



WATER QUALITY MONITORING SYSTEM USING IOT

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Abstract : Nowadays drinking water is the most precious and valuable for all the human beings, drinking water utilities faces new challenges in real-time operation. This challenge occurred because of limited water resources growing population, ageing infrastructure etc. Hence therefore there is a need of better methodologies for monitoring the water quality.

The online water monitoring technologies have made a significant progress for source water surveillance and water plant operation. The use of their technologies having high cost associated with installation and calibration of a large distributed array of monitoring sensors. The algorithm proposed on the new technology must be suitable for particular area and for large system is not suitable. By focusing on the above issues our paper design and develop a low-cost system for real time monitoring of the water quality in IOT environment. In our design Arduino is used as controlling unit. The design system applies a specialized IOT module for accessing sensor data from Arduino to the server. The sensor data can be viewed on the website using a special IP address.

I. INTRODUCTION

Water quality parameters encompass physical, chemical, and biological values along with monitoring concerns or testing provided samples. Temperature, pH, conductivity and salinity, turbidity, and dissolved oxygen are the frequently applied parameters to obtain water quality. Nevertheless, measuring algae, ISEs (ammonia, nitrate, chloride), and laboratory variables can also be considered as a water monitoring guideline. It is essential to monitor the water quality on open systems if the water is being used for humans or industrial purposes. Moreover, the description of a few parameters can be found below:

1.2.1 Temperature

The measurement of the average kinetic energy of water molecules on a scale of Fahrenheit or Celsius degrees is referred to as a temperature. It also determines the internal heat or the intensity of heat inside the objects. The kinetic energy results in the movement of the molecules with internal thermal energy. Thus, it affects the concentration of the dissolved gases and the saturation of the water. To be precise, oxygen amount, rate of photosynthesis by plants inside the water, metabolic rates of aquatic animals are adversely impacted by the increased temperature. The change in the temperature varies with the layers of the water and the duration of the time, i.e., colder at night and warmer at broad daylight. As a result, the temperature is considered an important criterion for water quality.

1.2.2 pH

The measurement of hydrogen-ion (H⁺) or negative logarithm of the hydrogen ion concentration is pH scale. Its value determines the acidity and base of the water where acidic water holds an extra amount of hydrogen ions and base water with extra hydroxyl ions (OH⁻). It is important to have a pH measurement to determine the state of water, and it is favourable for plants, aquatic animals, or even for drinking purposes. The lower the value more the water is acidic whereas the pure water has a value of 7.0 and is considered neutral.

The varying value of pH can result in several chemical reactions and could affect the lifestyle of aquatic animals since those are adaptive to certain pH scales. Besides, low pH can be more deadly to humans as heavy metals can readily dissolve in the water.

1.2.3 Dissolved Oxygen

Dissolved oxygen is a basic test of water pollution and one of the important parameters. The water with a higher concentration of oxygen is evaluated as pure water. Although the dissolved oxygen might not have severe consequences on human health, it can bring changes in the taste of water. Atmospheric pressure, temperature, pollution level, the concentration of salt are the several aspects that differentiate the dissolved oxygen (DO) concentration. Due to being a significant parameter, several Sensor technologies are out in the market to measure the concentration of DO.

1.2.4 Electrical Conductivity and Salinity

The ability of water to conduct electricity is referred to as electrical conductivity and functions of the types and quantities of dissolved substances in water. Both positive and negative ions present in the water sample are the reason behind the electrical conductivity. This parameter also relates to the number of dissolved solids as it is with ions, i.e., higher the total dissolved solids in the solution, higher the ion concentration, and finally affects the conductivity.

The amount of salt present in the water or concentration of the dissolved salt in water is salinity. Sodium chloride (NaCl) is generally called a common salt that is present on water bodies along with its ions. Its presence determines the ability for the growth of crops as maximum salinity affects the growth. Salinity is generally measured on PSS or practical salinity scale.

1.2.5 Turbidity

Turbidity is one of the physical parameters of water quality and is a measurement of the number of suspended particles in the water. The amount of light scattered determines the turbidity of water. The basis to define is solid objects like clay or silt and even algae. The more the water is cloudy, the less it is unhealthy for living organisms. The water treatment could be costly due to this parameter. Nephelometric turbidimeter is used for its measurements and value can be represented in NTU or TU. 1 TU is equal to 1 mg/L of silica in suspension. Most polluted water could have a value up to 100 NTU whereas a lower value of less than 5 NTU is considered normal visibility. Ideally, normal drinking water's value must be below 1 NTU.

1.3 Objective of Project

The objective of the project is to design and develop IOT based water quality monitoring system that will measure water temperature, water quality like pH level, Turbidity. The system is used to monitor all there above parameters of particular place and send all these reading/data to the server computer using IOT. The computer has website running on it will show the real monitoring of all the parameters. The system is very useful to know the environmental condition of particular place.

1.4 Scope of Project

In order to achieve the objective of the project, there are several scopes had been outlined. The scope of this project includes Arduino as a microcontroller, build hardware for the system, interface the hardware to computer by using Thing Speak and a graph to observe the performance of the system.

WORKING PRINCIPLE

- The proposed system uses sensors which are pH, turbidity, temperature and microcontroller unit as the main processing module and one data transmission module Wi-Fi module.
- The sensors collect the data like pH sensor measure the pH level of water, temperature sensor measure temperature of water and turbidity sensor measure the cleanliness of water. ADC (analog to digital converter) is used to convert the sensor analog signals into the digital format for further study.
- All the measured parameters are compared with the threshold value that defines the purity by the MCU and then updated to the server using the Wi-Fi data communication module. The whole system is designed in Embedded-C and simulating the written code using Arduino IDE. Authorized users can access these data using a user ID and password for accessing data on the server by logging into their accounts. The information is gathered, stored, analysed and transmitted in real-time.

