

# IoT based Water Monitoring and Alert System

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**Abstract** - Water is an integral part of life. 70% of the world is covered with water and about 2.5 is fresh, hence conservation of water becomes important. This paper presents a smart water management and alert system using the Arduino uno as IoT solution, for water distribution support and consumption. The proposed system presents a design of a low cost system for real time monitoring of quantity and quality of water using IOT. The system has sensors that measure the quantity and quality of the water. The measured values from the sensors can be processed by the arduino uno controller. A cloud platform was configured for data saving and analysis. The graph will be generated based on the analysis of usage of water. And then it will send an alert to the user about the usage of the water. This system gives accurate knowledge about how much water is being consumed in houses over a period of time. Hence consumption of water in the houses can be controlled. If impure water is detected in the system then an alert will be sent to the user on the mobile phone mentioning the pH value and usage of water. This will help to solve water shortage problems in cities. Thus, this feature is going to be very common in future buildings.

**Key Words:** Internet Of Technology, Arduino uno, Threshold, Water flow sensor, pH sensor, Cloud technology, etc

## 1. INTRODUCTION

This paper introduces a kind of water monitoring system which is constructed based on cloud technology. The main objective of this project is to build water monitoring and controlling, i.e constantly monitor and control water conditions in society. It focuses on saving water, increasing efficiency and reducing the environmental impacts on usage of water. The user can see conditions of the water on an android app and control the usage from faraway places. It is to increase the production of water supply and to save water, power etc. Principle rule of the system is to control the present conditions of the water using a water flow sensor, pH sensor and chips. For an IOT based system, the sensors and the chips will be controlled by Arduino Uno. The chip for controlling sensors will be ESP8266 which provides a robust and complete cloud solution. The entire system will be managed manually using Android application ThingSpeak. There are various applications of water monitoring systems based on the Internet of Things (IoT). The project is inclined towards a number of social applications. Various applications include waste water management, water quality testing and analysis, water conservation, smart irrigation.

## 2. Literature Survey

**Real-Time Water Quality Monitoring System using Internet of Things:** The paper was developed by Brinda Das and P.C. Jain. The purpose of this System is to check the quality of water in real time through various sensors (pH, conductivity, temperature) and to measure the quality of water. Zigbee & GSM data transmission modules have been used to Send SMS to phone. Microcontroller is used to send data from sensors to web page via wifi module. This system also has proximity sensors to alert the officials by sending a message to them via the GSM module in case someone tries to pollute the water body [1].

**Cloud based data analysis and monitoring of smart multi-level irrigation system using IoT:** The paper was developed by Sanket Salvi and Pramod Jain S.A. The purpose of this system is to give efficient and suitable solution to inefficient water consumption, absence of remote farm health monitoring, lack of useful inference. It uses Cloud for data aggregation, ThingSpeak to analyse, visualise, update and interact with web service & devices [2].

**IOT Water Consumption Monitoring and Alert System:** The paper was developed by Naram Mhaisen, Omran Abazeed and Osama Halabi. The purpose of this system is to present a smart self-powered water monitoring system that leverages IoT and cloud computing. It has a Water Consumption Monitor, and it consists of a hardware device and mobile app. The system consists of an IoT device that can be installed at any water source, a cloud application to receive the data from the devices, and a mobile app to know the water consumption at every monitored source. The system gives the user the

ability to identify the location and time of the excessive usage and leaks on the mobile phone [3].

**Self-Powered IoT-Enabled Water Monitoring System:** The paper was developed by Zainal Hisham Che Soh<sup>1</sup> and Muhammad S. Shafie<sup>1</sup> Here system uses microcontroller ZR16S08 to avoid losses of water. It operates through the smart monitoring of water flow across the network aiming for good quality of water supply. As pipe holes may be open doors to water contaminants we have to create a network of sensors capable of monitoring water pipes in real time [4].

**Smart Water Management System using the Microcontroller ZR16S08 as IoT Solution:** The paper was developed by Michel R. Machado and Tiago Ribas Júnior. Here system uses microcontroller ZR16S08 to avoid losses of water. It operates through the smart monitoring of water flow across the network aiming for good quality of water supply. As pipe holes may be open doors to water contaminants we have to create a network of sensors capable of monitoring water pipes in real time. Adopting criteria such as low consumption and low cost, the use the ZR16S08 microcontroller in the design of wireless sensor nodes that will be coupled in the water pipes was adopted. As a result a central processing unit, composed of a Raspberry Pi microcomputer, manages the traffic of the information collected by the sensor nodes and routes it to a web server. The data addressed by the central unit are available on-line by means of a supervisory platform [5].

