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IOT Based Water Quality Monitoring System using Arduino Nano

Sreethu.E.A.¹, Dr.P.Vivekanandan², Ihsana Muhammed.P³

M. Tech Student, Department of Computer Science and Engineering, Royal College of Engineering, Akkikavu, Thrissur, India¹

Head of Department, Department of Computer Science and Engineering, Royal College of Engineering, Akkikavu, Thrissur, India²

Assistant Professor, Department of Computer Science, Royal College of Engineering, Akkikavu, Thrissur, India³

ABSTRACT: Water is the most important thing in the world. All the living things on the earth must need water. Water pollution increases due to usage of various chemicals, plastic and unwanted elements. Once water gets polluted then, it is very difficult for living on the earth. So, monitoring water quality is important. IOT based system is one of the most automated and applicable tools for water quality monitoring. Water is used for various purposes and it has a strong impact on public health and the environment. Drinking contaminated water can cause many diseases. Even some of the packaged water that is available does not have the appropriate mineral content which in turn leads to an adverse health effect. The proposed System consists of various sensors which will compute the live values of some of the basic parameters of the water sample in real-time. If the values limits exceeded then alert is sent to the user using IOT system. The system continuously keeps monitoring about water storage and record the data will be analyzed.

KEYWORDS: Internet of Things, Arduino Nano, NodeMCU.

I.INTRODUCTION

Water is very precious thing in the fast-changing world with increased water demand. So information on water quality should be important and reliable due to water pollution, environmental problems. Traditional approaches often fail in the attempt to predict water quality and new ones are needed to handle water quality in real time. One of such approaches is IOT based water quality monitoring. The goal is to build the IOT based system that can accurately predict the quality of water by measuring live water quality parameters using different Sensors. Hereby have proposed a system that creates an Arduino based system which takes the inputs and process and analyze the value then generate the status of the water quality of the water sample instantaneously.

1. Existing system

Existing work considered using Machine learning Techniques like Linear Regression, SVM, Gradient boosting and many such algorithms using the prerecorded information and also the attributes are not actually contributing enough for training the model. Therefore, it might not be the ideal implementation. The existing IOT based systems are very costly and less effective.

2. Scope of work

Nowadays water pollution, environmental problems are increased. Due to increased water demand, Accurate information on water quality is important. Different approaches often fail in the attempt to predict water quality. So, goal of proposed IOT based water quality monitoring system is to build reliable and cost-efficient Arduino based system that can accurately predict quality of water by measuring live water quality parameters.

3. Motivation

Water is the most important resource of life in human beings. All the Living organisms in the earth need water with enough quality to continue their lives. There are certain limits of parameters that water species can tolerate. Exceeding these limits affects the existence of these creatures and threatens their lives. During the last years, water quality has been threatened by various pollutants. Therefore, modeling and predicting water quality have become very important in

controlling water pollution. In this work a IOT based system is developed to monitor quality of water. Arduino based system have been used for the water quality monitoring.

4. Problem formulation

To develop a reliable cost-efficient water quality monitoring system using IOT. Which consists of various sensors which will compute the standard values of water in real-time for effective action. If limits exceeded then alert is sent to the user using IOT. Depict the design and working of IOT(Arduino) based water quality monitoring system.

II.RELATED WORKS

This related Works explores the methodologies that have been employed to help solve problems related to water quality. Includes some of the relevant work done by the researchers. In determining water quality, while some analyses employ IOT system to assist in finding an optimized solution for the water quality problem.

In [1] the author's described a novel water quality monitoring system based on the concepts of IoT. Various parameters that define the quality of water such as conductivity, turbidity and temperature are measured using suitable sensors. Raspberry pi and Zigbee protocol are used in this work to process and transfer the data to the IoT platform. Cloud computing concepts are used to store the data and use them for the future modifications. Abhijit Pathakaet [2] described sensor- based water quality monitoring system. The main components of Wireless Sensor Network (WSN) include a microcontroller for processing the system, communication system for inter and intra node communication and several sensors. Real-time data access can be done by using remote monitoring and IoT technology, also helped Bangladeshi populations to become conscious against contaminated water as well as to stop polluting the water. In [3] the author's proposed a cost effective and efficient IoT based smart water quality monitoring system which monitors the quality parameters consistently. The developed model is tested with three water samples and the parameters are transmitted to the cloud server for further action. In the paper [4] the author's developed an IoT based Smart Water Quality Monitoring (SWQM) system which helps in incessant measurement of quality of water on the basis of four different parameters of water quality i.e., pH, temperature, turbidity and electric conductivity. Four different sensors are coupled to Arduino Uno in order to sense the quality parameters. The data collected from all the four sensors are communicated to a desktop application which is developed in .NET platform and the extracted data are matched with the standard values. A Monitoring system which consists of a number of sensors used in [5] to measure several quality parameters like turbidity, pH value, water level in the tank, dampness of the adjoining environment and temperature of the water. In [7] systematic method for smart water quality monitoring system in Fiji, by employing remote sensing and IoT technology. The quality parameters used to analyze water are Oxidation and Reduction potential PH.

