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IOT BASED REAL TIME WATER QUALITY MONITORING SYSTEM

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ABSTRACT

Pollution of water is one of the main threats in recent times as drinking water is getting contaminated and polluted. Water pollution is one of the biggest fears for the green globalization Nowadays Internet of Things (IoT) and techniques are used in different area of research for monitoring, collecting and analysis data from remote locations. To make certain the supply of pure water, the quality of the water should be examined in real-time. . In this paper,we present a design of real time water quality monitoring system which is used for ease of mankind a detailed review of the latest works that were implemented in the arena of smart water pollution monitoring systems is presented. The paper proposes a cost effective and efficient IoT based smart water quality monitoring system which monitors the quality parameters uninterruptedly. The developed model is tested with water samples and the parameters are transmitted to the cloud server for further action.

Keywords: *Internet of Things, pH sensor, Turbidity sensor, Temperature sensor, ESP32, WI-FI module*

1. INTRODUCTION

Water is one of the valuable natural resource gift to the mankind. Water quality plays a very important part in the health of human beings and animals. . The polluted water can cause various diseases to humans and animals, which in turn affects the life cycle of the ecosystem. Lakes and reservoirs ,canals one of the major sources of drinking water . But the quick progress of population, the water resources became polluted and contaminated. The major pollutants of water include viruses, bacteria, fertilizers, parasites, pharmaceutical products, pesticides, nitrates, fecal waste, phosphates radioactive substances and plastics.. Groups of observing points were initiated by the Central Pollution Control Board which observes the purity and quality of water.The first step towards water pollution control is to be able to monitor the actual level of water pollution. The conventional method of monitoring involves manual collecting water sample from different locations and tested in the laboratory using the rigorous skills. The old method of quality detection and communication is time consuming, low precision and costly. The Water Quality monitor checks the purity of portable water that the consumer receives, by measuring five qualitative parameters of water viz. pH, temperature, turbidity. The problem with water pollution monitoring is the manual effort of taking a boat through a lake or reservoir each time to monitor pollution throughout the water body. So we here design a solution for easy water quality checking of vast water bodies with ease. . In order to develop this, we used pH sensor, Turbidity sensor, Temperature sensor, and an ESP32 as IoT device. The pH sensor, Turbidity sensor, Temperature sensor will be connected to ESP32.

2. LITERATURE REVIEW

Vaishnavi V. Daigavane, Dr. M.A Gaikwad entitled ”Water Quality Monitoring System Based on IOT”. This paper measures Turbidity, pH and also flow of water using flow sensor. This paper shows the most economical and convenient method of water monitoring system by using the existing GSM network to transmit sensor values.

N Vijayakumar, R Ramya entitled “The Real Time Monitoring of Water Quality in IoT Environment”.This paper a proposed a less expensive system to examine the quality of water in real time with Internet of things (IOT) Various sensors were used to find out the temperature, PH, turbidity, conductivity and dissolved oxygen of the water in their model. A core controller which is of Raspberry Pi B+ model was used to process the information which was obtained from the sensors. After processing, the information was transferred on the Internet using cloud computing.

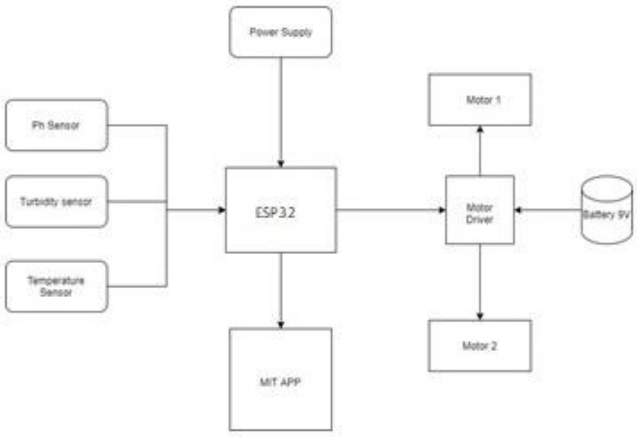
Atif A, Wasai Shadab, Mohammad Hassan, Shamim, Alelaiwi and Anwar Hossain entitled ”A Survey on Sensor-Cloud: Architecture, Applications, and Approaches” discusses about the sensor-cloud infrastructure, approaches, and different layers of transferring generated data by connecting sensors with cloud services.

