Review of IoT Based Smart Water Quality Monitoring System Using Raspberry-Pi

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Abstract:

One of the primary concerns for green globalization is water contamination. Water parameters are currently identified via a chemical test or a laboratory test, in which the testing equipment is stationary and samples are fed into the device. As a result, the existing water quality monitoring system is a timeconsuming manual operation. Testing equipment can be placed in water resources to increase frequency, and pollution detection can be done remotely to save costs. Variations in the values of water parameters such as pH, turbidity, temperature, and TDS indicate the existence of pollutants, thus we must estimate them. We have created a low-cost technology for real-time monitoring of the environment. The Sensor-Based Water Quality Monitoring System proposed in this research is used to measure physical and chemical properties of water. The Raspberry Pi, which serves as the main controller, can process the sensor data. Finally, the sensor data can be viewed on the Internet using smart API. The uniqueness of our proposed paper is to obtain the water monitoring system with high frequency, high mobility, and low power.

Key words: Water Quality; conductivity Sensor; pHsensor; Raspberry Pi;

1. Introduction:

Water quality has deteriorated in recent years as a result of massive industrial expansion, population growth, and excessive usage of inorganic compounds. The natural quality of water has deteriorated as a result of many types of dangers. Fresh and clean water is a finite resource on Earth, but it is a crucial resource for business, agriculture, and all living species, including humans. The manual collecting of water samples at various sites is a traditional method of water quality control. Analytical technologies were used to examine these water

samples in the lab. [1]. This process is tedious that requires more time and also involves human errors. Hence there is need of developing better system to monitor the water quality parameters in real-time with avoidance of the wastage of water. The water quality parameter pH is measure of hydrogen ion concentration of solution. A pH of 7 indicates acidity, while a pH of higher than 7 indicates alkalinity. pH levels should be in the range of 6 to 8.5. One of the most important markers of water quality is dissolved oxygen. It is necessary for fish and other aquatic species to survive. Oxygen dissolves in surface water due to aerating action of winds it improves the taste of drinking water. Turbidity is a measurement of how cloudy water is. Many drinking water utility strives to achieve levels as low as 0.1 NTU. The European standards for turbidity state that it must be no more than 4 NTU. World Health Organization (WHO), established that turbidity of drinking of drinking should not be more than NTU, and should ideally be below NTU[2]. In this project, when low level of water is detected in the overhead tank, the signal will be given to raspberry-pi that will analyze the quality of water in bottom tank If the quality of water is good, then it will be fed in the overhead tank through pump otherwise it will have drained off. And when high level is reached of overhead tank then pump will turn off.

2. Literature Review

"Smart Water Quality Monitoring System for Real-Time Application," by Tha. Sugapriya, S. Rakshaya, et.al. The International Journal of Pure and Applied Mathematics was published in 2018. This system uses four sensors (turbidity, temperature, pH, and conductivity) as well as an Arduino controller that is connected to the internet of things. The microcontroller module and the GSM transmission module handle the processing. [2].

"Online Monitoring of Water Quality Using Raspberry Pi3 Model B," by M. B. Kalpana. International Journal of Innovative Technology and Research was published in 2016. In this paper the system consists of conductivity, Turbidity and pH sensor of water grade testing, single board computer module/mobile module, internet and other accessories. Conductivity, Turbidity and pH of water are automatically detected under the single board computer Raspberry Pi3[3]

Vaishnavi V. Daigvane, Dr. M. A. Gaikwad entitled “Water Quality Monitoring System Based on IOT”. Advances in Wireless and Mobile Communication were published in 2017. In this paper the system consist of several sensors is used to measuring physical and chemical parameter of water. The core controller

is used in that system is Raspberrypi. The sensor data can be viewed on Internet using Wi-Fi system.[4]

3. Problem statement:

The world's water resources are under increasing threat from the impacts of climate change, population growth, and pollution. As the global population grows, a persistent challenge is how to access enough water to meet humanity's needs while also preserving the integrity of aquatic ecosystems. The Pacific Institute works on water resource issues around the globe, collaborating with stakeholders to ensure communities and nature have the water they need to thrive now and in the future. Internationally, the Institute promotes source water protection and "green infrastructure" solutions in order to increase the climate resiliency of water systems and improve ecosystem function. The Institute collects, catalogues, and shares good practice examples of nature-based solutions; catalyzes investment in green infrastructure projects; and connects stakeholders with a common

interest in advancing nature-based solutions. In California, the Institute has played an active role at the Salton Sea for more than two decades, emphasizing the importance of the sea and the negative consequences of failing to act on its behalf. The Sensor-Based Water Quality Monitoring System proposed in this research which is s used to measure physical and chemical properties of water so that the harms to human life can be resists.

4. Methodology:

The major components used in the proposed have been discussed briefly: 5.1Raspberry Pi3 Model B The Raspberry Pi3 Model B is a wonderful platform that can be used to build automation systems. Clearly, the Raspberry Pi3 model B board is perfect when being used as a "hub" for automation systems, connecting to other open-source hardware parts like sensors. Raspberry Pi3 Model B is a small sized single board computer which is capable of doing the entire job that an average desktop computer does Like spread sheets, word processing, Internet, Programming, Games etc.

