



# IOT ENABLED SMART WATER DISTRIBUTION SYSTEM

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**ABSTRACT**-The design and operation of an IOT-enabled smart water distribution system will be demonstrated to you in this project. Water is a vital resource for all earthly life. Water distribution and management are shown to be unequal in a country with a large population. The need for water is growing, which highlights the need for water management initiatives to ensure the wise growth and use of available water resources. In order to optimise water usage and provide clean drinking water, it is also important to establish the necessary networks and technologies. In this research endeavour, an attempt is made to rationalise water supply to consumers so they may comprehend losses, make corrective decisions, and construct a transparent, accountable, and effective water delivery system.

## I. INTRODUCTION

The efficient and successful delivery of clean, safe water to consumers is a crucial operation known as water distribution. The application of Internet of Things (IoT) technologies in water distribution has grown in popularity because of technological advancements because of its potential to enhance the efficacy, precision, and efficiency of the water distribution system. IOT systems are made up of a

variety of networked devices that gather, send, and evaluate data in real time. Water treatment facilities, storage tanks, distribution networks, and customer buildings are just a few locations in the water distribution system where these devices can be placed.

The capacity to continuously check water quality is one of the major advantages of IoT in the distribution of water. Different sites can have sensors put to identify changes in the quality of the water and send the information to a centralised control system. After then, the data can be examined to spot possible problems and take quick action to fix them.

The capacity to track and regulate the water pressure inside the distribution network is an additional advantage of deploying IoT devices in the water distribution industry. This can minimise water waste and increase the effectiveness of the distribution process by assisting in the detection of leaks or burst pipes.

IoT technologies can also be utilised to automate the control of sand pump valves and other aspects of soft water distribution. This can enhance the system's overall efficiency, optimise the distribution process, and use less energy.

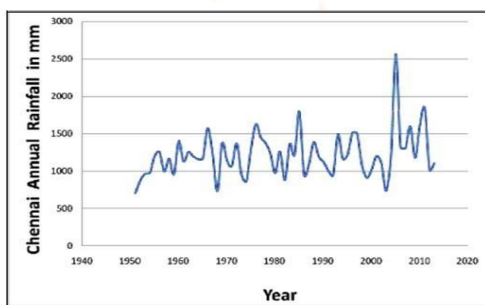
In conclusion, the distribution of water could undergo a revolution if IoT technology are used in this capacity. IoT solutions can help to decrease water waste while increasing the distribution process's efficacy, accuracy, and efficiency by offering real-time monitoring and control.

## II. METHODOLOGY

### A. Moving Average Model for Rainfall Prediction

The fresh dataset was acquired from IMD Pune. The dataset used is for the time duration from 01/06/2019 to 31/01/2020. The parameters for the dataset are as follows:

1. Temperature
2. Relative Humidity
3. Pressure
4. Precipitation Amount
5. Total Cloud Cover
6. Low Mid and High Cloud Cover
7. Wind Speed and Direction
8. Wind Gusts
9. Sunshine Duration
10. Solar Radiation.



**Fig 1. Moving Average Model of Rainfall Prediction**

### B. Measurement of Quality of Water

Water can be categorised as soft or hard, with the former having less minerals than the latter, which is rich in minerals like calcium and magnesium. The quality of water is primarily decided by a quantity called "Hardness of Water."

The process of classifying water can be initiated by measuring a quantity called pH, which is basically the concentration of hydrogen ions in water. The pH of pure water is 7, while hard water often has a pH of 8.5 or higher. Our technique attempts to soften hard water to suit all purposes before distributing the water to the city because different industries demand water with varied pH values. With varied pH values.

