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IOT Based Water Management System for Smart City

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Abstract: During the past decade, water needs have increased unpredictably in India. Increasing demand of water supply has become a major challenge for the world. Wasteful usage of water, climatic changes and Urbanization has further depleted the resource. Conservation and management of the resource must be given utmost importance. In this paper, we present an IoT design for water monitoring and control approach which supports internet based data collection on real time bases. The system addresses new challenges in the water sector -flow rate measuring and the need for a study of the supply of water in order to curb water wastage and encourage its conservation. We also measure the quality of water distributed to every household by deploying pH and conductivity sensors. The traditional water metering systems require periodic human intervention for maintenance making it inconvenient and often least effective.For shortcoming of the existing models for a ubiquitous usage of wireless systems for smart quality monitoring and communicate data wirelessly

Keywords: IOT, Ph Sensor, Wifi, Conductivity Sensor.

1. INTRODUCTION

Water is an important resource for all the livings on the earth. In that, some people are not getting sufficient amount of water because of unequal distribution. We can use this approach so that everyone gets the equal amount of water. It is also used to avoid the wastage of water during the distribution period. In the previous method, the employee will go to that place and open the valve for a particular duration, then again the employee will go to the same place and close the valve, it is waste of time.The proposed system is fully automated. Here human work and time are saved.

To ensure the safe supply of drinking water the quality should be monitored in real time for that purpose new approach IOT (Internet of Things) based water quality monitoring has been proposed. In this project, we will implement the design of IOT base water quality monitoring system that monitors the quality of water in real time. This system consists some sensors which measure the water quality parameter.

The real-time monitoring of water resources information will benefit the water resources management department and the public. The primary concept of real-time IOT based water resources information system is to provide comprehensive and accurate information. The system is developed through defining some explicit water resource parameters then, Water level and flow parameter are defined for water measure & management, followed by a sensor network for water resources information monitoring is constructed based on IOT.

2. Block Diagram

The ability to monitor water level and to protect water from wastage is an important issue through the fields of the environment as well as engineering. Our IOT based system consists of two solenoid valve, Ultrasonic sensor for level measurement, controller, flow rate sensor and sensors for water quality check like pH, conductivity. The block diagram of the designed system is given in Fig 1.

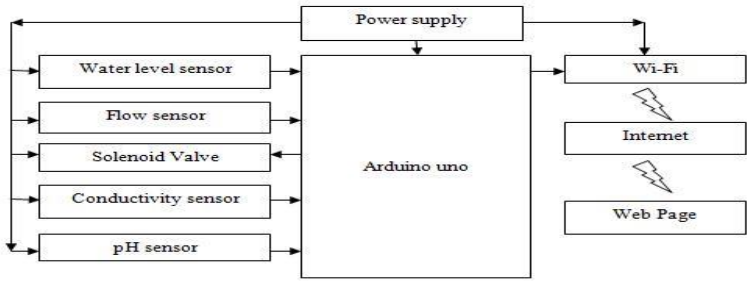

Figure 1.Block Diagram.

a. Power supply

In this system, we need a power supply of 3.3V for Arduino board. Power Supply of 5V for pH, Conductivity sensor, the Water level sensor/ ultrasonic sensor, Water flow sensor and Wi-fi. 12V for water solenoid valve.

b. Microcontroller

The Arduino Uno is used as a microcontroller in this system, it has 14 digital input/output pins of which we are using 6 pins for connecting sensors-pH, conductivity, ultrasonic, Water flow rate and solenoid valves, and can be used as PWM outputs, a USB connection, a power jack and a reset button is also present. We are interfacing Wi-Fi module ESP8266 for giving it an internet based approach.

Figure 2. Arduino Uno

c. pH meter

The pH meter is used for the quality check if water is safe for drinking. A balanced pH level is very important for human health; it should be approximately equal to 7. We are using ETP306 as it is compact and even can be placed in sunlight. It gives Full range pH reading from .01 to 14.00. It gives a Single reading and continuous reading modes. pH meter is shown in figure 3.

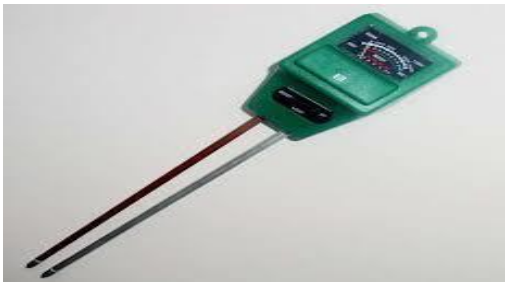

Figure 3.pH meter.

d. Conductivity

Electrical conductivity is also an indicator of water quality. It measures free chlorine without sample pretreatment. It does not have messy and expensive reagents needed. Conductivity data can detect contaminants, determine the concentration of solutions and determine the purity of water. It is

Compact in size. Conductivity sensor measures conductivity by AC voltage applied to nickel electrodes. These electrodes are placed in a water sample and reading is obtained. Conductivity sensor is shown in figure 4.

