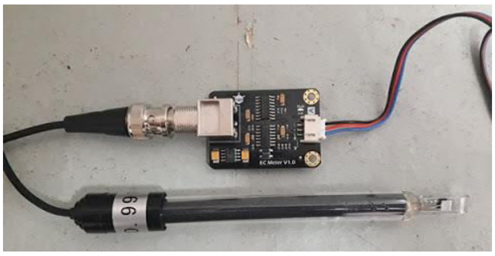

Figure 5. EC (electrical conductivity) Sensor

III. DESIGN AND IMPLEMENTATION

1. *Circuit Diagram*

Fig.1 shows the schematic circuit chart of the equipment set-up of the proposed SWQM framework. Aside from the temperature sensor, the other three sensors are of a simple sort. Every sensor has three distinctive shading wires, for example, red, dark what's more, others. Here, red wires are for +5V power gracefully, and dark wires are for ground and others are utilized for information assessment. A breadboard is being used for making regular focuses for base what's more, power gracefully independently[5]. At that point, the standard hub of the ground is associated with the foundation of Arduino and the same cycle is rehashed for control gracefully. The simple sensors are associated with the simple pins, and the advanced sensor is related to the computerized pin of the regulator.

2. *Machine Learning Algorithm*

For the proposed SWQM framework, the extricated sensor information is broke down in like manner to foresee the framework's precision. The quick woodland paired classifier has conveyed here where specific water tests, for example, salt, mud, channel, tap, soft beverages and drinking water are taken for preparing the informational index. The usual blend of numerous little and powerless decision trees in quick timberland relapse model structure a solid student. The algorithm functions as follow: for each tree in the timberland, a bootstrap test from Z is chosen[6]. At that circumstance, Z is the ith bootstrap. The decision tree learning algorithm adjusts the technique for this decision tree.Arbitrarily subset of highlights of a &X, where X means the arrangement of highlights. Here, an is so littler than X. The quick woodland algorithms bring R back which is the arrangement of the trained model. The narrowing of the collection of highlights, the learning set of highlights is accelerated definitely.

3. *Developed Desktop Application*

The presentation of the embraced quick woods two-fold classifier is contrasted and three other double classifiers: support vector machine (SVM), logistic regression and standard perceptron methods. Among four algorithms, quick woods double classifier gave better precision to the equivalent set of information. It used to build up the work area application "Sprinkle: Water Quality Checker" for monitoring the water quality[7].Shows the working plan of the work area application worked in the .NET stage. Right off the bat, ports associated with the Arduino are chosen. At that point, information is perused with the help of the sensors. This information is utilized to check whether the water test is drinkable or not drinkable; also, the outcome is spared into the information base. During the preparing of information, just three boundaries (pH, Conductivity furthermore, Turbidity) are thought of, because the temperature is utilized in the investigation as a factor of Conductivity[8].

IV. SWQM FRAMEWORK

Surface water quality monitoring (SWQM) provides essential information for water environmental protection. However, SWQM is costly and limited in terms of equipment and sites. The global popularity of social media and intelligent mobile devices with GPS and photography functions allows citizens to monitor surface water quality. This study aims to propose a method for SWQM using social media platforms. Specifically,Chat-based application platform is built to collect water quality reports from volunteers, which have been proven valuable for water quality monitoring.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 9, September 2019

The methods for data screening and volunteer recruitment are discussed based on the collected reports. The proposed methods provide a framework for collecting water quality data from citizens and offer a primary foundation for big data analysis in future research.

V. RESULTS

60 water tests are gathered from various water sources and tried to quantify the boundaries, i.e. pH, temperature, electric Conductivity and Turbidity for each test. These water sources are isolated into three categories: standard, unclean and consumable water sources[8].Table Ishows the exploratory qualities of recognized boundaries and framework's expectation for various water tests.The general rule for pH level in drinking water is around 6.5-8.5 recommended by WHO[9]. From the table, it is seen that practically 80% of the tried water tests are passed the suggested pH go, being antacid which shows the presence of carbonates and limestone in the water tests.

