# Smart Water Monitoring System

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***Abstract*— Water is one of the most important substances on earth. People now days always want something that can make their life easier. In this thesis is used to define 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. Sensor Based Water Detection, it will check the water quality by using these parameters such as the pH level, turbidity and temperature are measured in real time by the sensors and it will monitoring by an agent. This thesis our motivation is to prevent the water by using technologies and the monitoring system uses daily life device like laptop or mobile phone.***

***Keywords —IOT, Water Quality, Humidity, pH Sensors***

## 1. INTRODUCTION

Water is a limited resource and is essential for agriculture, industry and for creature existence on earth including human beings. Lots of people don't realize the true importance of drinking enough water every day. More water are wasted by many uncontrolled way. This problem is quietly related to poor water allocation, inefficient use, and lack of adequate and integrated water management. Therefore, efficient use and water monitoring are potential constraint for home or office water management system.

Every living thing on earth needs water to survive. Human bodies are made up of more than 60 percent water. We use clean water to drink, grow crops for food, operate factories, and for swimming, surfing, fishing and sailing. Water is vitally important to every aspect of our lives. Monitoring the quality of surface water will help protect our waterways from pollution. Farmers can use the information to help better manage their land and crops. Our local, state and national governments use monitoring information to help control pollution levels.

By using water monitoring system, we avoid the water wastage, power consumption and easily prevent the water for our generation. Water monitoring day was established in 2003 by America's clean water foundation as a global educational outreach program that aims to build public awareness and involvement in protecting water resources around the world water monitoring day is celebrated on September 18.

Water Level Monitoring, is used to avoid overflowing and intimate level of water in the tank. Water controlling system implementation makes potential significance in home applications. The existing automated method of level detection is described and that can be used to make a device on/off. Moreover, the common method of level control for home appliance is simply to start the feed pump at a low level and allow it to run until a higher water level is reached in the water tank. This is not properly supported for adequate controlling system. Besides this, liquid level control systems are widely used for monitoring of liquid levels, reservoirs, silos, and dams etc.

Water pollution monitoring can help with water pollution detection, discharge of toxic chemicals and contamination in water. And also check the quality by using Temperature, pH and turbidity are the typical parameters collected in river/lake water pollution/quality monitoring systems. The goal of this project is to design and manage a Wireless Sensor Network (WSN) that helps to monitor the quality of water with the help of information sensed by the sensors immersed in water, so as to keep the water resource within a standard described for domestic usage and to be able to take necessary actions to restore the health of the degraded water body.

Water pipelines leak detection, Pipeline systems are responsible for transporting vital materials such as water, oil and gas. Any leakage in the pipe can cause major financial losses and possible environmental damages. Currently, buried pipelines are only monitored at key points, which can be spaced several kilometer apart. A system with a higher spatial resolution would provide operators with a better understanding of their network. In buried pipeline monitoring, sensor nodes are deployed in soil. The underground environment imposes major limitations on sensor nodes, such as poor RF transmission and lack of maintainability.

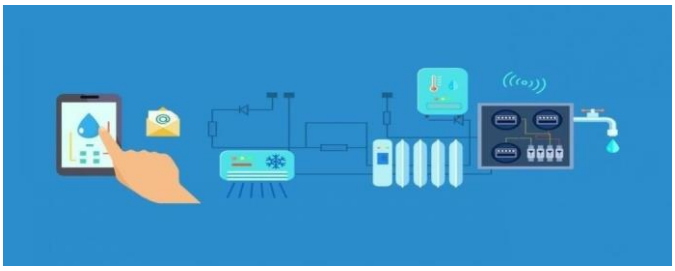


Fig 1.1. Architecture of Water Monitoring

Smart meters have already become an essential component of the modern-day electrical grids and are now finding their way in the water utilities. Currently, in a world where people are perishing due to lack of water, these meters are the breakthrough innovation that water utilities can use to provide everyone with potable water monitoring system.