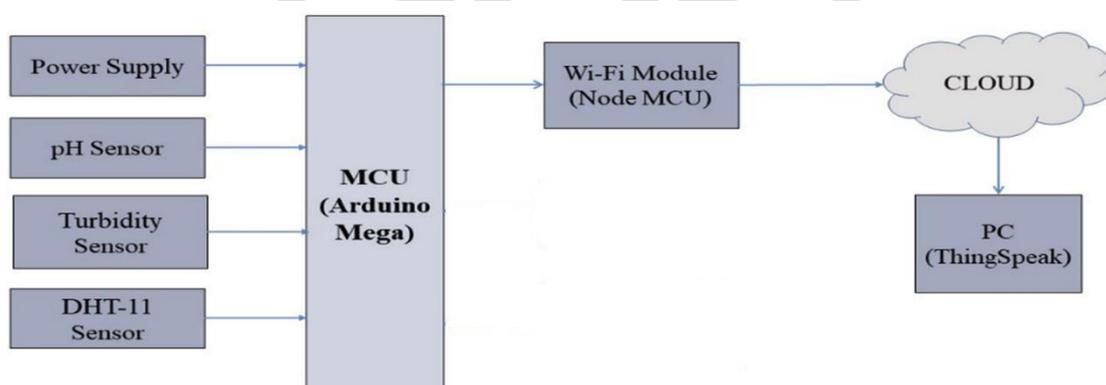


Figure-4.1: Block diagram

4.2 CIRCUIT DIAGRAM

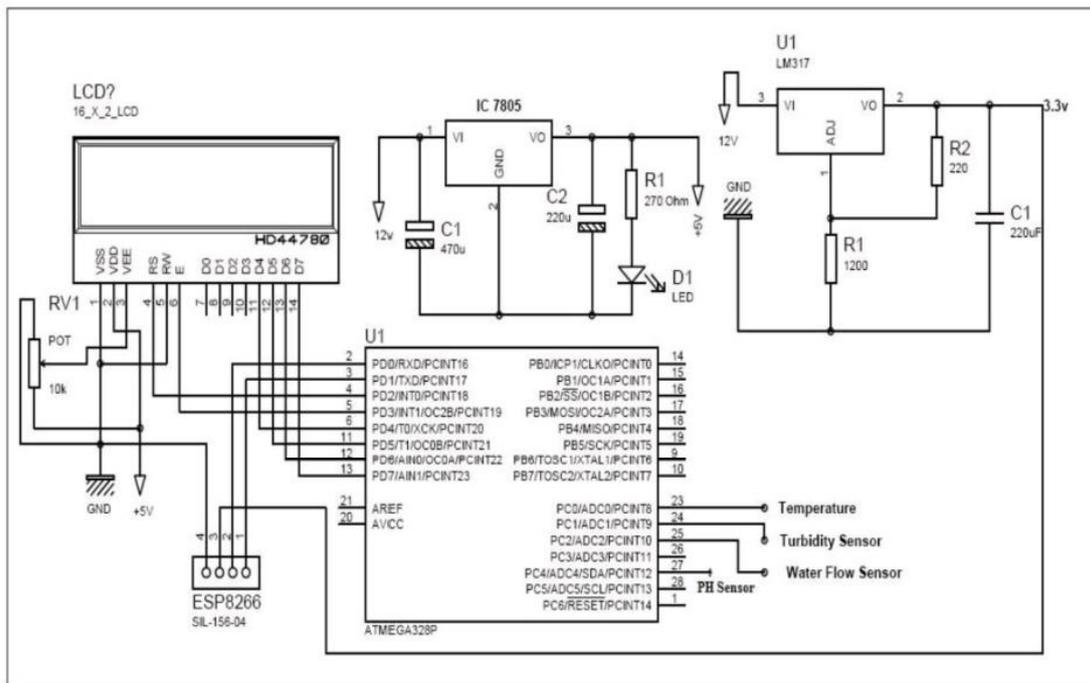


Figure-4.2: Circuit diagram

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 values, another one is Arduino atmega328 converts the analog values to digital one, & LCD shows the displays output from sensors, Wi-Fi module gives the connection between hardware and software. In software we developed a program based on embedded c language.

The PCB is design at first level of construction and component and sensors mounted on it. When the system gets started current given to the kit and Arduino and WIFI gets on. The parameters of water are tested and output se send to the server where all the data is shown. Thus, like this when the kit is located on any specific water body and WIFI is provided we can observe its real time value on our android phone, PC anywhere at any time.

RESULT

We have identified a suitable implementation model that consists of different sensor devices and other modules, their functionalities are shown in figure. In this implementation model we used ATMEGA 328 with Wi-Fi module. Inbuilt ADC and Wi-Fi module connects the embedded device to internet. Sensors are connected to Arduino UNO board for monitoring, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated.

After sensing the data from different sensor devices, which are placed in particular area of interest. The sensed data will be automatically sent to the web server, when a proper connection is established with sever device.

CONCLUSION

- Monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage and existing GSM network. 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.
- By keeping the embedded devices in the environment for monitoring enables self-protection (i.e., smart environment) to the environment. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, we can bring the environment into real life i.e., it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi.
- In Smart Cities, the big housing societies provide the direct drinking water, which is stored in the tank at the top of building. The system can predict the drinkable water quality and displays the readings on the LCD, which can be mounted inside the individual home. Also, it can be implemented in the chemical plants, where the sewage water is driven into the rivers and lakes. We can predetermine the water quality, before driving it into Rivers and lakes, to avoid the water pollution.

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