INTELLIGENT WATER QUALITY MONITORING AND LEAKAGE DETECTION SYSTEM

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ABSTRACT

In the urban area, the physical infrastructure plays an important role. In water distribution system, the water supplied from the reservoir to the consumer end. The pattern of the pipeline will follow the road network of the area. Due to rapid urbanization in an urban area, the water demand is rapidly increasing. Therefore, the pressure on the existing network is growing. This may result in the gap between supply and consumer chain in a different manner. Leak detection plays a significant role in the efficient management of Water Distribution System (WDS), as it will help in reducing water wastage. Water leakage is main problem which is to be rectified. The water quality is to be monitored to avoid some chronic diseases. By applying modern tools in the system, the existing problems will be minimized and give one step ahead for the making of the smart city.

I. INTRODUCTION

Driven by increasing concerns over the security of the nation's water supply and water quality infrastructure, reliable access to safe and clean drinking water has become one of the greatest global challenges. In order to maintain a safe water quality, it is critical to continuously monitor sudden changes in toxicity concentration at various water supply and distribution system locations at industries. Conventional techniques are not suitable for providing the required analysis capabilities of water quality because they are time-consuming, cumbersome and need a wide range of *ex-situ* experiments with external equipment. With the continuous economic growth, the water demand of enterprises is also increasing.

With the continuous economic growth, the water demand of enterprises is also increasing. The monitoring of water resources for these enterprises can prevent the occurrence of stealing water and leaking water effectively. Therefore, the monitoring system of urban water supply has aroused extensive attention in recent years. Urban water supply networks form the link between drinking water supply and drinking water consumers. These large-scale networks are vital for the survival of urban life, for maintaining a healthy level of economic development, and for the continuous operation of factories and hospitals.

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Water is one of the most important natural resource and water scarcity is the most challenging issue at a global level. The water is most crucial for sustaining life and is required for almost all the activities of humankind, i.e., industrial use, domestic use, for irrigation; to meet the growing food and fiber needs, power generation, navigation, recreation, and also required for animal consumption. Due to population growth, climate change at. al. there developed a huge gap between the supply and demand of water. In developing countries like India, the gap in supply and demand of water is increasing and predominant.

II. LITERATURE REVIEW

Deepiga and Sivasankari [1] have designed the water monitoring systems such as tank water level sensing monitoring, water pollution monitoring and water pipeline leakage sensing monitoring. The microcontroller based water level monitoring is used to indicate the level of water in the tank to agent. Leak detection in water pipelines, the pressure is calculated using force sensitive resisitors (FSR) generated from a leak. It will be indicated by an increase in the LED meter and a rushing sound of water in the pipe which can be heared in the headset.

Adsul and Kumar [2] have proposed a wireless leakage detection system using various sensors and microcontroller which makes system portable and non destructive techniques (NDT). In the system, the parameters like humidity, temperature, pressure, sound detection and gas detection around leakage areas are detected using sensors and arduino microcontroller.

Jayalakshmi and Gomathi [3] have proposed the design and implementation of a water leakage monitoring and detection system to monitor and detect leak with help of wireless sensor. The objective of an enhanced system is to detect possible underground water leakage for residential water pipes that are monitored from a personal computer.

Daadoo and Daraghmi [4] have focused on an application of wireless sensor networks for leakage detection in underground water pipes to overcome the problem of water dispersion. To address the problem and simplify the leakage identification process, the authors have designed a wireless network system making use of mobile wireless sensors.

Myles [5] has explained the background theory and practical application of a fibre optic based technology that uses Brillouin acoustic scattering to detect subtle changes in temperature in the cable. The paper will outline the background physics of the method, and provide results from a case study for leak detection of a brine pipeline.

Sithole et al., [6] have presented a practical low cost Smart Water Meter device (SWMD) which is capable of determining possible leakages. Flow Meter sensors have been deployed to measure the quantity of water consumed by a consumer.

Medina et al., [7] have introduced a technique based on signal analysis for leak detection in water supply systems. The paper presents the feature extraction from pressure signals and their application to the identification of changes related to the onset of a leak. Example, signals were acquired from an experimental laboratory circuit, and features were extracted from temporal domain and from transformed signals.