Table: I Test Values of Detected Parameters and System's Prediction

WaterSample	Temperature	EC	pH	Turbidity	System's prediction
1	26.55	0.16	8.1	0	Drinkable
2	27.26	0.20	8.3	0	Drinkable
3	23.67	0.78	9.2	0	Drinkable
4	24	3.75	9	1791	Not Drinkable
5	22.36	2.6	9.89	599	Not Drinkable
6	23.68	4.21	9.30	0	Drinkable

In result, overabundance presence of alkalinity in the human body can cause skin bothering, gastrointestinal and metabolic alkalosis. Turbidity speaks to a central question as far as breaking down the microorganism quality of water[10]. As per the guideline, the adequate turbidity level ought to be under NTU. A result shows the high worth of Turbidity for unclean water contrast with the characteristic water tests.In the case of measure the water quality or pollution level, electric Conductivity plays a vital role. Drinkable water conductivity ranging from 0.3-0.8 µS/cm. According to the table, more than 70% of the test sample's Conductivity is beyond the WHO standard value.

VI. CONCLUSION

A definitive objective of this work is to watch the quality of water tests by planning a smart water quality monitoring (SWQM) gadget actualized in IoT stage that can identify four explicit physical boundaries: temperatures, pH, Turbidity also, Conductivity in water, and investigate the removed estimation of these boundaries utilizing appropriate machine learning approach. Specific water tests are tried with the help ofArduino based sensors and gathered their analyses of various measurements. Quick backwoods double classifier shows better-investigating execution to approve the framework's exactness and viability in anticipating water quality.

REFERENCES

[1] N. Zidan, M. Mohammed and S. Subhi, "An IoT based monitoring and controlling system for water chlorination treatment," Proc. Int.Conf. Future Networks and Distributed Systems, ACM, Jun. 2018, p. 31, DOI:10.1145/3231053.3231084.
[2] Vishal Dineshkumar Soni 2019. IoT connected with e-learning. International Journal on Integrated Education. 2, 5 (Oct. 2019), 273-277. DOI:https://doi.org/10.31149/ijie.v2i5.496
[3] WHO, Guidelines for Drinking-Water Quality. 4th ed.; World Health Organisation: Geneva, Switzerland, 2012.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 7, Issue 9, September 2019

[4] Ankit Narendrakumar Soni 2018. Data Center Monitoring using an Improved Faster Regional Convolutional Neural Network. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 7, Issue 4, April 2018.
[5] S. Geetha and S. Gouthami, "Internet of things enabled real time water quality monitoring system," Smart Water, vol. 2, 2016, pp. 1, DOI:10.1186/s40713-017-0005-y.
[6] Vishal Dineshkumar Soni,2018 "ROLE OF AI IN INDUSTRY IN EMERGENCY SERVICES", IEJRD - International Multidisciplinary Journal, vol. 3, no. 2, p. 6, Mar. 2018.
[7] J. Ramprabu and C. Paramesh, "Automated sensor network for monitoring and detection of impurity in drinking water system, "International Journal for Research in Applied Science & Engineering Technology, vol. 3, Jan. 2015, pp. 275-280.
[8] Karunakarpothuganti (2013) 'An Efficient Architecture for Lifting Based 3D-Discrete Wavelet Transform' International Journal of Engineering Research & Technology (IJERT), Vol. 2 Issue 12, December – 2013 ISSN: 2278-018
[9] AnkitNarendrakumarSoni 2019. Text Classification Feature extraction using SVM. International Journal of Innovative Research in Computer and Communication Engineering, Vol. 7, Issue 7, July 2019. DOI: 10.15680/IJIRCCE.2019.
[10] A. N. Prasad, K. A. Mamun, F. R. Islam and H. Haqva, "Smart water quality monitoring system," Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE), IEEE, Dec. 2015, pp. 1-6,