### C. Breakdown of the uses of pH in various Industries

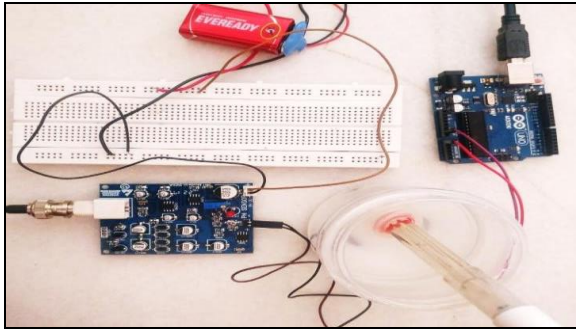
Water intended for human consumption must be kept at a specific pH level, whether it is consumed directly or indirectly. High pH water, or basic water, has an unpleasant taste and creates deposits in pipes and appliances. On the other hand, metal corrodes in water that has a low pH and is naturally acidic. The majority of industries mandate that water be kept at a specific pH level and that it be checked on a regular basis. Several sectors that measure pH levels include Treatment of wastewater Heavy metals, organic compounds, and hazardous materials are eliminated during this procedure, and suitable chemicals are used to balance the pH levels. The pH levels must be checked at each stage before the material is transferred for additional treatment.

The pH levels must be routinely checked in the aquaculture business since it is crucial to maintaining the aquatic life and making it safe for human consumption. A pH range of 6.5 to 9.0 is ideal for fish growth. The food and beverage sector is very significant because its products are all intended for human consumption and any pH imbalance can have detrimental effects on health. As such, it is crucial to maintain a suitable pH level in this sector. In order to maintain a safe environment, the water in pools and spas must also be continuously checked to determine how much sterilising agent has to be added. Along with maintaining a clean and hygienic environment, aquariums and fish tanks also require proactive monitoring to ensure the survival of fish and other aquatic life.

Maintaining a close eye on the pH levels is essential for hydroponic plant cultivation, which involves immersing plants in a nutrient-rich water solution. Plants can soon wither away if there is too much variation. Therefore, maintaining a proper pH level is crucial. Ultimately, to ensure safety and adherence, any sector requiring water monitors the qualities of the water, particularly pH levels.

### D. Testing of pH of Water

In this model the pH sensor along with a circuit driver and Arduino is used to measure the pH value of the incoming water before distribution takes place.



**Fig 2. pH testing module Setup**

The pH sensor is initially calibrated using different solutions like milk, coffee, water, soapy liquid. After this, it is we dip the probe in the required solution and find out the pH value of the rain water we received.

### E. Differential Softening of Water

Hard water must have its pH lowered to appropriate levels based on the industry's intended usage, as was previously observed. For the purpose of demonstration, we utilise a softening liquid in our model, although often companies use brine tanks to soften water. An Arduino is used to receive inputs, such as 1 for the food and beverage business, 2 for the aquaculture industry, and so forth. The softener lid is fitted with an SG90 Tower Pro DC motor.

We crank the motor 90 degrees clockwise, drop only that much softener into the water, wait three seconds, and then rotate it back 90 degrees in the other direction. This is done because, when 1 is input, we need a pH of 5.3, which means we need a considerably larger amount of softener. If 2 is input, the motor is rotated 30 degrees in a clockwise manner, and only that much softener is dropped into the water. We then wait three seconds before rotating the motor 30 degrees anticlockwise.



**Fig 3. Motor at 90° of softener for Food and Beverage Industry**

### F. Routing of Water

A preconfigured formula is used to compute how much water should be delivered to the various industries when the rainfall prediction figures are loaded into the Raspberry Pi. To control the valves for demonstration, we have employed a DC motor. The angles of the motor dictate when the valves open.

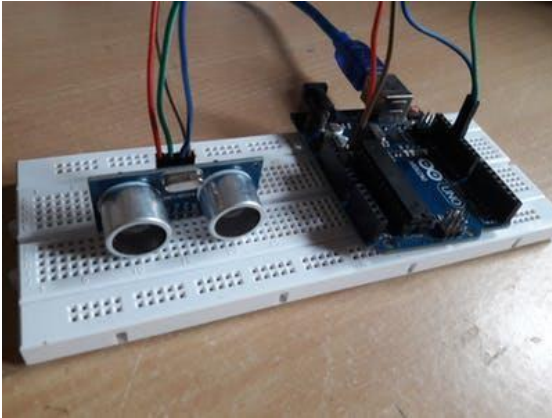
### G. IoT Interface

The Raspberry Pi 3 model B was utilised in this Internet of Things work. In order to retrieve and transmit water quality data from the sensor, the Raspbian operating system has been modified and the water Mond application is added. The embedded system is used as a knowledge processing centre, and the data is processed so that they are frequently temporarily stored in the local database using the SQLite and MQTT protocols in order to send the data to a big data server. Figures 5a, 5b, and 5c illustrate the single page application we created using the Heroku platform.

