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The Real Time Monitoring of Water Quality in IoT Environment

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Abstract: ***In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).the system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, conductivity, dissolved oxygen of the water can be measured. The measured values from the sensors can be processed by the core controller. The raspberry PI B+ model can be used as a core controller. Finally, the sensor data can be viewed on internet using cloud computing.***

Keywords: water quality monitoring, Internet of Things, Raspberry PI B+, cloud computing.

1. Introduction

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.

Traditional methods of water quality involve the manual collection of water sample at different locations, followed by laboratory analytical techniques in order the character the water quality. Such approaches take longer time and no longer to be considered efficient [1]-[5]. Although the current methodologies analysis the physical, chemical and biological agents, it has several drawbacks: a) poor spatiotemporal coverage b) it is labor intensive and high cost (labor, operation; and equipment) c)the lack of real time water quality information to enable critical decisions for public health protection. Therefore, there is a need for continuous online water quality monitoring.

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 raspberry PI B+ is used as a core controller. The design system applies a specialized IOT module for accessing sensor data from core controller to the cloud. 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.

The rest of this paper is organized as follows: In section 2, shows the relation with IOT. In Section 3, shows the overall flow diagram of the proposed method and its corresponding explanation. In Section 4 shows the experiment done and its corresponding result obtained is present. In Section 5 shows the conclusion of our proposed system.

2. In Relation with IOT

The internet has changed all the human lives in past decade. The IOT becomes a foundation for connecting things, sensors and other smart technologies [6]. IOT is an extension of the internet [7].IOT gives an immediate access to information about physical objects and leads to innovative service with high efficiency and productivity. There are several important technologies related to the IOT are ubiquitous computing, RFIP, wireless sensor network, cloud computing.

Cloud computing is a large-scale, low cost processing unit, which is based on IP a connection for calculation and storage .The characteristics of the cloud computing has been discussed in [8],[9],[10],[11]. The IoT application areas include home automation, water environment monitoring, and water quality monitoring etc. the water quality monitoring application involves large distributed array of monitoring sensor and a large distribution network [12], [13]. It also requires separate monitoring algorithms as reviewed in [14]. In our proposed method, we introduced a cloud computing technique for viewing sensor values on the internet. The rest of this paper is organized as follows.

3. Methodology

In this section, we present the theory on real time monitoring of water quality in IoT environment. In section 3.1, the overall block diagram of the proposed method is explained. In section 3.2, each and every block of the system is explained in detail.

3.1 Overall Block Diagram

The overall block diagram of the system is shown in figure 1.

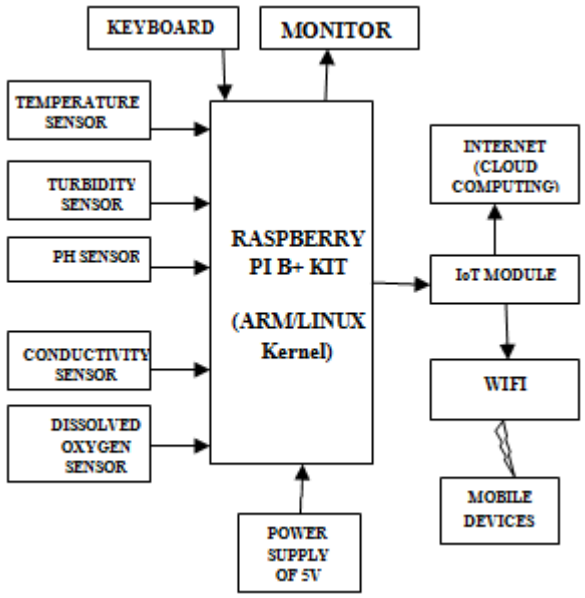

Figure 1: Overall proposed block diagram.

In this proposed block diagram consist of several sensors (temperature, Ph, turbidity, conductivity, dissolved oxygen) is connected to core controller. The core controller are accessing the sensor values and processing them to transfer the data through internet. Raspberry PI is used as a core controller. The sensor data can be viewed on the internet using cloud computing with a separate IP address.

3.2 Proposed System

In our proposed method, Raspberry PI B+ is used as a core controller. The raspberry pi is run on LINUX kernel by the use of keyboard and monitors the LINUX OS is boot on to the Raspberry PI. The temperature sensor, conductivity sensor, turbidity sensor, dissolved oxygen sensor, Ph sensor can be read directly from the command line. However, this requires us to input a command every time we want to know the sensors reading. In ordered to access all the terminals of the sensors, python program is used, which will read the sensors value automatically at set time intervals.

