RESEARCH ARTICLE

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Regular and Equal Water Supply System

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Abstract

Water scarcity is a severe problem in many Indian villages and cities. The urban water supply system is under immense strain in order to provide enough drinkable water to India's rapidly growing population. In order to achieve self-sufficiency, villages require a significant amount of pure or high-quality water delivery. For that we created water distribution systems that supply equal and of high-quality water. As a result, in our automated regular, equal, and quality water distribution unit, quality testing sensors and various pressure sensors are used. The water distribution system's equitable and quality water supply automation is versatile. It may be deployed in different ways in villages and metropolitan areas, depending on customer needs. This automation is also achievable in residential, industrial, and commercial buildings and rural locations. It is an effective strategy for reducing water scarcity and preventing health problems because it monitors water quality. It is an interdisciplinary framework in which Electronic & Telecommunications (E&TC) and Information and Communications Technologies (ICT) are combined with the Internet of Things (IoT) to provide effective and useful operation of water resources, water distribution, and water quality.

Keywords: Fully Automated System, Communication technology, Equal, and Quality Water Distribution, Internet of things, water pipeline, Water tank, sensors, Solenoid valve, Arduino UNO.

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Introduction

One of the most critical issues in human civilization has been the provision of sufficient water, of acceptable quality and quantity, and the challenge of meeting user demands has grown as the population has grown. Cities and towns are currently experiencing water scarcity, poor water distribution, and leakage issues. Furthermore, different floors in residential apartments and public buildings, different stores or industrial units, and various lanes in villages face challenges with equal or uniform water distribution systems, which are provoking huge disputes, particularly during the hot or rainy season.

In traditional water supply and distribution operations, professional operators who are familiar with the facilities forecast daily demand based on date and weather data and operate the entire facility. However, due to the mass retirement of skilled operators and municipal mergers, more efficient water supply and distribution operations and infrastructure maintenance and management have recently become necessary. As a result, there is a strong demand for a proper water distribution system to maintain an adequate and consistent water supply.

Many research has attempted to build a general water supply system to aid decision-makers in designing more reliable and continuous systems for a long-term operating period when water demand increases in the current water supply system. The National Rural Drinking Water Program (NRDWP) was established in 2009 with the goal of providing safe and sufficient water for drinking, cooking, and other household requirements to all rural residents on a long-term basis. A municipal corporation in a city has also started utilizing some software to implement water distribution. However, water leakage and improper water supply are severe issues with the same water supply source in many rural and urban areas in the country. As a result, this problem was observed. After much research and dealing with technology, we reached a technological solution and made a working system or prototype to overcome the existing problem. Our equitable distribution system aims to provide water of adequate quality, quantity, and pressure to end users, which is completely automated. In this system, information that we will get from the sensors will be on the web in offices. Also, emergency alerts will be on cell phones through GSM service and on the web application.

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Literature Review

Design and automation with the Internet of Things (IoT) is a key source to monitor and control the water supply. For

reading sensor value control the water supply system Arduino UNO is used. Also, they used Raspberry Pi as a mini-computer for data uploading purposes using Python programming language to the Adfruit cloud server for monitoring and sensors are for controlling.[1]

Radiofrequency (RF) transmitters and receivers are utilized to communicate with the Arduino board that controls the system. to increase signal and information transmission efficiency in the system. Their proposal for controlling the corporation's water supply is a cost-effective, efficient, and environmentally friendly approach. The project's benefits include time management since a consistent supply of drinking water over a certain period can help prevent water waste. They use an Arduino-based control board to manage the corporation's water supply in multiple places.[2]

The water WiSe@SG project in Singapore focuses on using water WiSe as a tool for monitoring, detecting, and localizing bursts, anticipating abnormal events, and identifying hotspots and locations in the network that are at danger of leaks and bursts that could indicate structural pipe failures. Leaks and bursts are an inherent part of water distribution system management, and if left undiscovered for lengthy periods of time, can result in severe water loss within a distribution network. Within a huge urban water distribution network in Singapore, the system is built around a network of wireless sensor nodes that measure hydraulic and water quality parameters (including pressures at data rates of O[250 Hz].[3]

