Smart Water Management System for Water Loss Detection using IoT
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Abstract—The water supply management in the world has always brought challenges. The water crisis is a major issue faced worldwide on a large scale. This article proposes a smart water management system using IoT, for water distribution support and loss prevention. To handle this situation, several experiments with a network of sensors capable of monitoring water pipes in real-time has implemented. The use of smart solutions, sensor networks, and IoT solutions may represent a great alternative for the monitoring of the water distribution network and reduce the water loss on a large scale. Through the Wi-Fi system, the sensor output data is sent to the concerned authority for further steps to supervise the water leakage. These sensor values are continuously uploaded into the cloud using wifi module.


1. INTRODUCTION:

The water supply management in the world has always brought challenges. Water is the primary resource that supports human survival; however, for adequate water distribution, some important factors must be considered to guarantee the supply. The major causes of water loss are technical failures in the distribution process and leaks. Water Loss is one of the biggest problems that we are facing, the advent of summer season accompanies severe drought and loss of ground-level water on a high scale. People will be unaware of how much they waste precious treasure and in the future, they run out of water. It is necessary to manage as well as supervise the amount of water that we are using every day. The need for a water management system is mandatory. Every house needs a rainwater management system and a water loss detection system to utilize the available water efficiently. Thus a smart water management system that detects water loss through the pipelines and gives an alert message is the need for the current era. Thus an IoT based system connected with the GSM module helps in tabulating the water flow readings.

2. PROPOSED SYSTEM:

To overcome the water loss problem an efficient and easy system is proposed with the help of the Internet Of Things so-called IoT is utilized. IoT being widely used technology can be used by implementing an Arduino Uno board connected to water flow sensors that calculate the flow of water through the pipes. The analog data captured by all the sensors are sent to the microcontroller through Analog to Digital converter. The flow of water is displayed and through a WiFi Module, the readings are updated in the database simultaneously. Any change in the readings indicates the water leakage and the database is updated as leakage detected. In addition to it, for early monitoring of leakage, an alert message is sent to the programmed number of any officials through GSM Module. The Architecture of the proposed system is shown below (fig 1).

![fig1 Architectural Diagram](image_url)

3. HARDWARE COMPONENTS:

3.1 ARDUINO UNO:

ARDUINO Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. Simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Arduino is the heart of our project which is used to control sensors and Wifi module.
3.2 NODEMCU (ESP8266):

NodeMCU contains built-in Esp8266 wifi module which is used to communicate with server thus the sensor data are uploaded into server by connecting to a Wifi Hotspot. We can simply connect our mobile hotspot to the nodemcu and obtain the readings. Fig 2 & 3

![NodeMCU ESP8266](image)

3.3 WATER FLOW SENSOR:

It is used to measure or sense the flow of the water using Hall Effect. Water flow sensor gives an amazing solution for measuring the flow rate of liquids. Huge industrial plants, commercial and residential buildings require a large amount of water supply. The public water supply system is used to meet this requirement. To monitor the amount of water being supplied and used, the rate of flow of water has to be measured. Water flow sensors are used for this purpose. Water flow sensors are installed at the water source or pipes to measure the rate of flow of water and calculate the amount of water flowed through the pipe. Rate of flow of water is measured as liters per hour or cubic meters.

3.4 POWER SUPPLY

Power supply circuit, the name itself indicates that this circuit is used to supply the power to other electrical and electronic circuits or devices. We have used 5V DC regulated power supply circuits, which can be designed for converting the available 230V AC power to 5V DC power.

3.5 GSM MODULE

It is a mobile communication modem that is connected to a PCB with different types of output and to Arduino board. It helps in establishing communication by inserting a sim card into the slot. This module helps in sending alert message to the programmed number. Once the connection is established successfully, the status/network LED will blink continuously every 3 seconds. You may try making a call to the mobile number of the sim card inside GSM module.

3.6 LIQUID CRYSTAL DISPLAY

It is a 16 pin interface that allows us to control LCD display with 5x7 pixel matrix. This LCD provides the flow values through both sensors.

4. HARDWARE IMPLEMENTATION

The necessary power supply is provided using a cable. Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from our computer or a wall power supply that is terminated in a barrel jack. This power supply enables the Arduino to get the necessary power supply. Voltage Regulator helps in balancing the fluctuation in the power and provide stable supply to the water flow sensors other modules. Once the water flow sensor gets the supply and the flow, display the value. Through the hotspot connectivity of the NodeMCU (ESP 8266), the value is updated in the database. GSM Module is connected with a separate adaptor and a 2G/3G sim is inserted that sends a message if leakage is detected.

5. SOFTWARE IMPLEMENTATION

Arduino IDE is open-source software that is mainly used for writing and compiling the code into the Arduino Module. It is official Arduino software, making code compilation to easy that even a common person with no prior technical knowledge can easily work on it. Arduino Uno program is fed into the compiler. Arduino Uno can once be compiled and saved for future use, thus the programmed code works as soon as the supply is fed to the Arduino board and the readings are updated on the database screen.

6. WORKFLOW

The Arduino programmed and power supplied with 5V is connected with the water flow sensors and the wifi module, on the reception of the water flow displays the readings. On the other hand, the wifi connected module updates the readings to the database page and recurrently updates the table. We can connect our mobile hotspot and The NodeMCU (Node Micro Controller Unit) is an open-source software and hardware development environment around the ESP8266, a very inexpensive system-on-a-chip (SoC) environment. The table shows whether there is any leakage if there is a change in the water flow through the sensor fixed pipes. When the difference in flow occurs GSM module receives the command ‘stop’ to induce an output (i.e) the alert message is sent. The overall and the simple working of the proposal is represented below(fig 4).

![Workflow Diagram](image)

7. CONCLUSION

Our proposed system is used to reduce the loss of water in apartments by utilizing IoT. In this project, the water flow sensor is used to sense the change in water flow and so the leakage efficiently. Data is simultaneously updated on the web server via Wi-Fi. When leakage is detected the alert message is sent to the officials.
8. REFERENCES


[4] Shifeng Fang, Li DaXu, Senior Member, IEEE, Yunqiang Zhu, Jiaerheng Ahati, Huan Pei, Jianwu Yan, and Zhihui Liu, “An Integrated System for Regional Environmental Monitoring and Management Based on Internet of Things”, document/6725615