III.METHODOLOGY

The traditional method of testing Turbidity and Temperature and water level is to collect samples manually and then send them to laboratory for analysis. However, it has been unable to meet the demands of water quality monitoring today. So, a set of Monitoring of Turbidity, PH, water level and Temperature of Water quality has been developed. In the Proposed IOT based monitoring system the Find water quality by connecting the PH sensor, water level sensor and turbidity sensor, temperature sensor. The measured values from the sensors can be processed by the core controller (Arduino) Finally, the sensor data can be viewed on internet using IOT. It is convenient for management to take corresponding quality measures timely and be able to detect real-time situation of water quality remotely. The system has realized the automation of water quality monitoring intelligence of data analyzing and networking of information transferring. The block diagram of the proposed system is shown in the figure [1].

BLOCK DIAGRAM

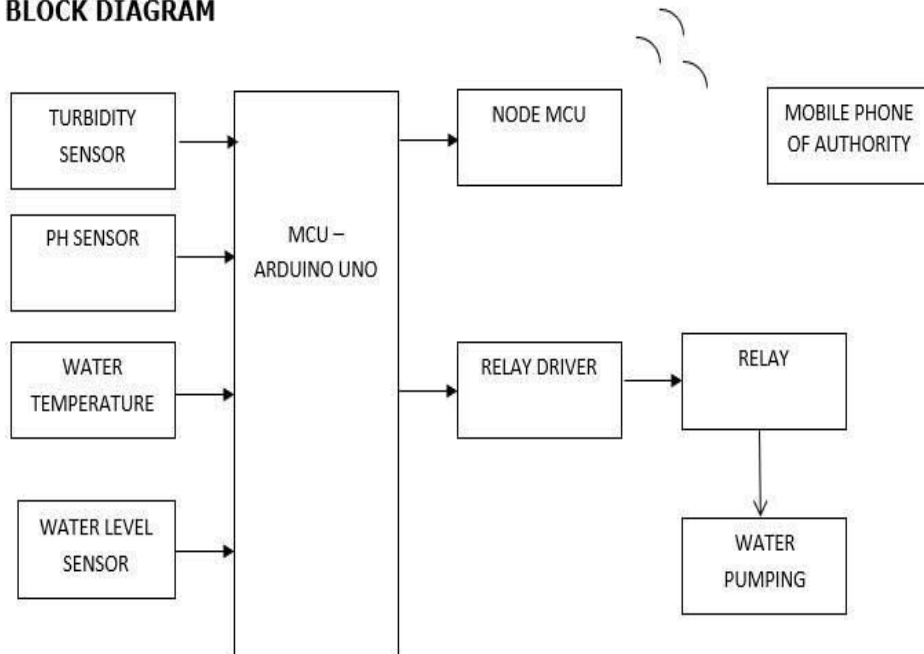


Figure 1. Block diagram of Arduino based water quality monitoring system

Turbidity, water level, PH, temperature of water is automatically detected under the control of single chip microcontroller called Arduino. Arduino controller gets the data, and then processes and analyzes them. After that, the data are instantaneously sent to monitoring center by IoT network to concern authority. If the water quality is abnormal, the data will be sent to monitoring center and management’s mobile in the same way at the same time. Water level sensor read the level of water, if the value below the threshold water level, then relay driver is switch on and motor starts working. Arduino core controller don’t have inbuilt Wi-Fi support so Arduino is use with Node MCU for Wi-Fi support.

1. System Architecture

The Flow diagram that describes the operation of the system depicted in figure [2]. First of all, Establish connection between controller, sensor and network. The PH sensor, water level sensor and turbidity sensor, temperature sensor read corresponding values. Arduino controller gets the data, and then processes and analyzes the sensor value greater than threshold or not. After that information is communicate to concerned End user through IoT network.

