

# IOT Based Smart Water Leakage Detection

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**Abstract:** -- water is the most essential element to live on earth. Technology provides people comfort, as there is a tremendous change in technology in every field our lives are becoming easier. Leak detection is a modern field of technology with the aim of standards and practices to facilitate control and maintain continual operation of transporting water, oil, gases, and other fluid products. Existing system for leakage detection is pressure deviation method which requires Force sensitive resistors (FSR'S) this is expensive. We have to use the sensors throughout the pipeline at different nodes and it becomes complicated. Adopting proper techniques for managing burst leaks is essential. To reduce this kind of burst and small leakages we are proposing the smart leakage detection system. In this paper we are implementing three modules such as water level monitoring, water pH level monitoring and water pipeline leakage detection using IOT Technology. By using this technology we can prevent wastage of water, here we are using 8051 micro controller to detect the three parameters namely Level, pH, Leakage. Here we have discussed about design and implementation of smart water leakage detection system and how it detects the leakage and at the same time the location of leakage and parameters data will be send to a smart phone by using an android application called Telnet through ESP8266 Wifi module. On usage of these two elements made this system smart and by implementing this system we can avoid huge water leakage in an easier way.

**Keywords:**-- microcontroller, pH, Conductivity, Telnet app.

## I. INTRODUCTION

Water is a limited resource and is needed for agriculture, industry and for creature's existence on earth. People don't realize the importance of drinking enough water every day. More water is being wasted by many in an uncontrolled way. This major problem leads to poor water allocation and integrated water management. Thus efficient use and water monitoring system is necessary to save water for future generations to avoid water shortage problem. 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. world water monitoring day is celebrated on September 18.

Leak detection is a current field of technology that is used alongside standards and practices to help monitor and maintain continual operation of transporting oil, gases, and other fluid products. Here we are proposing a project called Smart water leakage detection system to avoid those above mentioned problems. The microcontroller (8051) based Water level monitoring is used to indicate the level of water in the tank. The pH stands for "Potential of Hydrogen," referring to the amount of hydrogen found in a substance. Water pH level is measured in real time by the pH sensor. Leak detection in water pipelines, we use the aluminum wire which is attached to the supply pipeline and the leak is

detected, it will be indicated by an LED display.

### *Microcontroller*

A microcontroller is a small computer on a single integrated circuit; it is a system on a chip. A micro controller consists of one or more CPUs along with memory and programmable input/output peripherals.

Here we are using 8051 microcontroller for the implementation of project. 8051 micro controller posses 4K bytes internal ROM, 128 bytes internal RAM, four 8-bit I/O ports(p0-p3), two 16-bit timers/counters, 64K external memory for code and one serial interface.

### *Telnet Android Application*

It can help you to access your server easily when you cannot find a PC / Laptop for immediate use. It is an android application which acts like a barrier between user and microcontroller. It provides the parameters status to the user continuously. So that user can easily know the current status of the parameters and take decisions accordingly.

### *IOT Technology*

The Internet of things is the internetworking of physical devices, vehicles, connected devices and smart devices and network connectivity that enable these objects to exchange data. IoT is expected to offer advanced connectivity of devices, systems and services that goes beyond machine to machine communications and covers variety of protocols, domains and applications. Here we are connecting a smart phone to know the information regarding level, pH and leakage.

