Smart Water Monitoring System Using IoT

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***Abstract*— Water is one of the essential parts of life. Water pollution is one of the big problem to the world. In order to ensure the safe supply of the drinking and useful water for different purposes like agricultural and industry, the water should be monitored. In this proposed system presents a design of a low cost system for real time monitoring of the water quality and quantity of water in IoT (Internet of Things). The system having of several sensors is used to measuring physical parameters of the water. The measured values from the sensors can be processed by the controller finally, the sensor data can be shown on internet using Wi-Fi system. A cloud server was configured as data saving and analysis. This data can be used in future for research and development.**

Index Terms— Arduino Uno, Internet of Things (IoT), Real time monitoring, Wi-Fi module.

I.INTRODUCTION

Water is always a crucial part of everyday life. Due to global environmental situation, water management and conservation is vital for human survival but due to rapid pace of industrialization and greater emphasis on agricultural growth combined with latest advancements, agricultural fertilizers and non-enforcement of laws have led to water pollution to a large extent. The availability of good quality water is paramount in preventing outbreaks of waterborne diseases as well as improving the quality of life. In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. The Internet of Things (IoT) is a revolutionary concept that has the potential to turn virtually anything to smart. IoT provide interface to monitor and operate remotely from anywhere and anytime.

Water Pollution and water scarcity is a global problem, which requires ongoing modification of water resource guiding principle at the levels of international down to individual wells. It has been surveyed that water pollution is the leading cause of diseases worldwide. The records show that more than 10000 people die daily worldwide. In India predictable 500+ people die of water pollution related problems every day. Research has shown that after few years the quantity of useful water will be goes down to minimum level. In many developing countries, dirty or contaminated water is being used for drinking without any proper former using it. One of the reasons for this happening is the unawareness of public and administration and the lack of water quality monitoring system which creates serious global issues. Also natural effects such as volcanoes, algae tints, and earthquakes also change the quality and ecological status of water. Poor water quality spreads disease, causes death and hampers socioeconomic progress. Around 5 million people die due to water borne diseases around the world. Fertilizers and pesticides used by farmers can be washed through the soil by rain, to end up in rivers. Industrial waste products are also washed into rivers and lakes. Such contaminations enter the food chain and accumulate until they reach toxic levels, eventually killing birds, fish and mammals. Chemical factories also dispose wastes in the water. Factories use water from rivers to power machinery or to cool down machinery. Raising the temperature of the water lowers the level of dissolved oxygen and upsets the balance of life in the water. All the above factors make water monitoring essential.

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II. LITERATURE REVIEW

Now a day's water is polluted due to many reasons. In this current system, the equipment cost is high, and it takes a lot of time to process. Traditional methods have the drawbacks such as long waiting time for results high cost, low measurement precision, and complicated methodology [1]. So, by using the technology, different methods and techniques to check the quality of water. There is a disadvantage in the existing system that the system has high complexity and low performance.

The water supply management in the world has always brought challenges and it is an essential resource to human survival; however, for an adequate water distribution, some important factors must be considered to guarantee the supplying. Among them, the losses in pipes characterize a point of greater fragility in the whole process of water distribution. According to the International Benchmarking Network for Water and Sanitation Services – IBNET and based on studies conducted in developing countries, 35 average. Considering the causes for water losses, the main ones are technical failures in the distribution process and leaks caused by regular use in every day. In addition, there are some trade off regarding water loss control [2].

A complete IoT solution for water management was presented including the measurement system and data communication between sensor nodes and central node. Preliminary results have shown a fully operational prototype system capable of measuring the water flow, comparing the data and reproduce it with a minimal error. The use of the

microcontroller in this application was a great technological advance, because it is an integrated circuit with 100 percentage in Brazilian design [3]. Smart water quality monitoring system which illustrate four different water sources were tested within a period of 12 hours at hourly intervals to validate the system measurement accuracy. The results obtained matched with the expected results obtained through research. The temperature relation with pH and conductivity were also observed for all the water samples. GSM technology has been successfully implemented to send alarm based on reference parameter to the ultimate user for immediate action to ensure water quality.

III. SYSTEM IMPLEMENTATION

A. Block Diagram

The block diagram consists several sensors like Flow sensors, Turbidity sensor, pH sensor and Gas sensor.