Water supply with continuous and real-time monitoring via an IoT platform ensures proper distribution of available water in tanks, flow rate, and distribution line abnormalities. The IoT is a network of physical things with electronics, sensors, software, and network connectivity built in them. As a central office, monitoring can be done from anywhere. Using thing speak as a free server, data is continuously pushed to the cloud, allowing us to view data in real-time. Data may be monitored and processes controlled *via* the cloud using efficient client-server connection employing numerous sensors, a controller, and a Raspberry Pi as a mini-computer.[4]

The energy saving principle of a pump in a water supply system with speed regulation in response to disruptions. The programmable logic controller (PLC) and variable frequency drive (VFD) system, which is an automatic regulation water supply system in high floors in multistory buildings, can supply the building with water at constant pressure and conserve energy.[5]

The web framework for monitoring water quality, leak detection, contamination, and pipeline network management using sensors, MSP430, GSM modules, and other IoT-based systems.[6]

A prototype consisting of a pipeline from one water tank with automation. The framework having few sensors is accustomed to estimating the physical properties of the water. The deliberate qualities of the sensors can be handled by the microcontroller.[7]

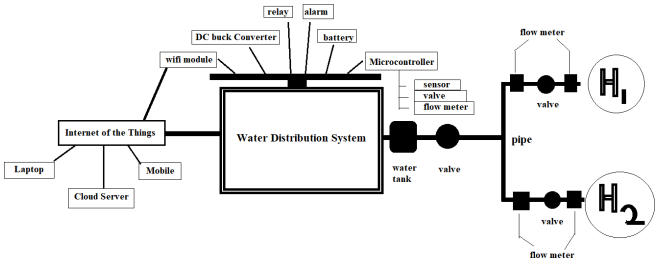

Figure 1: Basic flow diagram

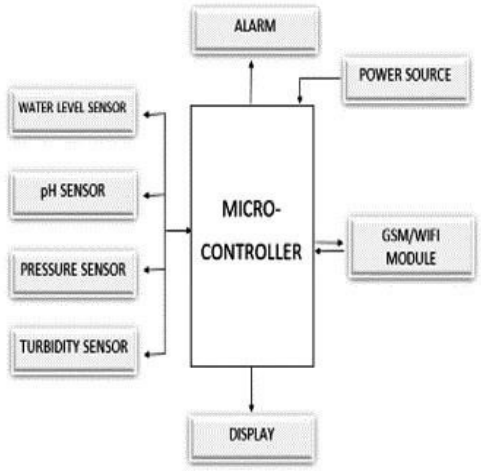

Figure 2: Basic block diagram

Methodology

Block Diagram 1

As shown in Figure 1, with the help of an automatic with help of an automatic water supply system we distribute water equally to house H1 and H2.

In an automatic water supply system, from the main reservoir and different water sources through an inlet pipe water reaches the main water tank. From the main water tank, it will be equally distributed to every house using a different sensor like a flow meter and solenoid valve. The flowmeter checks the water flow rate in the pipeline. solenoid valve used to turn on and off the water supply. The microcontroller used in this corresponding system is Arduino. A level sensor is fixed in the tank to check the water level in a tank. The level sensor gives microcontroller information, whether overflow or underflow. If it overflows, i.e., more than capable of a tank, the microcontroller will send a command for the solenoid valve to turn off the water supply. Also, When the water level is underflow, it will send a command to the solenoid valve to turn on.

Water pH level is checked in the main water tank through a pH sensor, corresponding data is uploaded on a webpage. The water pH sensor checks whether the pH of water is within the acceptable range. the good quality water's pH is 6.5-8.5 if the level of pH goes beyond this level it will immediately send a notification to the office through SMS and to the

solenoid valve from where the switch will be turned off and after treating water when the pH level is in between 6.5-8.5 solenoid valve will be turned on automatically. Flowmeter is used on the inlet of water pipeline for the respective house before and after solenoid valve to check flow rate through microcontroller and water flows equally through the pipeline with the help of solenoid valve. Hence, when water is received from the Main tank through the main pipe, the microcontroller automatically controls and distributes water equally to each house with the help of a sensor and IoT. All sensor information is uploaded on the corresponding webpage and all datastore on the cloud server which can be accessed through a secure login. Notification will be sent in form of SMS to administrators and users. So, this system fulfills all the user requirements.

Block Diagram 2

Figure 2 shows a basic diagram of the electronic components of the system. It will be divided into main two parts i.e., Transmitter and Receiver. GSM /Wi-Fi module work as a bridge between Transmitter and Receiver.

