Water Supply Measurement and Management System Based on IoT with Water Leakage Detection

1. Narendra Kumar. T, 2. Tejasri. A, 3. Anusha. Ch, 4. Bharath Kishore. M, 5. Rama Rao. G

1Assistant Professor, Dept. of ECE, DVR & DR. HS MIC College of Technology, Andhra Pradesh, India.

2,3,4,5 Dept. of ECE, DVR & DR. HS MIC College of Technology, Andhra Pradesh, India.

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Abstract:

Every living creature need water. Water has become a highly useful part in everyone's life. We receive water from rivers, ponds, and other waterbodies, and it is delivered to people via pumps or water tanks. It is supplied not just to people but also to enterprises, hospitals, and other organizations. However, when comparing water supply between rural and urban locations. When compared to rural areas, metropolitan areas receive more water. However, urban areas misuse this. They are taking more water than they are using. They are wasting water by taking more of it. Rural communities are receiving less water than usual because urban areas are taking more water. As we can see, water is being squandered. Leakage is another reason that wastes water. When there is a leak, in the current system, a man must go ahead and repair the leakage spot. It takes time, and there is a possibility that additional water will be wasted. By considering these two and avoiding them, the proposed system that we are following is measuring, monitoring, and leak detection employing the major functions such as Arduino UNO (ATMEGA 328p) and ESP8266 Wi-Fi module. The sensors involved in this are the level sensor and the flow sensor. We can update the data in the cloud by using the thing speak cloud.

Key Words: *Arduino UNO, ESP8266 Wi-Fi Module, Level Sensor, Flow Senor.*

1. INTRODUCTION

A .Motivation:

The inspiration originates from the real-world issues that we experience these days due to a lack of water. Every year, between 250 and 500 million m3 of drinking water is lost in numerous megacities. Saving this amount may offer drinking water to an additional 10 to 20 million people in each megacity. We can see how much water is wasted by looking at the numbers above. We can estimate how much water is lost by comparing water waste in different countries.

The graph above depicts the percentage values of water waste in various cities around the world. We can gradually deploy this project in certain locations to reduce this.
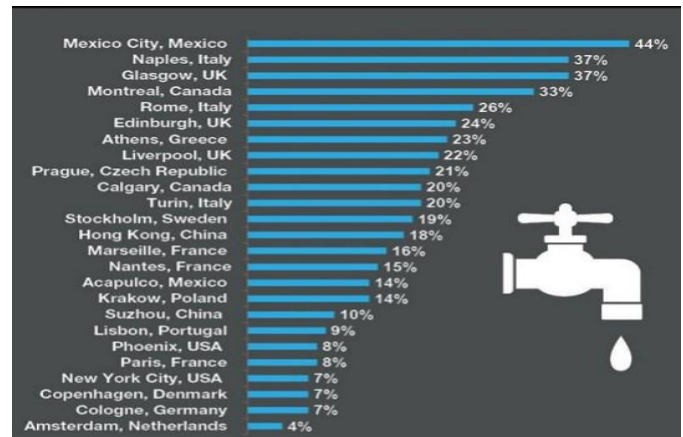

Fig 1 : wastage of water in different cities

The population of the twenty-first century is rapidly increasing. Few people have access to clean drinking water, which is a major issue in today's world. Due to the huge population, there are also circumstances when water theft and leakage occur. We can control and monitor the water supply using this technology, reducing the amount of water wasted due to leaks and theft by consumers.

B. Objective:

Water is the most precious and valuable resource for all humans; however, today's water supply systems are having trouble operating in real-time because of a lack of water resources due to reduced rainfall. As the world's population grows, so does the number of people living in cities. As a result, water has become a critical issue that affects water distribution, conservation, consumption, and quality. The main objective to implement this project is to design and develop a low cost reliable and efficient technique to make proper water distribution by continuous monitoring and also we can solve water-related difficulties by controlling it from a central server.. Based on our objectives and the difficulties in today's water delivery systems, we may conclude that a proper monitoring and regulating system is essential. So, we are focusing on real-time water supply monitoring in this project. Water supply can be ensured through continuous water level monitoring, allowing for optimal distribution of the available water in tanks, water flow monitoring, and whole pipeline monitoring.

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2. PROBLEM IDENTIFICATION& PROBLEM SOLVING

2.1. EXISTING METHOD

The existing infrastructure provides urban water to the home with the assistance of some manpower. The person in charge will travel to the location and open the valve to that specific region. When the timer runs out, the individual will return to that location and close the valve. This type of operation necessitates the use of human resources. Going to such location and returning frequently is a waste of time. People can also take extra water for personal use by using a motor or other equipment. As a result, many individuals will not have enough water to drink. This is exactly what is happening in the current system. To avoid this, the system has been adjusted to operate automatically without the use of human labour.

