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The Monitoring of Water Quality in IoT Environment

Anuadha T
Department of CSE, PDA College of Engineering, Kalaburagi, Karnataka, India

ABSTRACT

In order to ensure the safe supply of the drinking water the quality needs to be monitored in real time. In this paper, a design and development of a low cost system for real time monitoring of the water quality in IOT. The system consists of several sensors are used to measure physical and chemical parameters of the water. The parameters such as temperature, pH, turbidity, conductivity of the water can be measured. The measured values from the sensors can be processed by the core controller. The Raspberry Pi model can be used as a core controller. Finally, the sensor data can be viewed on internet using cloud computing.

Keywords: Raspberry Pi processor, pH sensor, Turbidity sensor, Temperature sensor, Internet of Things(IoT) technology.

I. INTRODUCTION

Currently, drinking water faces many challenges in the present situation. The drinking water is essential for all human beings. Due to the growing population, ageing infrastructure, inadequate water resources many challenges occurred. So water quality methodologies are required. Water is a fuel of life and no lives exist without water on this earth planet. The water has to be monitored regularly using smart technologies. There are various purification technologies proposed for monitoring of drinking water; but the hazards of different category are mixed with the drinking water which comes through industries, urbanization, agriculture resources etc. Hence, the water quality is needed to be monitored at different places in one stretch to avoid pollution in IoT (Internet of Things) environment. The 'Internet of Things (IoT)' has the potential to modernize the water production, as more and more its technology is connected to the web. Conventionally, the water samples are collected from different places, and then tested by the scientist at their laboratory using many techniques to determine the water quality. Even though water quality test includes physical, chemical, biological parameters, it has so many disadvantages they are:

- ✓ Reduced spatiotemporal exposure
- ✓ High cost and requires high human resource
- ✓ Difficult to take critical decisions in real time.

So, it is necessary to monitor the water quality in online. And move to the water quality monitoring through the online. In this process it is done only for the water plants.

To check the water quality a number of sensors are required, and other equipments, those instruments are high cost difficult to afford and these techniques are not suitable for all the areas. By considering these issues in this design a low cost system for water quality parameters in IoT is proposed. Here Raspberry pi B+ is used as an important module and takes the input from the sensors and the IoT connects the remote objects. The novelty of this paper is monitoring the water quality in the real time. Raspberry pi B+ module plays major role in processing and storing data in the cloud. Additionally the IoT module also provides the public to view the water data about the contamination if they are not taken any action within the particular period.

II. RELATED WORK

There are very few works have been done on monitoring of water quality in IOT. In [1], the water analysis is done manually by taking the samples from the water source and send to the lab for study. The ARM7, ZIGBEE module and data concentrates module are physically placed in each and every water sources. The water quality monitoring sensors gather data from water.ARM7 forward that data to concentrates module through ZIGBEE module for remote transfer of data to the lab. The data concentrates which is located in each & every lake sends that data to the cloud configured server which is situated TWAD testing laboratory. The TWAD department workers monitoring this data remotely & securely provide this data to the requested users which are stored in the cloud.

In [2], Mithila Barabde their aim was to develop a system for continuous monitoring of water quality at remote places using wireless sensor networks with low power consumption, low cost and high detection accuracy. The proposed water quality monitoring system based on WSN can be divided into three parts: Data monitoring nodes, Data base station and Remote monitoring centre. The system consists of Turbidity, pH &Temperature sensors of water quality testing Arduino microcontroller data acquisition module, information transmitted an module, monitoring center and other accessories. Turbidity, pH & Temperature &ware are automatically detected under the control of single microcontroller all day. The single chip gets the data & then processes and analyses them, if the water quality is abnormal, the data will be sent to monitoring center & alert the public at the same time. It is convenient for management to take corresponding measures timely & be able to detect real time situations of water quality remotely is discussed in [3]. In [4], the autonomous water quality monitoring system using GSM is proposed. This was developed jointly as an element of the Autonomous Live Animal Response Monitor (ALARM) Toxicity biosensor designed to be displayed in stream for continuous observation. The objective of this system is to develop a low cost wireless water quality monitoring system that aids in continuous measuring of water conditions. Their contribution during this is that the system level integration of biosensors sensing element signal processing and sensing element information management. Their system was designed to measure a suite of biologically relevant physiochemical parameters in fresh water. They measure temperature, intensity level, pH element electrical conduction. Total dissolved solid, salinity, dissolved oxygen there parameters provide insights into the current status of changing water conditions and assist in identifying pollution sources.

Using image processing technology for water monitoring system: The fish responding behaviour has been taken one of the methods in monitoring water quality in recent years. Using image processing technology and fuzzy inference in auto-recogning the gesture of fish. After finding the center-of-gravity position of fish profile we can obtain the real time characteristics information of fish in position speed and moving track. Finally put their information in the input of fuzzy inference system via appropriate rules bank in analyzing the output value can be obtained. In this study Zebra fish and common goldfish are adopted to be the study objects by using different into water and out of water device as well as different concentration of agent in observing the fish in response.

Design of smart sensors for real time quality monitoring using Zigbee: The system is able to measure physiochemical parameter of water quality.Such as flow, temperature, conduction and also the redox potential.There physiochemical parameters are used to detect water contaminates.The sensors which are designed from first principles and implemented with signal conditioning circuit are

connected to a microcontroller based measuring node, which process and analyses the data.In this design Zigbee receives and transmitter modules are used for communication between measuring node and notification nodes.The notification node presents the reading of the sensor and output an audio alert when water quality parameters reach unsafe level.