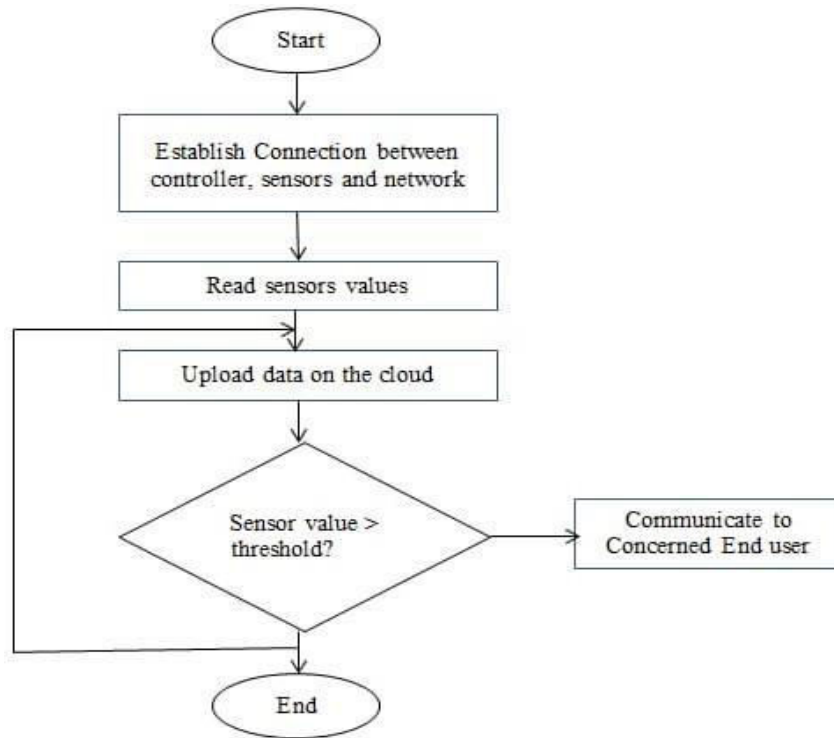


Figure 2. Flow Diagram

2. Internet of things (IoT):

IoT is a computing concept that describes the idea of everyday physical objects being connected to the internet and enabling them to send and receive data. It is used in different fields for collecting, monitoring and analysis of data from remote locations.

3. Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the AT- mega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor. The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30- like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9V battery.

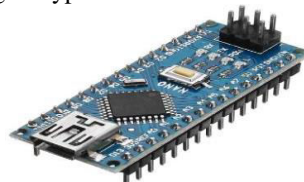


Figure 3. Arduino Nano

4. NodeMCU

NodeMCU is an open-source firmware for which open-source prototyping board designs are available. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects. NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface. The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use.

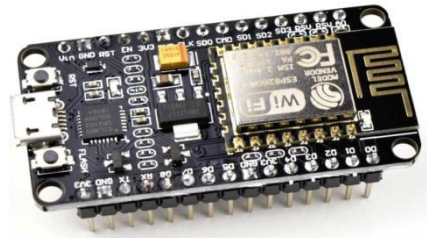


Figure 4. NodeMCU

5. PH sensor

In evaluating the acid–base balance of water, PH is an important parameter. It is also the indicator of acidic or alkaline condition on of water sample. The logarithmic scale of PH range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. WHO has recommended a maximum permissible limit of pH from 6.5 to 8.5. It operates on 5V power supply and it is easy to interface with Arduino. The normal range of pH is 6 to 8.5.



Figure 5. PH sensor

6. Turbidity sensor

Turbidity is a measure of the cloudiness of water. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

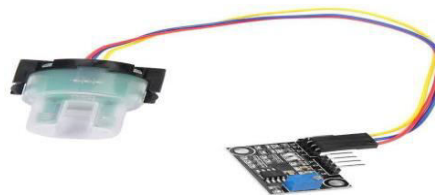


Figure 6. Turbidity sensor

7. Temperature sensor

Water Temperature indicates how water is hot or cold. The range of DS18B20 temperature sensor is -55 to +125 °C. This temperature sensor is digital type which gives accurate reading. Temperature of water is one of its most basic properties, and many other parameters depend on temperature for accuracy. With temperature data it can monitor thermal loading or discharge and determine changes in the thermocline, which affect the health of aquatic species and organisms. Many aquatic organisms are sensitive to high temperatures. The solubility of oxygen is lower in warmer water, thus limiting oxygen supply. The resistance of the thermistor changes with temperature. The measured resistance is converted to temperature using an algorithm.