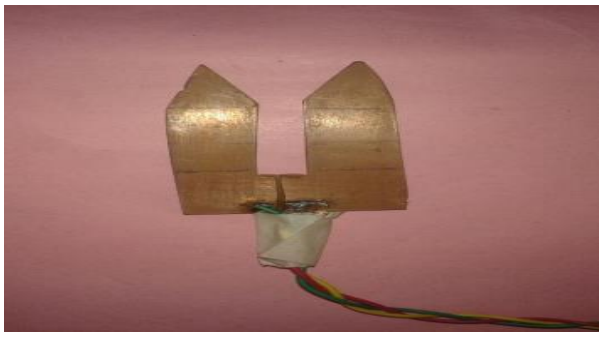

Figure 4. Conductivity sensor.

e. Water level sensor

Water level sensor will help us decide if we have enough quantity of water to be supplied. If the tank is empty water flow and a quality check will be on hold and if the tank is full then, water can be distributed after a quality check.Ultrasonic sensor HC-SR04 is used to measure distance in the range of 2cm-400cm with an accuracy of 3mm. The ultrasonic sensor module works on the natural phenomenon of ECHO of sound.

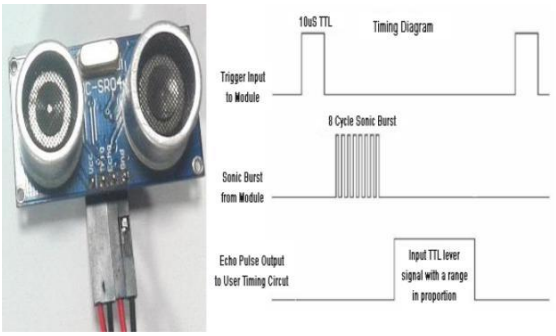

Figure 5. Ultrasonic sensor & waveform.

f. Water flow sensor

For continues, water flow rate measurement YF-S201 is used. Connections required for this flow rate sensor with respect to Arduino's is very minimal.

It has operating temperature range of -25°C - 80°C which is wide enough for our application to operate successfully. Water flow sensor is shown in figure 6.

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Figure 6.Water flow sensor.

g. Water controlling valve

A solenoid valve is used as a water controlling valve, it is a simple electromagnetic device that converts electrical energy directly into linear mechanical motion. A solenoid valve is the combination of a mechanical valve and basic solenoid. So a solenoid valve has two parts namely-Electrical solenoid and a mechanical valve. Solenoid converts electrical energy to mechanical energy which operates a mechanical valve that is to open, close or to adjust in a position. The solenoid valve is shown in figure 7.

Figure 7.water controlling valve

h. Wi-Fi module

After all the parameters are measured and checked the information has to be sent online so that it can be monitored remotely. For this purpose, wifi module is used. It helps us make this system real time. The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either offloading Wi-Fi networking functions from another application processor or hosting an application. Wifi module is shown in figure 8.

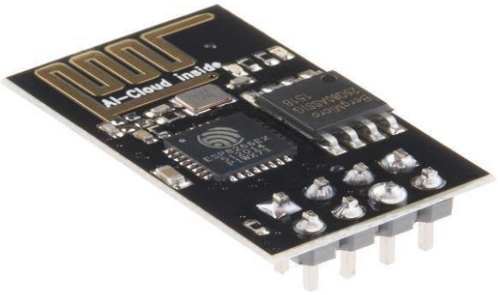

Figure 8.Wi-Fi module.

3. Working

This system can be implemented on water tanks for safe and waste less consumption. Water when supplied from the reservoir to tanks then the pH level of water will be checked, if it comes in required range than the conductivity of water will be checked. If pH or conductivity of water will not be in safe range than the water will not be supplied to household tanks and valves will be closed. The Same procedure will be followed till water does not come in safe range. After the satisfactory quality check of water if the tanks are full than valves of the tank will be opened and water will be distributed. During distribution of water rate of flow is measured so that equal distribution is done. This whole data is sent from Wi-Fi to the Web page so that system can be accessed remotely from a computer. The flow of distribution and quality of water both will be monitored from the web page which can be displayed anywhere using the internet. Flow chart of the system is shown in figure 9.

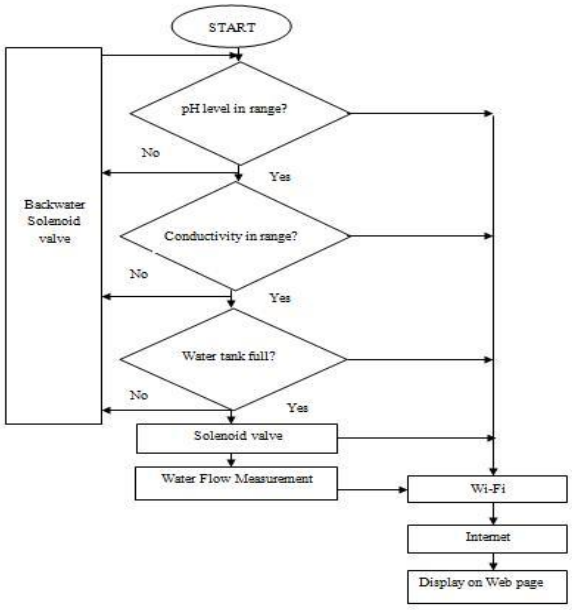

Figure 9.Flow Chart.

CONCLUSION

This paper will demonstrate the successful implementation of an internet-based approach to measuring water quality and usage on a real-time basis. A flow sensor for measuring of quantity supplied, eliminating the drawbacks of traditional water metering systems. Future enhancements can include prepaid billing and automatic treatment of water based on the nature of contamination. Water metering system will be used for automated billing, eliminating the drawbacks of traditional water metering systems. This novel idea can be further extended to other areas like oil and natural gas monitoring systems.

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