2.2. PROPOSED METHOD

Before we get into the suggested system, consider how water gets into household faucets. Water is typically obtained by cities from rivers, lakes, and ground water reservoirs. Water comes from aquifers through pipes from pump houses to sewage plants.. The water is cleaned at the treatment plant before being piped into reservoirs. The reservoir serves as a holding tank for the treated water. Water is pumped from these reservoirs to the city's overhead tanks. The water is then supplied to homes and factories via a network of gravity-powered pipelines. In other circumstances, water is delivered directly from reservoirs to homes.

As many towns work on a smart city concept, our system focuses on the Internet of Things, a new scenario for transforming a city into a smart city with various applications. The primary goal of implementing this project is to create and construct a low-cost, dependable, and efficient technique for proper water distribution through continuous monitoring and control from a central server, allowing us to solve water-related problems. The proposed system comprises of an Arduino uno, which contains a microcontroller named ATMEGA328p, an ESP8266 Wi-Fi module, and several sensors such as a water level sensor and a flow sensor. Arduino takes data from sensors and uploads it to IoT platform. This method addresses the issues of overflow, overconsumption, and adequate distribution. This solution allows for continuous monitoring and control from a central server.

3. Methodology & Implementation

The approach of this project design involves the implementation of the proposed method.. This project can be justified by dividing it into 2 functionalities:

1.Measurement&Management.

2. Leakage Detection.

3.1 Measurement & Management

Measurement and management systems play an important part in the everyday operation and upkeep of water supply. Regulating devices are deployed near the equipment they are intended to regulate directly in the field of monitoring and controlling. Connecting these devices to the internet allows the user to save and alter data from any location. This includes not just the use of telemetry or dedicated Internet Protocol (IP) lines to enable the interconnection and region-wide management of such facilities across a utility's service area, but also the use of such facilities as monitoring and control systems for individual facilities. As a result, the monitoring and control system can build a network of things. monitoring and control systems in the era of the IoT where all different types of things are connected to networks are opening up possibilities for sensing devices and equipment at a finer amount of precision than previously. Using this information through IoT platforms not only improves operation and maintenance, but it also has promising utility in recognizing ageing or damaged systems and equipment. So, in this project, anytime the flow of water is surpassed, the water supply is cut off. We can manage the overflow of water by monitoring it and updating the flow rate values via the internet.

3.2 Leakage Detection

Generally, Water is lost due to leaks and cracks in pipelines and fittings. Special technologies are required for leak detection, which allows inspectors to precisely assess the location and severity of pipe line leaks. This is a field that continues to grow and advance by incorporating both established technologies and new ways.As a result, this technology aids in reducing water waste due to leakage. When there is a leak, the flow rate of the water increases. As the flow rate increases, it is considered stealing, and the guy proceeds to work on the leakage area. As a result, the leak is corrected as soon as it is discovered. As a result, the amount of water wasted is promptly determined.
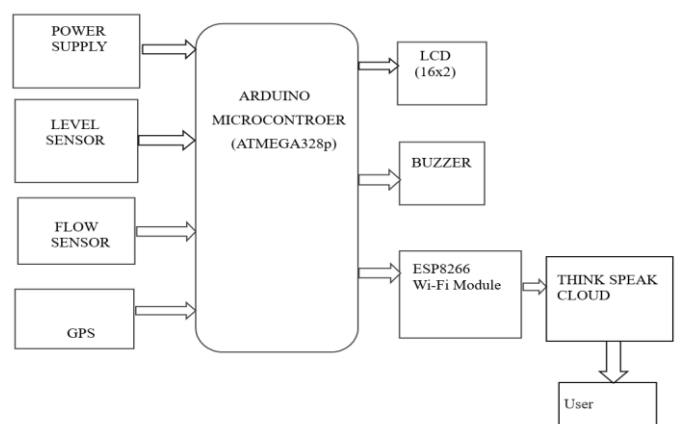
This project's block diagram is presented below:

Fig 2: Block Diagram

4.1. HARDWARE REQUIREMENTS

1. Arduino UNO

2. ESP8266 Wi-Fi Module

3. Level Sensor

4. Flow Sensor

5.GPS

6.LCD

7.Buzzer

4.2. SOFTWARE REQUIREMENTS

1. Arduino IDE

2. ThingSpeak Cloud

5. Result Analysis

The technique we took here discusses how water is monitored and controlled, as well as how leakage is detected. Let's have a look at how this project works, what strategies we employed, and what the benefits of using this project are. The components used here are an Arduino UNO with an ATMEGA328p integrated on board, a Wi-Fi module commonly known as an ESP8266 Wi-Fi module, a level sensor for measuring the water level, a flow sensor for measuring the flow rate, an LCD for displaying the level and flow rate, a buzzer for indicating if a leakage was detected, a GPS for determining the location of the leakage, and a ThingSpeak cloud for updating and storing data. When it comes to the operation of this project, the main functional unit is Arduino. It is in charge of all operations. It is both software and hardware friendly. We use the Arduino IDE for the software portion. It is a platform for writing code for the Arduino, which is then dumped into the Arduino through a USB wire. Fixed values for level and flow sensors are defined in the code. The level sensor was attached to the water tank, while the flow sensor was attached to the water pump. The current reading from the sensors will be compared to the predetermined values. If the level sensor reading was less than the predetermined value and the flow sensor reading was less, than the predetermined value, we can deduce that a leakage or theft occurred. For internet communication, a Wi-Fi module was employed. We may view the readings on the ThingSpeak platform using the Wi-Fi module. This is the operation that was a part of this project.
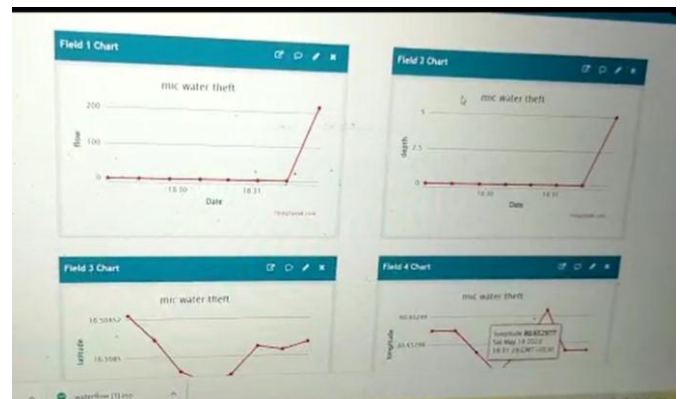

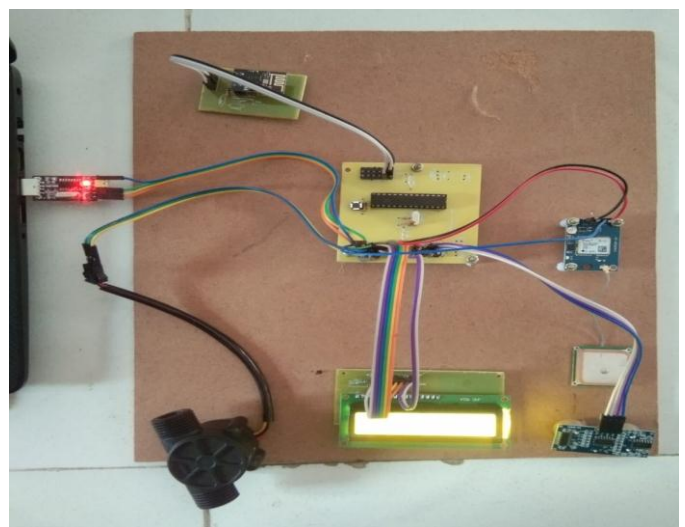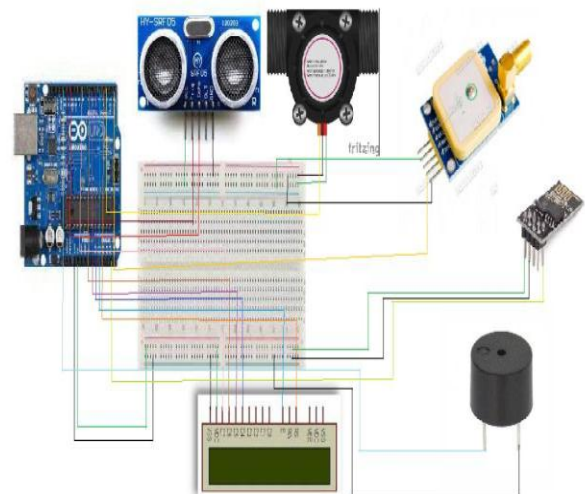Fig 3: Results on ThingSpeak Platform

Fig 4: Project Setup

Fig 5: Schematic Diagram

6. CONCLUSION & FUTURE WORK

6.1. CONCLUSION

We can utilise Wi-Fi to communicate with authorised persons because the ESP8266 Module is employed. As a result, we believe that a technique to minimizing water leaks or theft was successful to the degree that greater potential room for improvable chances can be anticipated. It'll prove to be a relieving measure for the authorized personnel someday. By bringing this system in a real field, we hope the count of water leak due to pipeline-crack to go minimum to none.

6.2. APPLICATIONS

This can be used as water management system and can be minimizing the water wastage takes place.

This concept can assist us in delivering more efficient water management and easier bill payment methods via mobile phone..

6.3. FUTURE WORK

When expanded on a wider scale, this concept can be practically implemented in the Municipal Corporation of any village, town, or city.

The same method can be used to construct an automated town energy management system.

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