Martini et al., [8] have presented the control of water leaks in water distribution networks represents a critical issue for all utilities involved in drinking water supply. The work deals with the detection of water leaks by using vibration monitoring technique. The objective of the paper is

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to develop a system for automatic early detection of burst leaks in service pipes.

III. REVIEES OF EXISTING SYSTEM

In developing country like India, loss of water in domestic sector on account of leakage is approximately 30 to 40% of the total flow in the distribution. By using water monitoring system, we avoid the water wastage, power consumption and easily preserved water for next generation.The existing system of water supply is facing problems like a higher rate of leakage, poor maintenance, poor customer service, and poor quality of water.

IV. DISADVANTAGES

- Leakage may not identify by the water board immediately
- The quality of water is not known by the user
- The water theft using high watts pump couldn't to be identify

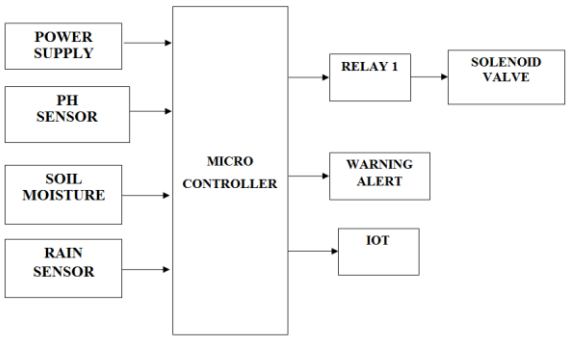
V. PROPOSED SYSTEM:

The proposed system is establishing a technique to avoid the drawbacks of existing system. The proposed system monitors a water quality level at the distribution tank. If any PH level value goes abnormal, the solenoid valve stopped the water flow and the information is sent to the water board officer. All the sensors are connected with the micro controller. The proposed system also monitors leakage detection at the pipeline between distribution tank and end user. It consists of soil moisture sensor and rain sensor. Rain sensor placed on the soil and moisture sensor placed under the soil. From these sensors, the leakage can be identify thereby valve will stop the flow and information will transferred to the water board with location through IoT.

Advantages:

- it can be used in real time water distribution system.
- Error reduction
- Reduced pollution and intimate to control board
- Prevents diseased from polluted air

VI. BLOCK DIAGRAM



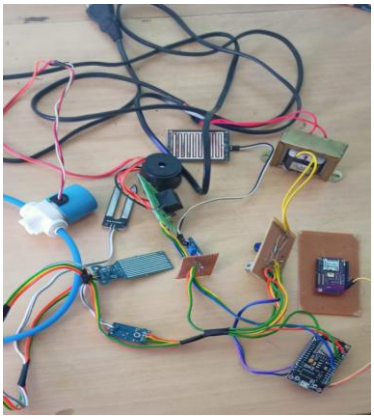


Fig: Entity structure of water monitoring system

VII. BLOCK DIAGRAM EXPLANATION

ARDUINO NODE MCU

Arduino is a single-board microcontroller to make using electronics in multidisciplinary projects more accessible. The hardware consists of an open-source hardware board designed around an 8-bit AtmelAVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller.

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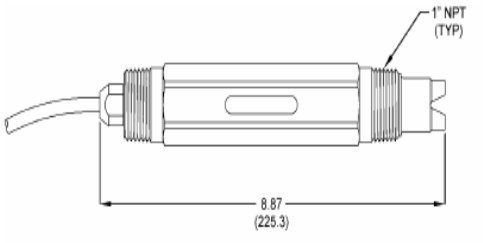
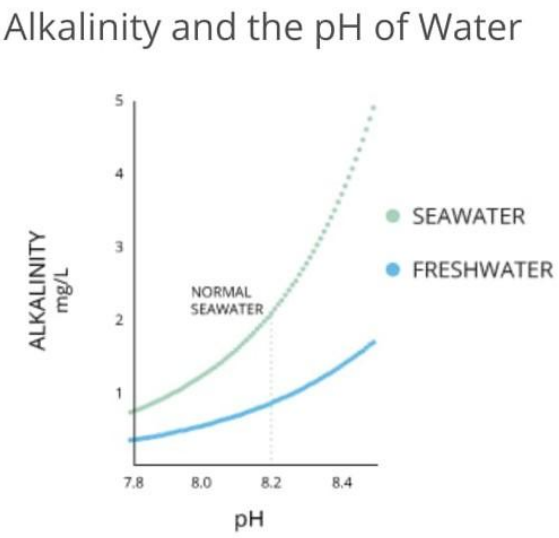
PH SENSOR