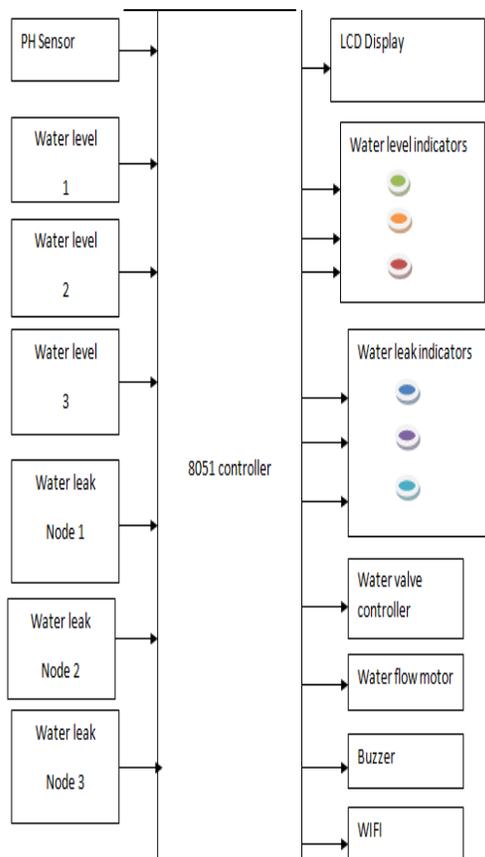
### *WIFI ESP8266 Module:*

It has 8 pins, 4 in the row of 2. The first pin on the

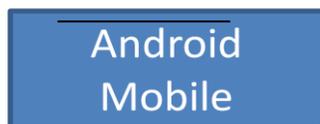
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top left is GND. The two pins right from the GND are GPIO 2 and 0. The pin on the top right side is the RX pin and the pin on the lower left is TX and these are the pins for communication. The middle pins on the bottom are CH\_PD(chip power-down) and RST(reset).

**II. ARCHITECTURE**



**Receiver:**



**Fig-1: Block diagram of smart water leakage detection system**

Fig-1 depicts, the overall architecture of smart water leakage detection system using IoT. First the water level indicator is used to indicate level of water in the tank. To the tank we have fixed three LED's, based on the size of the tank we decide the number of LED's. Here we use three LED's for our convenience we name them as LED 1, LED 2 and LED 3 from the lowest point. LED 1 indicates the low level, LED 2 indicates medium level and LED 3 indicates high level and that means the tank is full. When the water level reached low level LED 1 glows so that the level of the tank is low and also level indication can be known in the our smart phone using telnet android application. The microcontroller (8051) will pass the input signal to the wifi module and then it transfers the data regarding parameters to the smart phone.

Second one is water purity checking that means here we are checking the pH level of the water using a pH sensor. A pH sensor is kept at the over head tank.

The third one is pipes leakage detection. Using a aluminum wire we can detect the leakage. By wounding aluminum wire to the water pipeline the leakage problem is solved.

**III. DESIGN METHODOLOGY**

Microcontroller has four I/O ports port-0, port-1, port-2 and port-3. Port-0 is connected to leakage detection module, port-3 is connected to level indication module and port-1 is connected to pH level detection module. Also a ESP8266wifi module and a buzzer is connected to the microcontroller

**Level Indication Module**

Level is detected for a over head tank. LED 1 is connected to tank through a metal wire, when the water level touches the wire conduction takes place and the signal is sensed by microcontroller and LED 1 glows that means it indicates water is at low level in the tank. A transistor BC547 is connected at the LED it acts a switch and makes the LED glow when it is sensed and microcontroller sends the signal to the telnet application using a wifi module.

The technique of water level sensing system monitoring concentrated with some basic units which are aggregated together in our proposed method. The wire

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attached here acts as water level sensor, it takes the job of indicating the water level in over head water tank. The water is supplied from the water source to the over head tank through a submersible motor in the water source. Basic units are described below

**(i) Water level indicator :**

In water level indication module we use LED light which will be used for level indication.

**(ii) Water level sensor:**

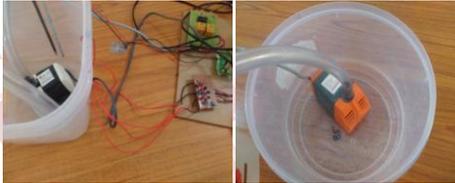
To make water level sensor we could introduce some materials like Iron rod, nozzles, resistance, metal wires, rubber etc. Here we have used metal wire which acts as water level sensor.

**(iii) Water pump system:**

We can control the water pump by connecting it with an output pin of microcontroller to a motor driver circuit. When microcontroller sends a positive signal(+5V) or a ground signal(0V) to the motor driver circuit. Motor is driven using a 12V relay.