In this system, Arduino is used as an embedded computer. On an embedded computer different connection of the sensor is made. LCD is connected to check all the readings of the system. And power supply to run this system. Various sensors such as water level sensors, pH sensors, water flow meters, and solenoid valves are used. A water flow meter is used to check the flow rate of water in a pipe. A pH sensor is used to check the permissible pH range of water. The water level is used to check the water level in the tank. The solenoid valve acts as a switch to turn the water supply on and off. The GSM/WIFI module is installed to transfer data to localhost and mobile phones *via* SMS service.

Working

The proposed framework provides equal water to each house with quality checking at a cheaper rate and low maintenance. Water reached the main water tank from the main reservoir through the inlet pipe. from there, it will be equally distributed to every house using a different sensor like a flow meter and solenoid valve. A level sensor is fixed on the tank to check the water level in the tank. The level sensor gives information to microcontroller, whether it is overflow or underflow.

Water pH level is checked in the main water tank through a pH sensor, corresponding data is uploaded on a webpage. The water pH sensor checks whether the pH is of waterwithin the acceptable range or not. Flowmeter is used on the inlet of water pipeline for the respective house before and after solenoid valve to check flow rate through microcontroller and water flows equally through a pipeline with the help of solenoid valve. Hence, when water is received from the Main tank through the main pipe, microcontroller automatically controls and distributes water equally to each house. All sensor information is uploaded on the corresponding webpage and all datastore on the cloud server which can be accessed through a secure login. Notification will be sent in SMS form to the administrator and user.

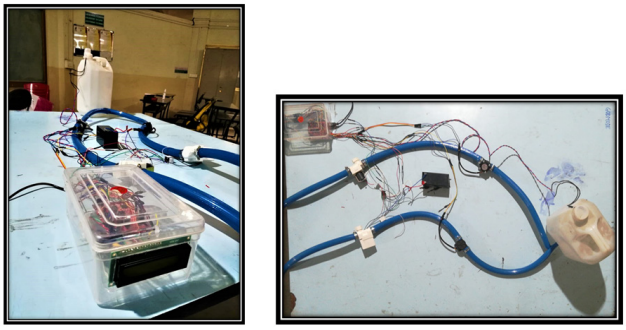

Figure 3: Hardware setup.

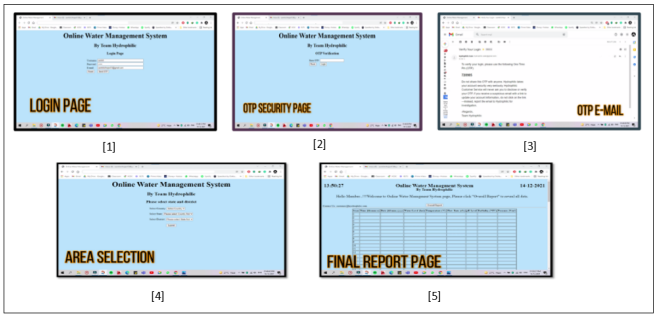

Figure 4: Webpage of login and security.

Result

The microcontroller is connected to the main tank, pipes, solenoid valve, LCD display, battery, and flow meter in the diagram below.

Figure 3 shows a working prototype, with the result displayed on a display board, or LCD.

All of the results are saved on a cloud server and in the administrator's office, where they can log in using their password and OTP through email. After selecting the required area or location, they can access the final report page where all updated data will display as shown in Figure 4. The cloud provides end-to-end automation data storage.

Conclusion

In both developed and developing cities in our country, water distribution is a serious problem. People are assigned to control the flow and manually distribute the water according to the needs. However, problems with water supply amount and delivery time may arise for a variety of reasons. The automation of this water distribution system has the potential to reduce problems and water consumption. An automatic equal quantity and quality detection water distribution system for equal water supply is designed in this work, together with leak detection, main tank water level detector, water quality testing, cloud server, alarm, and current water supply. The proposed effort is critical for rural and urban

residents to address water-related challenges. In a rural region, collecting data monitoring in the corresponding main office of a building or Gram panchayat helps to solve water distribution problems, and every end-user will be free from the water issue. Water scarcity may be completely avoided by implementing this recommended approach, and theft of water from the main government pipeline is also prevented, ensuring that the government's water management strategy is safe. This system is totally automated, requiring no human intervention, and it can also save data for future use. The system can also be expanded to detect the thief's precise location, the amount of water required by the user, and billing in the water distribution system.

Acknowledgment

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