### 2.3 Summary of Related Work

The summary of methods used in literature is given in

Literature	Observations
Brinda Das et al. 2017 [1]	proximity sensors to alert the officials by sending a message to them via the GSM module
Sanket Salvi et al. 2017 [2]	ThinkSpeak to analyse, visualise, update & interact with web service & devices..
NaramMhaisen et al. 2018 [3]	This system gives the user the ability to identify the location and time of the excessive usage and leaks on the mobile app
Zainal Hisham et al. 2018 [4]	Real-time data collection Allowed consumer to control the water consumed in order to prevent water wastage
Michel R.Machadoi et al. 2019 [5]	low power consumption and low cost 8 bit microcontroller ZR16S08.

Table -1: Summary of Literature Survey

### 3. PROPOSEDWORK

The major components are Arduino uno, wifi module ESP8266, a block consisting of factors such as Ph sensor, water flow sensor and cloud technology. system development is based on IOT to monitor water consumption level and pH value detected by water flow sensor and pH sensor respectively, and send to IOT cloud, the data can be read back from ThingSpeak dashboard and to give early notification to the owner about the excessive usage or any water leakage. the development system consists of a water flow sensor, Wi-Fi router that interconnected the sensor node to IOT cloud platform that consist of secured IOT devices organization, ThingSpeak Dashboard to display and visualize the water consumption level data using real time graph and Event to notify homeowner via mail/sms on smartphone via an alert on excessive water consumption that were over the specified water usage threshold limit. The sensor will sense the parameters such as water flow sensor, pH sensor present inside the water. If the parameters deviates from the threshold value, the user will get a notification in his cell phone via Android

application ThingSpeak.



Figure -3: Principle of the system[1]

### 3.1 System Architecture

The system is made up of front-end data acquisition, data processing, data transmission and data reception. The water flow is processed in real time by the water flow sensor and simultaneously pH of water is also measured. Processed data is sent to the Arduino uno via wifi module. The intermediate node aggregates all data and sends it to the PC, at the same time, staff may view, analyse or store data by the PC that provides real-time data for water. Connect ESP8266 chip to Arduino uno. Sensor senses the parameters inside the water. parameters exceed the threshold value, control the parameters using Android App via installed actuators. Else, continue sensing. Similarly, if parameters falls behind the threshold value, control the parameters using Android app via installed actuators. Else, continue sensing. The system architecture is given in Figure 1. Each block is described in this Section.

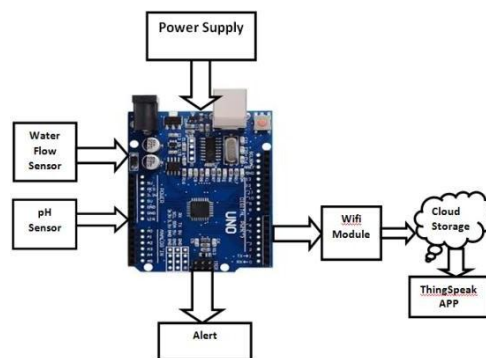


Fig -3.1: Proposed system architecture

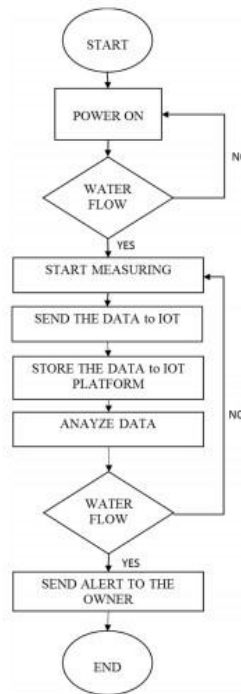


Figure -3.2: Flowchart

**Water Flow Sensor:** Water Flow sensor is used to take a note of how much water has been transferred from one area to the other. Water flow sensor consists of a plastic body, a water rotor and a hall-effect sensor. When water flows through the rotor, the rotor starts rolling after feeling the pressure. Water flow sensor is used for checking quantity of water.

**pH sensor:** The pH of a solution, i.e. how acidic or basic it is, is a major indicator of water quality. pH sensors are used to determine pH of any liquid. They are usually a single electrode, typically made of glass and are quite delicate. An electrode is attached to an analyzer that has an interface for data collection, calibration, and alerts. The pH sensor is used for checking one of the major water quality parameters in the water monitoring system.