Nikhil Kedia entitled ”Water Quality Monitoring for Rural Areas-A Sensor Cloud Based Economical Project” This paper not only highlights embedded sensor systems, but also discusses the challenges and economic viability of the system involving Mobile Network Operator and Government. This system directly contacts Government to take action based on the severity of quality issue.

Pradeepkumar M, Monisha J, Pravenisha R, Praiselin V, Suganya Devi K entitled ”The Real Time Monitoring of Water Quality in IoT Environment”. This paper discusses not only sensor based system but also it introduces cloud computing architecture into IoT which makes the sensor data accessible worldwide.

R.Karthik Kumar, M.Chandra Mohan, S.Vengateshapandiyan, M.Mathan Kumar, R.Eswaran entitled aSolar based advanced ˆ water quality monitoring system using wireless sensor networka uses solar node to power the wireless sensor network ˆ and displays results using GUI created through Matlab.

PROPOSED SYSTEM



In this, we present the theory on Iot Based Real Time Water Quality Monitoring System

The overall block diagram of the proposed method is explained. Each and every block of the system is explained in detail.

3. HARDWARE DESCRIPTION

In this proposed block diagram consist of several sensors (pH, Temperature, Turbidity,) is connected to ESP32. The ESP32 access all the data from the sensors and once the data is retrieved from the sensors the ESP32 ESP32 sends the data to the application which is developed with the help of MIT APP inventor

pH Sensor- The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a logarithmic scale whose range is from 0-14 . Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. The pH value of neutral water is seven. It operates on 5V power supply and it is easy to interface with arduino .The normal range of pH is 6 to 8.5. When the pH sensor is connected to the Arduino board, we have to calibrate the sensor to get the correct value. To calibrate the sensor, first we need to take a pure drinkable water and dip the sensor in it. Now the sensor value needs to be seven or around seven, so if it is not then we have to adjust the value by rotating the pin on the Analog to Digital Converter of the sensor. The sensor usually gives analog values to convert into digital values, we used the Analog to digital converter. After the successful calibration of the sensor, it will be able to take pH values of water more accurately

Turbidity- 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. To find the degree of light which is dispersed by the accumulation of solids in any water can be find out with the help of turbidity sensors. The more the turbidity level of water means more number of particles accumulated in water. So turbidity sensor is useful to examine the water if any impure particles are present in water or not. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

Temperature sensor-

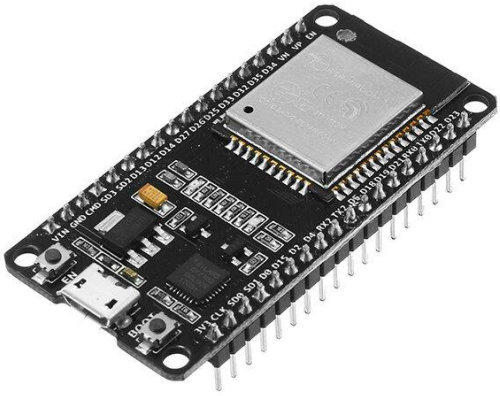
To measure the temperature of water, temperature sensors are used. The temperature sensor selected for this project is DS18B20. Water Temperature indicates how water is hot or cold. The range of DS18B20 temperature sensor is -55 to +125 ℃. This temperature sensor is digital type which gives accurate reading.

L293D-

L293D Motor Driver Module is a medium power motor driver perfect for driving DC Motors and Stepper Motors.

It uses the popular L293 motor driver IC.

It can drive 4 DC motors on and off, or drive 2 DC motors with directional and speed control.



ESP32-

ESP32 is a single chip 2.4 GHz Wi-Fi and Bluetooth combo chip designed with TSMC ultra-low power 40 nm technology.
It is designed and optimized for the best power performance, RF performance, robustness, versatility, features, and reliability, for a wide variety of applications, and different power profiles.