**(iv) Microcontroller :**

Microcontroller is a computer on a chip that is programmed to perform almost any control, sequencing, monitoring and display the function.



**Fig 2: (a)Level Indicator (b)Submersible pump pH level detection module :**

The pH stands for “Potential of Hydrogen,” referring to the amount of hydrogen found in a substance. pH is measured on a scale that runs from 0 to 14. 7 is neutral, means there is a balance between acid and alkalinity. A measurement below 7 means acid is present and a measurement above 7 is basic.

The pH is of major importance in determining the corrosion of water. In general, lower the pH, the higher level of corrosion. However, pH is only of a variety of factors affecting corrosion. The pH of a solution is the negative common logarithm of the hydrogen ion activity.

$$pH = -\log[H^+]$$

The pH of water is a measure of 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 raise.



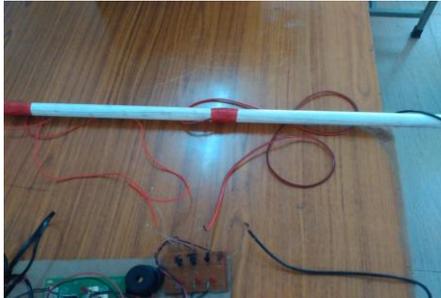
**Fig-3: pH sensor**

pH sensor is kept in the tank like the electrodes are immersed in the water of the tank. The value of pH in the water is measured by the sensor and gives the value to the microcontroller and the controller sends the pH measured value to the smart phone.

**Leakage Detection Module:**

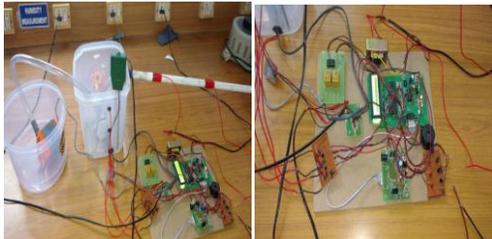
Leak detection in water pipelines, which will detect the leakage in the pipelines. An aluminum wire is turn around the water pipeline. Divide the pipeline into required number of parts here we divided into three parts and name them as leak-1, leak-2 and leak-3 for easy identification of leakage location as shown in fig4. In this project we set three LED’s for three leakage locations. If there is a leakage the water from the pipe leak outside and when the aluminum wire senses the water it starts conducting and microcontroller receives the leak signal and buzzer rings accordingly one of the leak detection LED’s glows based on the node. At the same time the leakage information will be send to smart phone.

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**Fig 4: Leakage module setup with an aluminum wire**

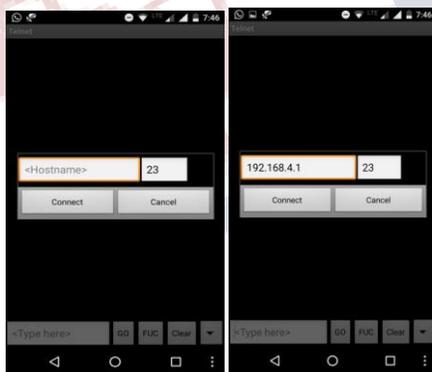
**IV. RESULTS AND DISCUSSION**



**Fig 5: Leakage detection module**

The three modules like level indication,  $p^H$  level and leakage of water has been sensed and the detail information has been transmitted through WIFI module to TELNET application of Android mobile. The screen shot has been show below:

**V. EXPERIMENTAL RESULTS**



**Fig 6: TELNET Application with IP address**

**VI. CONCLUSION**

In this paper, we can conclude that the detection of water leak in the pipeline can be sensed within a short time and the information can be send through WIFI module to

telnet app of android mobile. By seeing the information any one can easily identified the leakage nearest node so and we can avoid water wastage. In this paper we have developed and evaluated a advanced technique to obtain an energy-efficient resource management in IOT. The developed system mainly highlights the level indication,  $p^H$  level by using PH-45H sensor which compacts with 8051 microcontroller with low cost production and efficient information. The main aim of this paper work is to develop a real-time water monitoring and control which gives notice through TELNET app.

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