## 2. LITERATURE SURVEY

**B. Dhivyapriya et.al.(2015) in "continuously keeps track of the level of water in water systems like overhead water tanks"-** proposed the client can send the message to the framework to realize the water level subtleties of the tank and furthermore be utilized to manage the siphon suddenly by killing the siphon when the basic dimension of water in tank is come to and send the message to the client that the water in the tank is full. This is intended to control the dimension of water with help of ultrasonic sensor and GSM innovation

**Dr.V. Chandrasekaran et.al.(2015) in "GSM based water tank level monitoring and pump control system"** - proposed in which another procedure is proposed to consistently monitors the dimension of water in water frameworks like overhead water tanks. The client can send the message to the framework to realize the water level subtleties of the tank and furthermore be utilized to control the siphon unexpectedly by killing the siphon when the basic dimension of water in tank is come to and send the message to the client that the water in the tank is full. This is meant to control the dimension of water with help of ultrasonic sensor and GSM innovation

## 3. BLOCK DIAGRAM

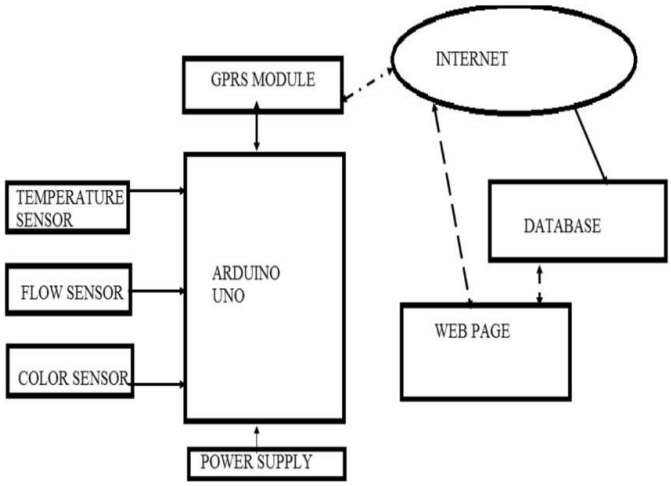



Fig.3.1. Block diagram of Smart Water Monitoring System

### 3.1 Microcontroller

The Arduino Uno is used as a microcontroller in this structure, it has 14 propelled data/yield pins of which we are using 6 pins for interfacing sensors-pH, conductivity, ultrasonic, Water stream rate and solenoid valves, and can be used as PWM yields, a USB affiliation, a power jack and a reset catch is moreover present. We are interfacing Wi-Fi module ESP8266 for giving it an electronic system. Arduino is a microcontroller board subject to the ATmega328P. A 16 MHz quartz valuable stone, a USB affiliation, a power jack, an ICSP header and a reset catch. It contains everything expected to help the microcontroller. Arduino Programming (IDE) were the reference

adjustments of Arduino, directly created to additional forward-thinking releases. The Uno board is the first in a movement of USB Arduino sheets, and the reference model for the Arduino arrange; for an expansive once-over of current, past or old sheets see the Arduino document sheets.

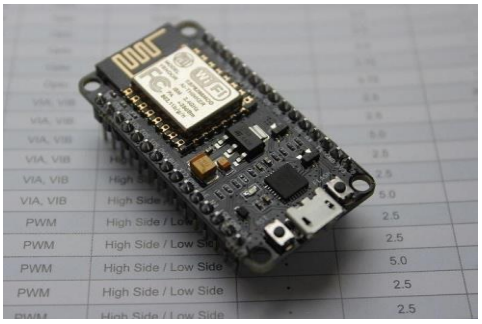
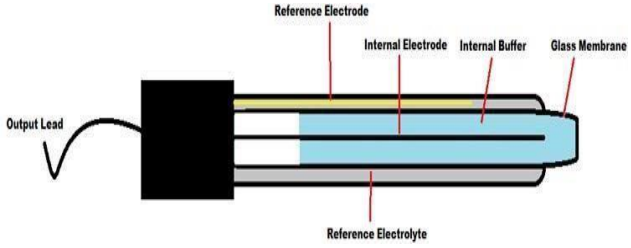


Figure 3.1.1 NODEMCU

### 3.2 pH Electrode

The construction of a pH sensor is shown above. The **pH Sensor** looks like a rod usually made of a glass material having a tip called “Glass membrane”. This membrane is filled with a buffer solution of known pH (typically pH = 7). This electrode design ensures an environment with the constant binding of H+ ions on the inside of the glass membrane. When the probe is dipped into the solution to be tested, hydrogen ions in the test solution start exchanging with other positively charged ions on the glass membrane, which creates an **electrochemical potential** across the membrane

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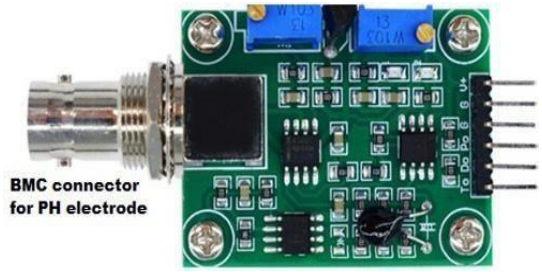


Fig 3.2.2 pH Signal Conversion Board

### 3.3 Temperature Sensor

Temperature Sensor - DS18B20 is a single wire temperature sensor, as this can be interfaced with microcontroller or Arduino using single data wire. This is available in a waterproof and Non-waterproof format.