**Wifi module:** ESP8266 WiFi module can be integrated with Arduino Uno board. This WiFi module works at a voltage of 3V. We are using ESP8266 module in our water monitoring system. It is very popular for its Internet of Things applications. ESP8266 WiFi module's maximum working Voltage is 3.6V

**Cloud storage:** ThingSpeak is an IoT analytics platform service that helps to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics. We are using ThingSpeak for analyzing data and storage of data which is sensed by water flow sensor, pH sensor, and temperature sensor.

### 3.2 Implementation Details and results

Implementation detail are as follows:-

There are various parameters present inside the water. Attributes such as water flow, pH are received via sensors. The sensors are there inside the pipe containing water. The inputs for Android application are user controlled parameters and threshold values. Let us discuss the output. For the android application, various actuators such as water flow sensor, pH sensor can be considered as the output.

The table given below represents a sample dataset. The sample dataset consists of parameters and their corresponding threshold values. The dataset includes flow of water, pH of the water. The threshold value for water is 500 ml whereas the threshold for pH is 7.

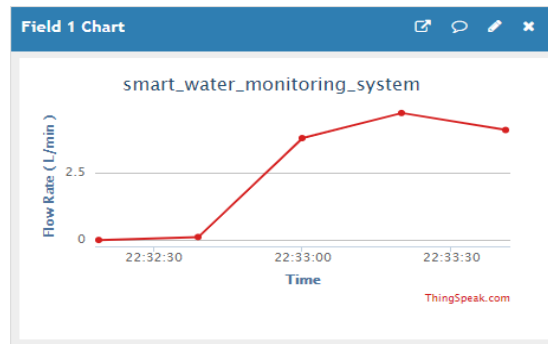


Table -3.2.1: Flow Rate (L/min)

In order to evaluate the proposed system, experiments were conducted on data collected from Water Flow Sensor, a IOT based water monitoring system. All data recorded is stored in the cloud in the form of excel sheet. The data was divided into Flow Rate (L/min), Current Liquid Flow (ml/sec), Output Liquid Quantity (ml) to evaluate the system.

	A1	created_at			
	A	B	C	D	E
1	created_at	entry_id	field1	field2	field3
2	2020-03-05 15:47:28 UTC	1	0	0	0
3	2020-03-05 15:47:49 UTC	2	0	0	0
4	2020-03-05 15:48:09 UTC	3	0	0	0
5	2020-03-05 15:48:29 UTC	4	0	0	0
6	2020-03-05 15:48:50 UTC	5	0	0	0
7	2020-03-05 15:49:10 UTC	6	0	0	0
8	2020-03-05 15:49:31 UTC	7	0	0	0
9	2020-03-05 15:49:51 UTC	8	0	0	0
10	2020-03-05 15:50:12 UTC	9	0	0	0
11	2020-03-05 15:50:32 UTC	10	0	0	0
12	2020-03-05 15:50:53 UTC	11	0	0	0
13	2020-03-05 15:51:13 UTC	12	0	0	0
14	2020-03-05 15:51:33 UTC	13	0	0	0
15	2020-03-05 15:52:05 UTC	14	0	0	0
16	2020-03-05 15:52:25 UTC	15	0	0	0
17	2020-03-05 15:52:46 UTC	16	0	0	0
18	2020-03-05 15:53:06 UTC	17	0	34	34
19	2020-03-05 15:53:27 UTC	18	0	37	100
20	2020-03-05 15:53:47 UTC	19	0	14	181
21	2020-03-05 15:54:08 UTC	20	0	7	220
22	2020-03-05 15:54:28 UTC	21	0	5	272
23	2020-03-05 15:54:49 UTC	22	0	30	378
24	2020-03-05 15:55:09 UTC	23	0	0	390
25	2020-03-05 15:55:30 UTC	24	0	0	390

Fig -3.2.2: All data recorded is stored in the cloud in the form of excel sheet.

### 3.3.1 Sample Dataset Used:

An experiment is conducted in order to identify the input/output behavior of the system. Identify inputs. Specify the sample inputs that would be used in the experiments. The sample dataset used in the experiment are identified and given in Table

Dataset	Thresh old
Quantity of water (ml)	500
pH	07

Table -3.2.2: Sample Dataset Used for Experiment

## CONCLUSION

A System which can be easily installed in any platform. As it is using an application, It can be used anytime, anywhere. This way, mobility can be achieved. The low cost, low power wireless Cloud technology applies in water monitoring systems. The system realizes the remote intelligent control to the room equipment through the Internet. It improves the operational efficiency and system application flexibility by using the wireless sensor network instead of the traditional wired network, and at the same time reduces the manpower cost. The environment data of the water can transfer reliably, and the control instruction is sent timely. This design realizes remote intelligent monitoring and control of water, and it will be helpful to future building, organization

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