In [5], the proposed system is divided into three subsystems. Data management subsystem accesses the data storage cloud & displays the same to end user. Data transmission subsystem consists of a wireless communications device along with build in security feathers which transmit the data from the controller to data storage cloud. Data collection subsystem consists of multi –parameter sensors & optional wireless communication device to transmit the sensor information to the controller, a controller gathers the data processes the same. The design of IoT Based Water Quality Monitoring System that monitors the quality of water in real time is proposed. This system consists of some sensors which measure the water quality parameter such as pH, turbidity, conductivity, dissolved oxygen, temperature. The measured values from the sensors are processed by microcontroller to make compatible for Zigbee module. These processed values are transmitted remotely to the call controller using Zigbee protocol. Finally sensors data can view on internet browser application using cloud computing is discussed in [6].

III. PROPOSED SYSTEM

The proposed method is used to overcome the drawbacks present in existing method. Here we are using Raspberry pi as core controller and various sensors to monitor the water Quality. Raspbian OS run on the Raspberry pi to manage various types of equipments including sensor networks, so on. We are connecting different sensors Raspberry pi to monitor the conditions of water. The Raspberry pi will access the data from different sensors and then processes the data. The sensor data can be viewed on the cloud using a special IP address. Additionally the IOT module also provides a Wi-Fi for viewing the data on mobile.

A. Hardware Components

Raspberry pi processor: It is a Minicomputer, Usually with a Linux OS to run multiple programs. Raspberry pi has the built in Ethernet port, through which you can connect to the network. Raspberry pi is shown in Figure 1..But to starts with Pi you don't need dive into the loading language and a small knowledge of electronics and is component is enough.

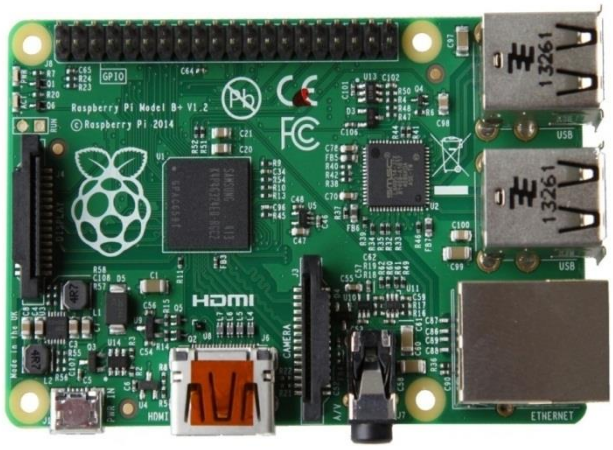

Figure 1. Raspberry Pi

Temperature Sensor (DS18B20): Temperature is a measure of how much heat is present in the water. We used DS18B20 to measure the temperature water its range is -55 to 125°C this sensor is shown in Fig 2. This sealed digital temperature probe lets you precisely measure temperatures in wet environments with a simple 1-Wire interface. The DS18B20 provides 9 to 12-bit (configurable) temperature readings over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor. The pinout for this sensor is as follows: RED=Vcc BLACK=GND WHITE=SIG.

Figure 2. Temperature Sensor

pH Sensor: The term pH is a measure of the concentration of hydrogen ions in diluted solution as shown in the Fig.3. The pH scale is a logarithmic scale whose 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. The normal range of pH is 6 to 8.5.

Figure 3. pH sensor

Turbidity Sensor: Turbidity is a measure of cloudiness in the water. High turbidity means that there are a lot of particles suspended in the water and light cannot get through. Low turbidity means that there are fewer particles in the water and it is more clear. Its range is 1-5 NTU. This is shown in Fig 4.

Figure 4. Turbidity Sensor

IV. RESULTS AND DISCUSSION

The program must run as super user, so type the following command into the terminal to start it:

- ✓ $:sudo python thermometer.py
- ✓ you will see a series of readings like this:

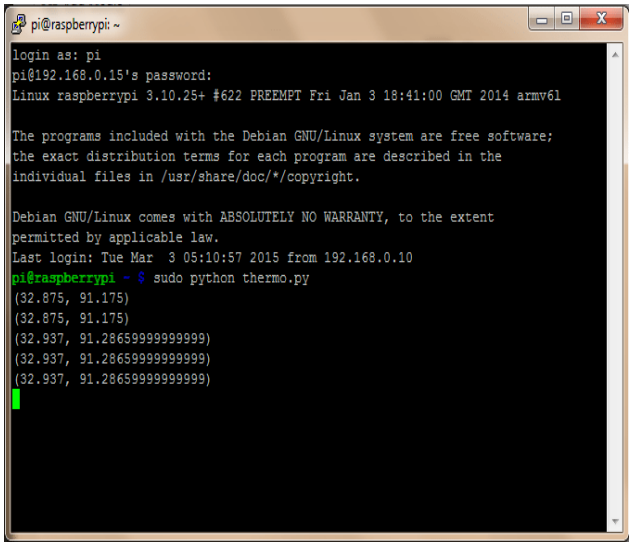

Figure 5

V. CONCLUSION

This paper has proposed "The Real time Monitoring of Water Quality in IoT Environment" is to be designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced

Raspberry Pi board and with the help of growing technology the project has been successfully implemented.

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