**Technical Specifications:**

- Temperature range: -55 to 125°C
- bit selectable resolution: 9-12 bit
- 1-Wire interface
- Unique 64-bit address enables multiplexing

- Accuracy: ±0.5°C
- Operating Voltage: 3-5 VDC
- Conversion time: 750ms at 12-bit

Fig 3.3 Temperature Sensor

### 3.4 Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, mac, OS, ,Linux) that is written in the programming language Java. It is used to

write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

Fig 3.4 Arduino IDE

### 3.5 Blynk App

Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. After downloading the Blynk app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. Using the widgets, you can turn pins on and off or display data from sensors.

Fig 3.5 Blynk App

## 4. Circuit Diagram

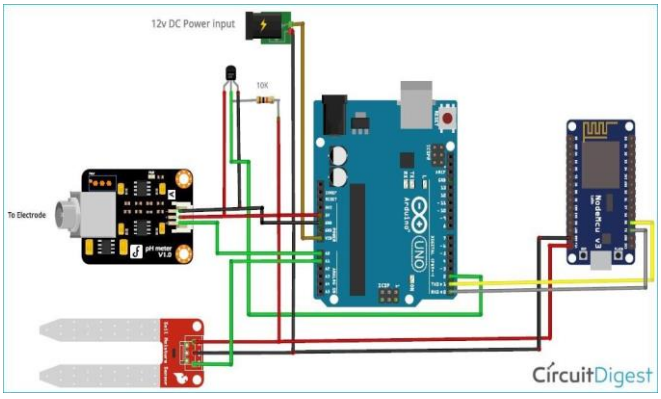


Fig 4 Complete Hardware Circuit system

The system proposed in this paper is an efficient, inexpensive solution for real-time water quality monitoring. The developed system having Arduino Mega and Node MCU target boards are interfaced with several sensors successfully. An efficient algorithm is developed in real-time, to track water quality.

The problem with sampling is that results can take weeks to come back, by which time conditions may have changed. Using real-time monitoring, instant data allows pre-cursors to potential issues (such as corrosion) to be flagged up and immediately be addressed before major issues occur.

In our project we have tried to simplify the need of common people regarding the knowledge about Smart Water Monitor .We made it easier for the consumers to get the basic knowledge regarding the System. Without a smart water monitoring system, sampling is the main way water quality checks take place. The ability to make real-time decisions during critical moments can be vital in preventing expensive repairs and breakdown.

The pH of water is a measure of the acid–base equilibrium and, in most natural waters, is controlled by the carbon dioxide bicarbonate carbonate equilibrium system. An increased carbon dioxide concentration will therefore lower pH, whereas a decrease will cause it to rise.

Temperature will also affect the equilibrium and the pH. In pure water, a decrease in pH of about 0.45 occurs as the temperature is raised by 25 °C. The pH of most raw water lies within the range 6.5–8.5. The most common pH sensor is the glass electrode. Real –Time Monitoring of pH is used sewage treatment plant (STP) to automate chlorine control and monitor the pH.

pH Spot testing, we kept the pH and temperature probes in the water for two minute and recorded the pH value that was displayed on the meter screen after the two minute period solution bottle and turned the meter off to converse energy.

## 5. IMPLEMENTATION OF SYSTEM

### *A. Arduino Programming*

First of all, include all the header files, which will be required throughout the code. Here we are using **onwire. h**and**DallasTemperature. h**library for a DS18B20 temperature sensor. This can be downloaded from the links given and included in the Arduino library. Similarly, we are using **Arduino Json. h**library for sending JSON data from the transmitter to the receiver side.

The ideal sensor for pipeline monitoring should be non-invasive to the pipe, low in power consumption and easy to install. Furthermore, they should be able to gather useful information without extensive data processing or high sampling rates.

One of the key parameters in pipeline monitoring is the internal pressure of the pipe. Leaks or blockages can potentially alter the normal pressure in the pipe and hence monitoring the pressure can potentially help to identify these. Temperature measurements of a pipe and its surroundings can also provide useful data in pipeline monitoring. A slow leak might not have a major effect on the internal pressure of the pipe, but it can potentially change its surrounding temperature profile.