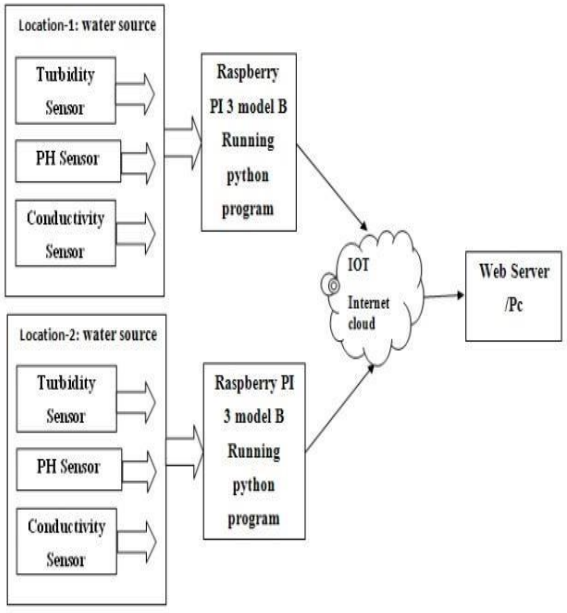

Fig 1- Proposed Block Diagram of IoT based smart Water Quality Monitoring System using Raspberry Pi

Raspberry Pi3ModelB Built on the latest Broadcom 2837 ARMv8 64bit processor, the new generation Raspberry Pi3 Model B is faster and more powerful than its predecessors. With built-in wireless and Bluetooth connectivity, it becomes the ideal IoT ready solution.It consists of 1.2GHz QUAD Core Broadcom BCM2837 64bit ARMv8 processor,BCM43438 Wi-Fi on board, Bluetooth Low Energy (BLE) on board,1GB RAM,4x USB 2 ports,40pin extended GPIO,HDMI and RCA video output. The Raspberry Pi3B model is shown in Fig-2. Raspberry Pi3Model B runs on Linux kernel based operating systems. It boots and runs from the SD card. It does not have any internal memory other than the ROM. It has an SD card slot which is capable of reading up to 32 GB. The GPIO pins of the raspberry Pi3 Model B are programmed using Python programming language. The I/O devices like sensors are given to GPIO pins whenever needed.

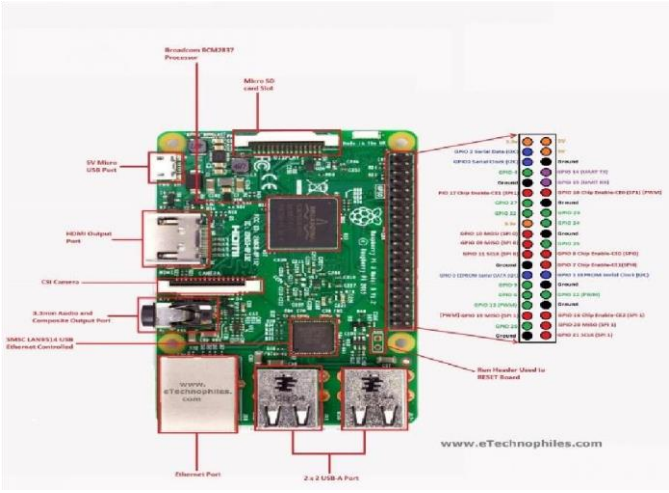

Fig-2 Raspberry Pi3 Model B

One powerful feature of the Raspberry Pi3 Model B is the row of GPIO (general purpose input/output) pins along the edge of the board. Figure 3 GPIO pins The program can be written on the pins to interact in amazing ways with the real world. Inputs don't have to come from a physical switch; it could be from a sensor or a signal from another computer or device. For example, the output can do anything, from turning on an LED to sending a signal or data to another device. If the Raspberry Pi3B is on a network, you can control devices that are attached to it from anywhere and those devices can send data back. Connectivity and control of physical devices over the internet is a powerful and exciting thing, and the Raspberry Pi3 model B is ideal for this.

4.1 Total dissolved solids (TDS)

Total dissolved solids (TDS) is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in molecular, ionized, or microgranular (colloidal sol) suspended form. TDS concentrations are often reported in parts per million (ppm). Primary sources for TDS in receiving waters are agricultural runoff and residential (urban) runoff, clay-rich mountain waters, leaching of soil contamination, and point source water pollution discharge from industrial or sewage treatment plants. The most common chemical constituents are calcium, phosphates, nitrates, sodium, potas sium, and chloride, which are found in nutrient runoff, general storm water runoff and runoff from snowy climates where road deicing salts are applied. The chemicals may be cations, anions, molecules or agglomerations on the order of one thousand or fewer molecules, so long as a soluble micro-granule is formed. More exotic and harmful elements of TDS are pesticides arising from surface runoff. Certain naturally occurring total dissolved solids arise from the weathering and dissolution of rocks and soils. The United States has established a secondary water quality standard of 500 mg/l to provide for palatability of drinking water.

4.2 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 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with Arduino or raspberry-pi. The normal range of pH is 6 to 8.5. The Fig-3 shows pH sensor to be interfaced to board.

Fig-3 pH Sensor

5. Advantages & Application

The system's key advantage is its adaptability in terms of installation. The system is suitable for both commercial and home applications. For commercial service it would be mainly be helpful for the Water Supply Agencies. Also it would be a boon for the health department since it can identify the reason of water diseases and can be helpful in keeping track of it. Due to automation it will also reduce the time required in measuring the parameters and would increase the efficiency of check. It is economically affordable for domestic use and it requires no or very

low maintenance. The best gift to human society would be, it will help in prevention of waterborne diseases.

6. Inspiration

Increasing number of death due to consumption of polluted water is major problem for green globalization. This inspired us to do something for the improvement in the water purity and towards humanity

7. Conclusion:

Monitoring of Turbidity, pH & conductivity of Water uses corresponding sensors. The system can monitor water quality automatically, and it up date to server's web site with low cost and does not require people on duty. So the water quality testing has to be more economical, convenient and fast. The system has good flexibility by replacing the corresponding sensors and changing the relevant python programs. This system can be used to monitor other water quality parameters.

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