IOT BASED WATER QUALITY MONITORING SYSTEM

[1]A.DHEEBISH SHYNI MARIYA [2].K.DEVADHARSHINI

[1] Assistant professor Dept.of.ECE, Ponnaiyah Ramajayam institute of Science and Technology (PRIST) Thanjavur

[2] Master of technology, Dept.of.Commuication System, Ponnaiyah Ramajayam institute of Science and Technology (PRIST) Thanjavur

ABSTRACT

The conventional method of testing water quality is to gather samples of water manually and send to the lab to test and analyse. This method is time consuming, wastage of man power, and not economical. The water quality measuring system that we have implemented checks the quality of water in real time through various sensors (one for each parameter: pH, conductivity, temperature, turbidity) to measure the quality of water. As a variation in the value of this parameter points towards the presence of pollutants. The Wi-fi module in the system transfers data collected by the sensors to the microcontroller, and transfers the data to the smart phone/PC. This system can keep a strict check on the pollution of the water resources and be able to provide an environment for safe drinking water.

Keywords:-Waterquality,PH,Conductivity,Temperature,Turbidity,IOT,Wi-fi(ESP8266).

INTRODUCTION

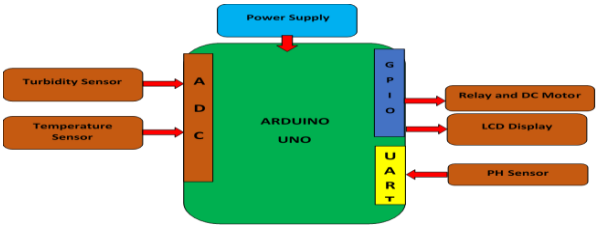
Water is one of the most essential natural resource that has been gifted to the mankind. But the rapid development of the society and numerous human activities speeded up the contamination and deteriorated the water resources. For above water quality monitoring is necessary to identify any changes in water quality parameters from time-to time to make sure its safety in real time. The Central Pollution Control Board (CPCB) has established a series of monitoring stations on water bodies across the country which monitor the water quality on either monthly or yearly basis. This is done to ensure that the water quality is being maintained or

restored at desired level. It is important that it is monitored on regular basis. Water quality monitoring helps in evaluating the nature and extent of pollution control required, and effectiveness of pollution control measures. CPCB has plans to establish water quality monitoring network across Ganga river basin. All the stations will operate in real time and central station can access data from any of the above stations using GPRS/GSM or 3Gcellular services. State pollution boards and CPCB zonal offices can also access data from central station. Large amount of data can help to take right decisions and also to implement in time accordingly Cost of the system depends on number of parameters to be measured. Water quality monitoring systems need to quickly identify any changes in the quality of water and report the same to the officials for immediate action.

The system is designed for continuous onsite sensing and real time reporting of water quality data where the officials can access the data on the smart phone/PC through Internet. Our proposed system employs use of multiple sensors to measure the parameters, measures the quality of water in real-time for effective action, and is economical, accurate, and required less manpower.

IMPLEMENTATION

This system makes use of three sensors (pH, conductivity, turbidity, temperature), processing module microcontroller, The four sensors capture the data in the form of analog signals. The ADC converts these signals into the digital format. These digital signals are sent to the microcontroller via a Wifi module.



The microcontroller will process the digital information, analyse it, and further communication is done by the Wifi module, which sends an Information with the water quality parameters onto the smart phone/PC, which also displayed on the LCD of the micro controller.shows the water quality monitoring system. Microcontroller accepts and processes the data collected from the

sensors to the Web page via Wi-Fi module. This is carried out with the help of coding. The code is written in Embedded-C and using the Arduino software to simulate the code

System design:

The water quality monitoring system shown in Figure 2 employs sensors to collect the data (parameters: pH, temperature, Electric Conductivity (EC). This data is processed through the LPC2148 microcontroller module and transferred via the ESP8266 Wi-Fi data communication module to the central server. This data can be accessed by the authorized users by logging into their accounts using a User ID and password to view data. The data is collected, processed, analyzed, and transmitted and displayed all in real time.

The Arduino Uno microcontroller is based on real time emulation and embedded trace support. It supports embedded high speed flash memory. Due to its low power consumption and small size, it is good to use where size is a key requirement for access control and point-of-sale applications. It is suitable for gateways and protocol converters in communication, soft modem, voice recognition, low resolution imaging, and provides high processing power and large buffer size.The ESP8266 is a low cost Wi-Fi module consists of Wi-Fi chip with full TCP/IP stack and micro controller chip manufactured by M/S Espruino .Above module is a WLAN network, which hosts the applications or offload WiFi network functions from other application processor. During hosting the applications it boots up directly from external flash. Performance of the system is improved and memory requirement is also minimized because of its integrated cache. Wireless Internet access can be introduced to any microcontroller based design using CPU AHB bridge interface or UART interface when Wi-Fi module works as Wi-Fi adapter.ESP8266 uses serial transceiver (Tx/Rx) to send and receive data in Ethernet buffers, and serial commands to query and change configurations of the Wi-Fi module. It only requires two wires (Tx/Rx) to communicate between a microcontroller and Wi-Fi module. It offloads Wi-Fi-related tasks to the module, allowing the microcontroller code to be very light-weighted. Wi-Fi Module is addressable over SPI and UART, making it easy to build an Internet of Things application. We use AT commands to connect to Wi-Fi networks and open TCP connections without need to have TCP/IP stack running in our own microcontroller. By just directing connecting the microcontroller to this module, we can start pushing data up to the Internet (Central server).