4. IMPLEMENTATION

ESP32 is programmed with the help of ArduinoIDE. Download and install the Arduino IDE on the computer. Connect the ESP32 to the computer select the port in which it is programmed. The firmware uses the Lua scripting language.

Once the setup of ESP32 is completed according to our requirements we can connect our sensors the ESP32

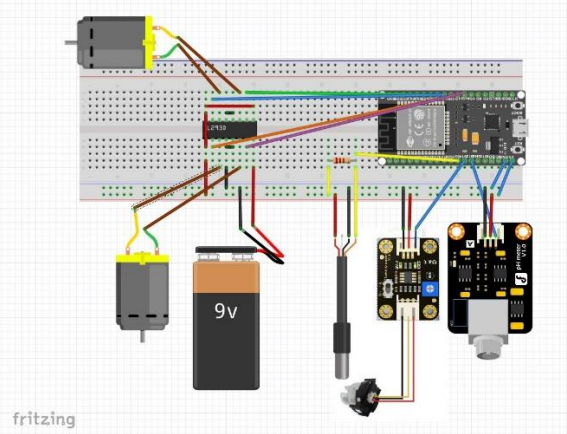
Connect pH, turbidity and temperature sensors to the ESP32 ESP32. The pH sensor is used to find out the pH value (from 0 to 14) of the water. Turbidity sensor can find cloudiness in the water. Temperature sensor in the system is used to find the temperature of water. Each of the sensors will be connected to different pins in the ESP32, then only we will be able to take values from different sensors. To connect the sensors with the ESP32 it needs jumper wires. Using this jumper wire, the sensors are connected to different ports. If the pH is connected to the pin on the ESP32, then that pin cannot be used to connect any other sensors. Accordingly the remaining sensors are connected to the board.

The Arduino IDE is used to program the ESP32 to take values from the sensors. The code written on the IDE is compiled and make sure that there are no errors in it. Once the compilation has finished, the code is loaded to the ESP32. When the codes are uploaded, the ESP32 will be able to take values from the sensors. The sketch should be according to the connection of the sensors otherwise we will not get the correct values. To avoid this, we must ensure the pins on the sketch and on the board.

To read the values from the sensors, it should be dipped in the water. They sense the water and gives the output to the ESP32. These values are used to find out if the water is polluted or not. If everything is there will be no problems in getting the values.

Once the readings from all the sensors are obtained the next step is to show them somewhere so with the help of ESP32 module we will be able to connect to the internet. ESP32 is a microcontroller with integrated wifi and dual-mode Bluetooth. The ESP32 takes the readings and they are send to cloud , here we use Thingspeak cloud to get the readings. The Thingspeak cloud shows the analysis report of the sensors.

Further the the readings and the Analytic reports from the Thingspeak will be transfer to a app. The app which will be developed we the help of MIT APP inventor. This app will be developed in such a way that the user will receive all the values and readings that will be collected from sensors by the ESP32.



The circuit diagram for the project “Iot Based Real Time Water Quality Monitoring System

” is as shown above. The whole design of the system is based mainly on IOT which is newly introduced concept in the world of development. There is basically two parts included, the first one is hardware & second one is software. The hardware part has sensors which help to measure the real time valuesTo get the required readings from the sensors the connections must be according to the circuit diagram as shown

5. CONCLUSION AND FUTURE SCOPE

The system proposed in this paper is an efficient, inexpensive IoT solution for real-time water quality monitoring.

The system can monitor water quality automatically, and it is low in cost and does not require people on duty.
So the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility.

Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters.

The operation is simple. The system can be expanded to monitor hydrologic, air pollution, industrial and agricultural production and so on.

It has widespread application and extension value. The future scope of this project is monitoring environmental conditions, drinking water quality, treatment and disinfection of waste

water etc. This system could also be implemented in various industrial processes. The system can be modified according to the needs of the user and can be implemented along with lab view to monitor data on computers.

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