Figure 7. Temperature sensor

8. Water level sensor

Water level sensor use to alert us when a liquid reaches a certain level. Furthermore, water level sensors can also trigger an automatic response in machines. The water level sensor is that when the sensor is put into a certain depth in the liquid to be calculated, the pressure on the sensor's front surface is converted into the water level height. For instance, flash an indicator, or activate a drain or other water level controls when the liquid reaches a certain level.



Figure 8. Water level sensor

9. Mini motor

Mini or small motor is also termed as the electric motor where the fundamental functionality is to convert electrical energy to mechanical energy. Depending on the power availability, mini motors can be implemented in various applications where the minimal size and load enhance dependability and efficiency.



Figure 9. Mini motor

IV. RESULTS AND DISCUSSIONS

1. Water quality parameter range

As per the literature review, the range of different quality parameters for safe drinking water is tabulated in Table 1.

Table 1. Water quality parameter range for drinking water.

No	Parameter	Range
1	Temperature;	25 to 35 degrees Celsius
2	Water level	Greater than 25ml
3	PH model	6.5 to 8.5
4	Turbidity	Less than 5 NTU

2. Smart water quality monitoring system

Due to the limited drinking water resources, intensive money requirements, growing population, urban change in rural areas, water pollution worsened the water quality available to people. A smart water quality monitoring system is an essential device which monitors the quality of water.

Working model of smart water quality monitoring system is depicted in figure 10.

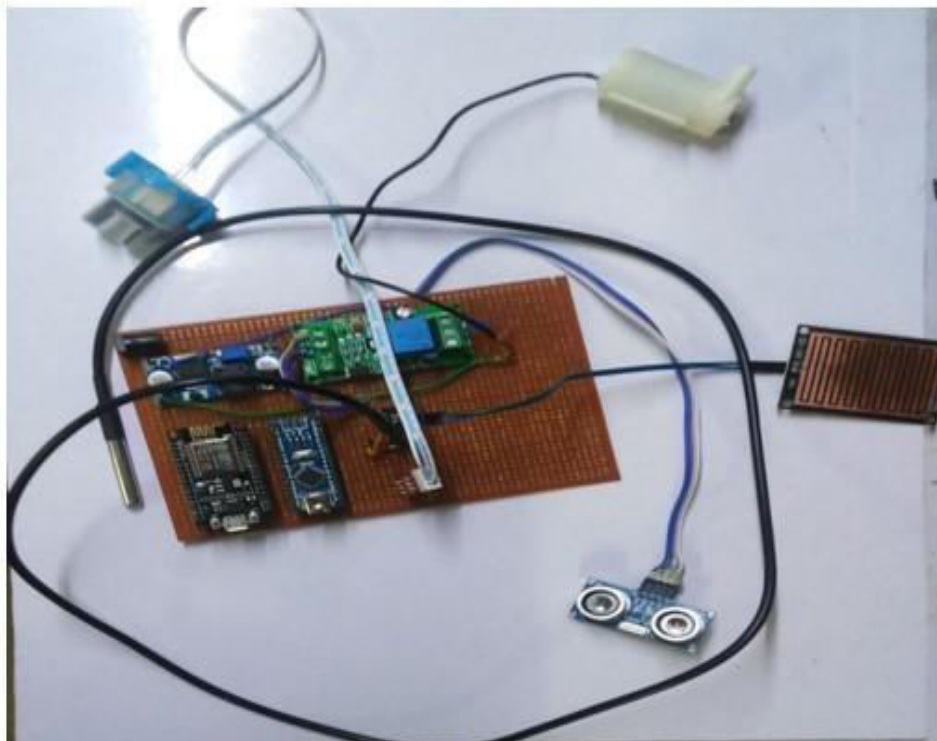


Figure 10. Developed model

V. CONCLUSION

The water is more precious and required for the human beings and other living objectives on earth. Due to much pollution and huge water usage, the water became polluted. So, it is essential to monitor the water pollution. The water quality system provides a mechanism to have continues monitoring. With the advances in IoT technology, the water

quality monitoring system is becoming smarter with reduced power consumption and ease of operation. This work presents an Arduino based IOT model make water quality monitoring systems smart, low powered and highly efficient such that monitoring will be continuous and alerts/notifications will be sent to the concerned authorities for further processing. The developed model is flexible and simple to use.

As a future directive, the suggestion is to use latest sensors for detecting various other parameters of quality. Use better wireless communication standards for better communication and IoT to make a better system for water quality monitoring and the water resources can be made safe by immediate response.

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