A. Sensors

A sensor is a transducer device to detect events or changes in its environment, and then provide a corresponding electrical output. The most important characteristics of a sensor are precision, resolution, linearity, and speed. Sensor calibration improves the sensor performance. The performance can be enhanced by removing structural errors in the sensor outputs. Structural errors can be find out by taking difference between sensor's measured output and its expected output. Above repeatable errors calculate during calibration are compensated in real time during measurements carried out by sensors.

B. pH Sensor

pH is a measure of how acidic or basic alkaline the water? It is defined as the negative log of the hydrogen ion concentration. The pH scale is logarithmic and goes from 0 to 14. The pH term translates the values of the hydrogen ion concentration. It is low for acidic and high for alkaline solutions. A natural source of water pH is around 7. For each increase in number of pH, the hydrogen ion concentration decreases ten-fold and water becomes less acidic. A pH sensor has measuring electrode and a reference electrode. A battery positive terminal connected to the measuring electrode and negative terminal to the reference electrode. The reference electrode provides fixed potential and when pH sensor immersed in the solution, the reference electrode does not change with changing hydrogen ion concentration.

C. Electric Conductivity

Sensor Salts dissolve in water breaks into positive and negative ions. Dissolved ions are the conductors and conductivity is the ability of water to conduct an electrical current. The major positively charged ions are sodium, calcium, potassium, and magnesium and the major negatively charged ions are chloride, sulfate, carbonate, and bicarbonate. Nitrates and phosphates are minor charged ions to the conductivity. Electric conductivity is measured with the help of a probe and a meter. The probe consists of two metal electrodes spaced 1 cm apart (unit: mili- or micro-Siemens per cm). A constant voltage is applied across electrodes. The current flow through the water is proportional to the concentration of dissolved ions in the water, which measures the electrical conductivity.

D. Turbidity Sensor

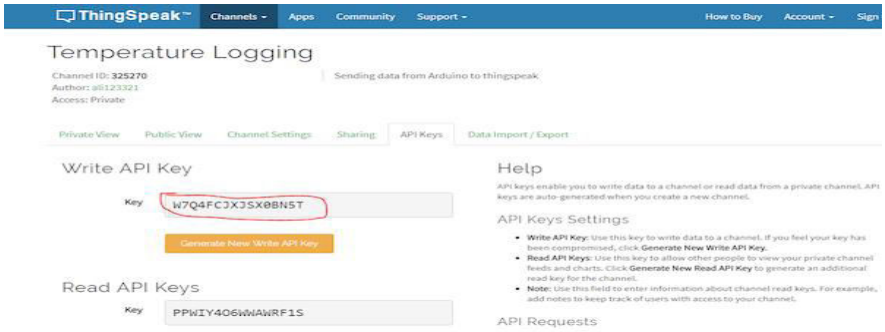
Turbidity is the quantitative measure of suspended particles in a fluid. It can be soil in water or chocolate flakes in your favorite milk shake. Whilechocolate is something we so want in our drinks, soil particles are totally undesired. Keeping aside the potable purposes, there are several industrial and household solutions that make use of water in some or other manner - for instance, a car uses water to clean the windshield, a power plant needs it to cool the reactors, washing machines and dish washers depend on water like fish.

E. Temperature Sensor

An analog temperature sensor is easy to explain it's a chip that tells you what the ambient temperature is. These sensors use a solid-state technique to determine the temperature. That's to mention, they don't use mercury(like previous thermometers),bimetallic strips(like in some home thermometers or stoves),nor do they use thermistors(temperature sensitive resistors.)Instead, they use the actual fact as temperature will increase; the voltage across a diode will increase at an acknowledged rate. Technically, this is actually the voltage drop between the base and emitter- the Vbe- of transistor. By exactly amplifying the voltage change ,it is simple to generate an analog signal that is directly proportional to temperature. In this, we are using LM35 sensor.

RESULTS

Authorized users can access data by logging on Thing Speak website as shown in On entering the registered user ID and password, it goes to the web page where the parameters are displayed in real-time in the form of plots.



To demonstrate the quality of water, the pH sensor and EC sensor is put into a container filled with tap water, to which 34 drops of acid is added. From the graphs in shown below, we can see

that the pH of the water remains at around 3 to 4.5 means the water is acidic in nature. The temperature of the surrounding stays between 32 to 34 degrees. The conductivity of water is at 7 to 9 micro centimeters/centimeter. Total Dissolved Solids are 0.67*electrical conductivity which can be measured from the graph

CONCLUSIONS

In this article, the design and development of low-cost system for real time monitoring of water quality and controlling the flow of water by using IoT is presented. The proposed system consists of sensors for water quality monitoring and solenoid valve for controlling the water flow in the pipeline.The low cost, efficient, real-time water quality monitoring system has been implemented and tested. Through this system, the officials can keep track of the levels of pollutions occurring in the water bodies and send immediate warnings to the public. This can help in preventing diseases caused due to polluted water and presence of metals. Quick actions can be taken to curb extreme levels of pollution like in the case of the Ganga and Yamuna rivers. The system can be easily installed, with the base station kept close to the target area, and the task of monitoring can be done by less-trained individuals. These devices are low in cost, highly efficient and flexible. These are connected to Raspberry pi core controller and IoT module. Finally, sensed values viewed and controlling is performed by internet and also through Wi-Fi to mobile devices.

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