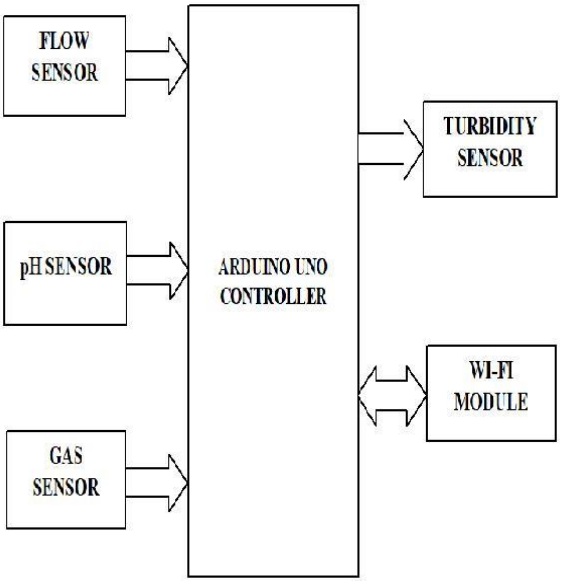

Fig. 1. Block Diagram

B. Water Flow Sensor

Water flow sensors are installed at the water source or pipes to measure the rate of flow of water and calculate the amount of water flowed through the pipe. Rate of flow of water is measured as liters per hour or cubic meters. Flow sensor is shown in below figure.

Fig. 2. Water Flow Sensor

Flow sensor consists of a plastic valve from which water can pass. A water rotor along with a Hall Effect sensor is present the sense and measure the water flow. When water flows through the valve it rotates the rotor. By this, the change can be observed in the speed of the motor. This change is calculated as output as a pulse signal by the Hall Effect sensor. Thus, the rate of flow of water can be measured. The main working principle behind the working of this sensor is the Hall Effect. According to this principle, in this sensor, a voltage difference is induced in the conductor due to the rotation of the rotor. This induced voltage difference is transverse to the electric current.

C. Turbidity Sensor

Turbidity is a property that is a result of particles of solid matter being suspended in water, rather than dissolved into it If water is turbid it appears to be cloudy, so is a visual guide to water quality. Turbidity water testing is an important part of water quality maintenance. Increased levels of turbidity raises water temperatures, because heat is absorbed by the suspended particles. Warm water holds less dissolved oxygen than cold, so increased water temperatures result in decreased levels of dissolved oxygen.

The turbidity sensor is as shown in the below figure. Higher turbidity also reduces the amount of light that can penetrate the water, therefore reducing photosynthesis and the production of dissolved oxygen. Higher turbidity can have a negative effect on the ecosystem in the affected body of water. Sudden changes in turbidity may be an indication of the emergence of a new pollution source, or with drinking water there may be an issue in the treatment process.

Fig. 3. Turbidity Sensor

D. pH Sensor

pH is the numeric representation of gram equivalent per liter of hydrogen ion concentration in any solution. It varies between 0 to 14. It is the logarithmic measurement of moles of hydrogen ions per liter of solution. The solutions having pH value between 0 to 7 are acidic solutions with large concentration of hydrogen ions whereas solutions having pH value between 8 to 14 are basic solutions with small hydrogen concentration. The solutions having pH value of 7 are neutral solutions. Measuring the pH gives the measure of alkalinity or acidity of a solution. The pH sensor is as shown in the below figure.

Fig. 4. pH Sensor

IV. WORKING PRINCIPLE

The IoT based water monitoring system is deployed using different sensors (i.e. Flow sensor, Turbidity sensor, pH sensor, Gas sensor). The data transmission of those sensors are done by Wi-Fi system.

In this proposed system Arduino UNO is used as a controller. The board consist of 14 digital I/O pins (6 capable of PWM output), 6 analog I/O pins and is programmable with the Arduino IDE. It can be powered by the USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. The measured values (Flow of the water, turbidity in the water and pH level of the water) from the sensors can be processed by the controller. Finally, the sensor data can be shown on internet using Wi-Fi system. A cloud server was configured as data saving and analysis. The server collects the water monitoring data and store in a database for analytics as well as displaying them in web-based dashboard.

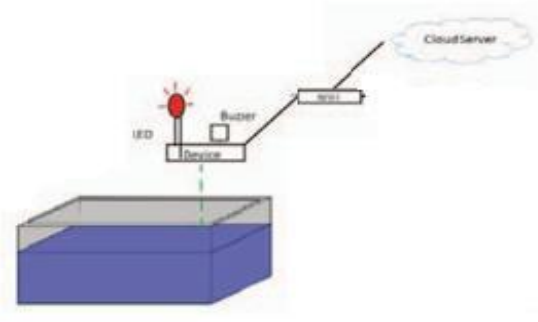

Fig. 5. System Diagram of IoT based Water Monitoring System

CONCLUSION

In this paper, the design and development of a low cost system for real time monitoring of water is presented. The various sensors are used in this system to check the quality and quantity of water. 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 parameters. By deploying sensor devices in the environment, we can bring the environment in to 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.

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