## III. EXISTING SYSTEM

The current technology uses an ultrasonic sensor to determine the water level. Many homes waste a lot of water because their above tanks overflow. An indicator and controller for water level can help solve this issue. Different controller circuits transmit different signals as the water level rises. These signals are employed to turn the motor pump ON or OFF in accordance with our needs.

Therefore, appropriate authorities will intervene to stop water waste. Previously, turbidity and pH sensors could be used to measure the quality of water.



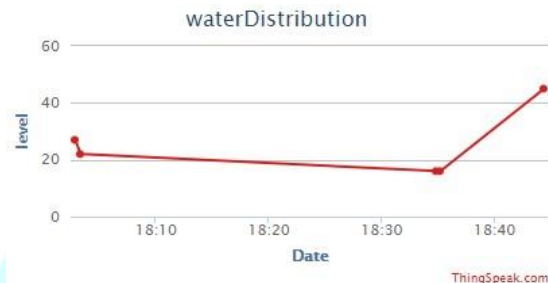
**Fig4. Ultrasonic sensor Interfacing with Arduino**

#### IV. RESULTS AND DISCUSSION

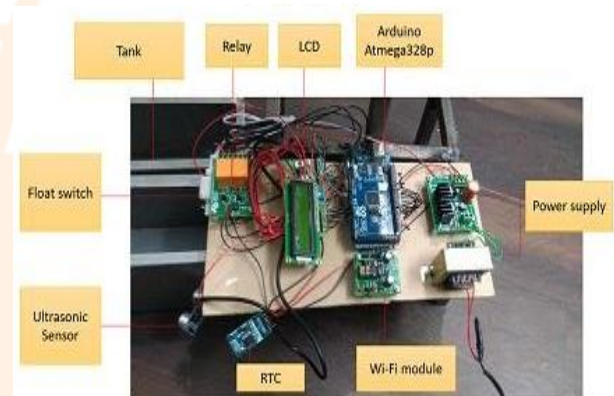
The outcomes, which were derived from thing talk, are shown in the figure. The primary valve will only open if the RTC provides the Arduino with a digital time input, which is the first requirement. The ground level tank's water level is detected by the second condition float switch, which also signals the controller to open or close the solenoid valve on branch pipes.

The microcontroller receives the numbers that the ultrasonic sensor detects when the tank level in the overhead tank rises or falls. The primary valve should be opened based on the digital input of the time that the RTC provides to the Arduino. The float switch detects and notifies the controller to close the solenoid valve on branch pipes when the water level in the ground level tank reaches its maximum value. The Liquid Crystal Display (LCD) will show the water level status. A flow metre installed in the main and branch pipes is used to measure the water flow rate. Therefore, it is also possible to identify water leaks.

The amount of water used by each and every dwelling in a certain area is determined by measuring the flow rate and the duration between solenoid valve opening and closing. After being received by the microcontroller, the sensor's data is uploaded to the internet. For those who are not Android users, a web server will be used.



**Fig 5 Level measurement of water in overhead tank**



**Fig 6 Flow rate of water in ground level reservoir**

**Fig Experimental setup of the proposed system**

#### V. CONCLUSION AND FUTURE SCOPE

The environmental aspects of this project include affordability, longevity, leak avoidance, and maintenance concerns. Thus, this system guarantees an effective water management system and prevents excessive

water use and waste. The system's PLC development is part of the future plan. This contributes to increased durability and dependability. It is also possible to incorporate more nodes and to quickly swap out a specific component. to create an application that will allow the community's residents to track how much water they use.

## VI. REFERENCES

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