The Model PHE-45P pH Sensor measures the pH of aqueous solutions in industrial and municipal process applications. It is designed to perform in the harshest of environments, including applications that poison conventional pH sensors. All seals are dual o-ring using multiple sealing materials. The sensor is designed for use with the Omega PHTX-45 Monitor/Analyzer.



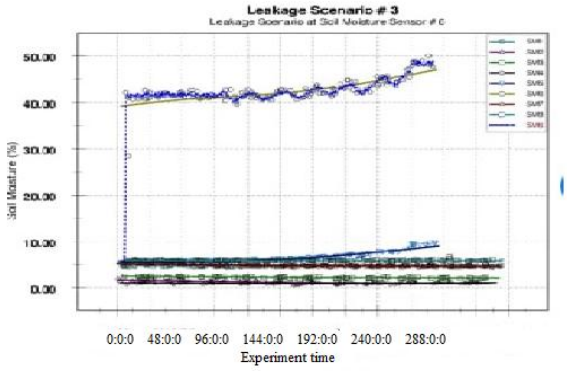
PH OUTPUT OF PH SENSOR DURING ALKALINITY IN WATER



SOIL MOISTURE SENSOR

Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. One common type of soil moisture sensors in commercial use is a Frequency domain sensor such as a capacitance sensor. Another sensor, the neutron moisture gauge, utilize the moderator properties of water for neutrons.

SOIL MOISTURE OUTPUT OF MOISTURE SENSORS DURING LEAKAGE



RAIN SENSOR

Here is the simple and reliable circuit of rain water detector which can be constructed at low cost. If there is no rain, the resistance between the wires will be very high and there will be no conduction between the wires in the sensor. If there is rain, the water drops will fall on the rain sensor which will also decrease the resistance between the wires and wires on the sensor board will conduct and make the buzzer to sound.

ADVANTAGES & APPLICATIONS

ADVANTAGES

- Error reduction
- Reduced pollution and intimate to control board
- Prevents diseased from polluted air

APPLICATION

- This project can be used to avoid the water pollution
- It can be used in processing mills
- It can be used at drinking water purifying process

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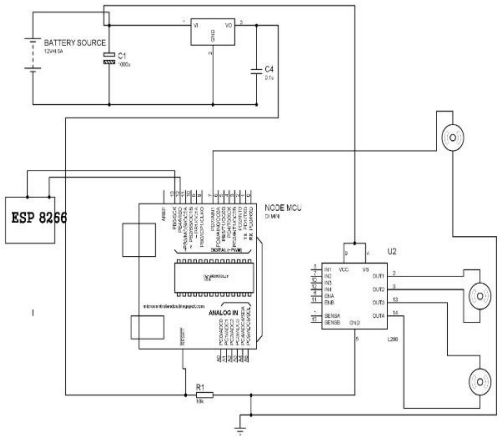
CIRCUIT DIAGRAM



VIII. CONCLUSION

In this paper, smart pipes-a novel water quality monitoring system using onion omega 2+ was introduced. The automated system implemented into the water distribution network ensures the update of the refurbished water supply urban utilities; it offers new ways of monitoring and optimized exploitation of the water resources and technological. A new system is proposed system consisting of three sensors, the soil moisture sensor kept under the soil for observing the leakage on the underground and rain sensor placed on the ground. PH sensor kept in the water tank for observing water quality. This automated system not only used to monitor the water supply micro controller. It also used to observe any leak in the water supply line.

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