The Raspberry Pi comes equipped with a range of drivers for interfacing. However, it's not feasible to load every driver when the system boots, as it will increase the boot time significantly and use a considerable amount of system resources for redundant processes. These drivers are therefore stored as loadable modules and the command *modprobe* is employed to boot them into the Linux kernel. Then Raspberry Pi sends the data to the IoT module (USR-WIFI232-X-V4.4). The IoT module send the data to internet using cloud computing and also to WIFI for accessing mobile devices. The hardware circuit diagram for connecting iot module (USR-WIFI232-X-V4.4) with Raspberry Pi is shown in figure 2.

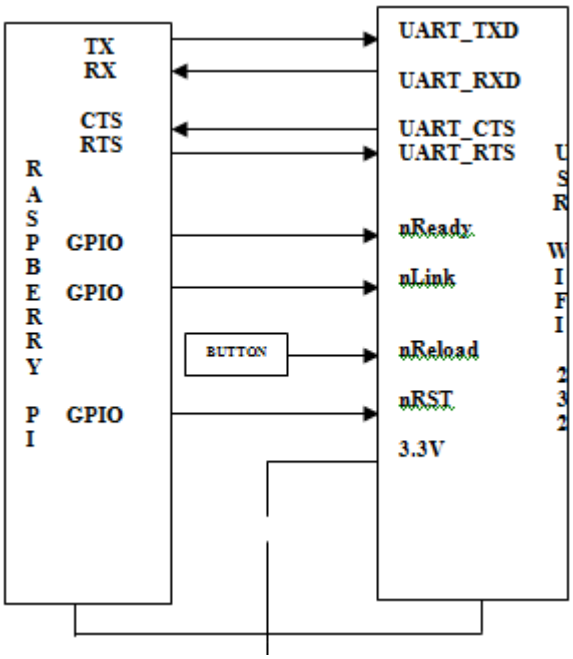

Figure 2: Circuit diagram for connecting core controller to IoT module

Then the monitoring parameters of the water from the sensors are transmitted through IoT module to the gateway. The gateway is responsible for data analysis and forward sensing data to the remote server. The UDP packets produced at the gateway encapsulate sample data to be sent to windows based remote server. The server collects sample data by receiving the UDP packets containing sample data from the IoT module and gateway and store in database. By using a separate IP address we can view the sensor data anywhere in the world.

4. Experiments and Results

The Water quality monitoring is important for several applications such as environment monitoring of pond and ecosystem, drinking water distribution and measurement, Contamination Detection in Drinking Water etc. such applications need a separate technique for monitoring the water quality. In our proposed system, we can monitor the water quality parameters on the internet by using cloud computing. The water quality parameters values are stored in separate web server on the cloud. These parameters can be viewed by using a separate IP address. The figure 3 shows the output results from the web server on the internet.

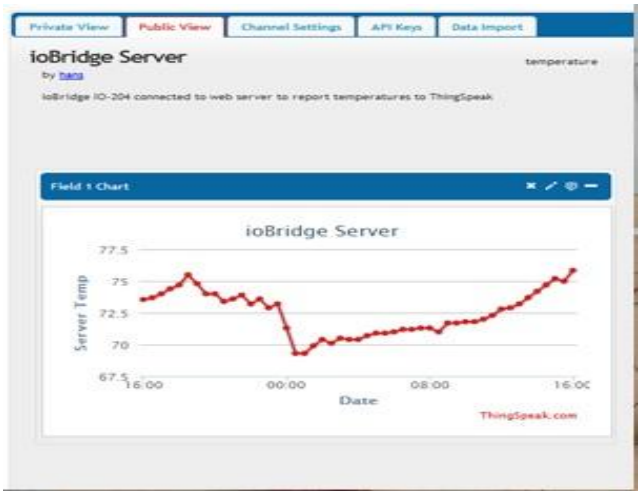

Figure 1: Output results from the web server

5. Conclusion

In this paper, the design and development of the real- time monitoring of the water quality parameters in IoT environment is presented. The proposed system consists of several water quality parameter sensors, Raspberry PI B+ core controller and an IoT module (USR WIFI 232). These devices are low cost, more efficient and capable of processing, analyzing, sending and viewing the data on cloud and also through WIFI to mobile device. This can implement is suitable for environment monitoring, ecosystem monitoring, etc. and the data can be viewed anywhere in the world.

In the future, we plan to implement biological parameter of the water and install the system in several location of pond and also in water distribution network to collect water quality data and send to water board.

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