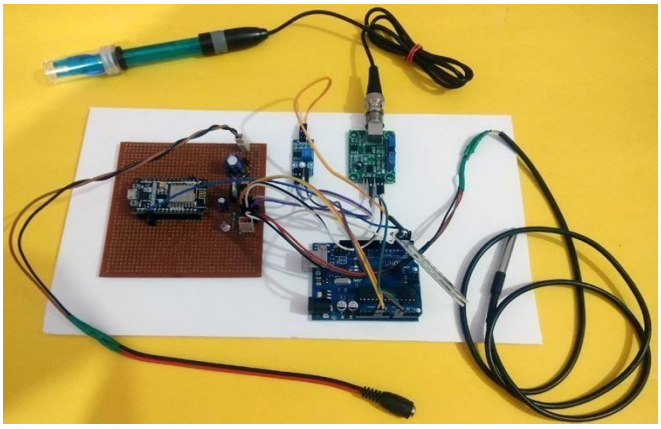

Fig 5.2 Working Model of System

Alkaline ionized water can neutralize acid build up in the body caused by years of consuming acidic food and beverages. Over acidity can cause all type of diseases from obesity to osteoporosis. The mean of pH levels in clean water is appropriate and the mean of pH level in polluted water is appropriate above 8. In Fig-4 shows the comparison chart of pure water and pollute water.

The development of graphical user interface (GUI) for the monitoring purpose at the base monitoring station is another main component in the project. The GUI should be able to display the parameters being monitored continuously in real time. The Sensor will also check the water quality by using these parameters involved in the water quality monitoring such as the pH level, turbidity and temperature is measured in real time by the sensors that send the data to the base station or control/monitoring room

This section comprises the elements that were involved in the implementation of this system and the integration of these elements with the system.

| Parameters | Value | Units |
|---|---|---|
| PH Value | 3 | N/A |
| Temperature | 31 | Centigrade |
| Moisture | 1 | % |

Fig 5.1 pH value, Temp, Moisture variation

In this system the NodeMCU acts as the central processing unit i.e the microcontroller of the proposed hardware. It is a Wifi enabled open-source platform. A very inexpensive wifi system on a chip (SoC) named ESP8266 having both software & hardware built designed by Espressif systems. Being user-friendly and easy to interface with various parametric sensors and other devices it is always a favorable choice for the IoT projects. It can be easily communicated with the IoT platform based on the HTTP protocol. It can be Programmed by Lua script and Arduino IDE as well. The ESP8266 NodeMCU acts as a gateway. In IOT, a gateway is a system that links the data collected by the sensors to the cloud.

The data sent by the sensors through an HTTP request is processed by the IOT service in Blynk App which communicates with a virtual server. The server and the IOT service communicate directly with the application. One Blynk App channels have been used. Creating a channels leads to the generation of a JSON file which is then fetched simultaneously using the Java code in the android studio. Fig. 5 shows the rest of the sensors plot i.e. Water Quality, pH vale and Moister.

### *B. Android App*

For visualization and authentication, in this research work, the team has built an Android App. The Android Application does not restrict itself to Blynk app but also has a Firebase Real-time Database. Firebase is a Google-provided API to create a database and fetch from it in real time. It also provides enhanced security for the developed App. Also, it is used for backend support and other functionalities like data storage, user authentication and hosting. Real-time data variations are recorded automatically and updates are sent to clients. The HTTP protocol works on a simple request and response system but firebase is different as its real-time database uses data synchronization. It can be used for user authentication purposes as the user credentials are securely stored using bcrypt. Readings fetched from the Blynk through API, stored in the Firebase Real-time Database to view 5 recent readings shown in the Fig 5.

Once the firebase API is included in Android or iOS App, firebase features like Analytics, Authentication, Storage, Messaging, Hosting, Crash reporting, Real-time Database etc. can be used. Fig. 7 shows the last reading fetched from Blynk App to Android App. The next section includes a 5 recent readings, when click on a button top right side of 1st sction. By clicking on Today in the menu, a list of cities is displayed of which the data is to be monitored. The JSON data fetched by the Android App from Blynk App is displayed in a tabular form with the help of JavaScript Object Notation (JSON) parsing.

## CONCLUSION

Water is one of the most important basic needs for all living beings. But unfortunately a huge amount of water is being wasted by uncontrolled use. The main issue that is being addressed in this project is about developing an efficient wireless sensor network (WSN) based water monitoring system. Three different ways to monitoring the water such as water level monitoring, water pollution monitoring and water pipeline leakage monitoring. Finally the thesis water monitoring system of smart homes/office research concept will be completed by using wireless sensor technology. By using the monitoring system we can easily prevent the water and the water will be save to our generation.

## ACKNOWLEDGMENT

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