ABSTRACT

Nowadays, all over India, there is a water crisis. To solve this crisis, we need proper water management on the individual level and we need a water level indicator. By doing water level management on an individual level, we can save plenty of water and could get rid of the water crisis.

The water level indicator with automation is an innovative system designed to monitor and manage the water levels in reservoirs, tanks and overhead water storage system. The primary goal is to automate the process of water level, monitoring and control, reducing manual intervention and ensuring efficient use of water resources. The system employs a combination of sensors to detect the water levels in real time. This project demonstrates a practical solution for sustainable water management and automation in both residential and industrial applications.

Acknowledgement

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Table of contents

CHAPTER 1

1.1 Introduction

Water is life and we know for a fact that 70% of our planet is covered with water. That makes it obvious to think that it will always be plentiful. However, only 3% of the total water available is freshwater – which is fit for usage. The remaining amount of water is either present in the form of glaciers or unavailable for our use. This makes freshwater a very valuable resource. People living in urban areas who have unlimited supply of water often fail to realize the severity of water scarcity. Spending a day without water seems impossible to them. Water overflowing and getting wasted is a very common occurrence. On the other hand, there are 1.1 billion people within the world who lack access to water. A total of 2.7 billion people find water scarce for a minimum of one month of the year. Natural sources of freshwater like rivers, lakes, aquifers are either dehydration or becoming too polluted to use. Almost 50% of the world's wetlands have disappeared. Climate change has further led to drought in some areas and floods in others.

India constitutes 16% of the total world population and just 4% of the total freshwater reserves in the world. India's urban population is expected to rise to 50% of the total current population by 2050, according to projections by the UN. As such, the demand from domestic sector in India over the next twenty years will increase from 25 billion cubic meter to 52 billion cubic meter.

The above-mentioned facts alarm our attention towards the urgent need to take precautionary steps to save water. It is a necessity for us to conserve and control the consumption of water for sustainable development of the country. This can be done at individual level by installing systems that ensure that water flow is turned off once container is completely filled. The system will comprise of ultrasonic sensors which will be fitted right at the brim of the container. As soon as the sensors detect that water level has reached its maximum potential, water flow will automatically be turned off. The aim of our project is to not only ensure that water doesn't overflow but also display the amount of water filled in the container at any given time on an LCD screen.

The open-source electronics platform Arduino has been used in the construction of this system. If such a system is installed in every household, there will be drastic reduction in the amount of water being wasted. Although the primary aim of this system is to assure that no water is wasted, it can also be used in fuel tanks of vehicles wherein the exact amount of fuel present inside the tank is displayed to the driver. It will be extremely beneficial as the driver will be informed about the quantity of fuel left in the tank at all times. Also, the pump attendants at petrol stations won't be able to fill in lesser amount of fuel as the driver will be certain about the quantity of fuel to expect after refilling. On a wider scale, this system can be used in large scale industries where tons of liters of water and other valuable fluids get wasted due to overflowing.

1.2 OBJECTIVE:

1. **Automatic Water Level Monitoring**

• To develop a system that continuously monitors the water level in a storage tank (e.g., overhead tank, underground tank, or reservoir).
• To create a visual or auditory indicator (such as LEDs or an alarm) that provides real-time feedback on the water level.
• To use sensors to detect various water levels in the tank (e.g., low, medium, and full) and trigger corresponding actions.

2. Prevention of Overflow

• To design a mechanism that prevents water overflow by automatically stopping the water inflow when the tank is full.
• To implement a **high-level water alarm** that alerts the user when the tank has reached its maximum capacity to avoid spillage and wastage of water.

3. Low Water Level Notification

• To ensure that users are notified when the water level drops below a predefined threshold, preventing dry pumps or water shortage.

• To incorporate a **low-level water alert** system that sends notifications, allowing for timely intervention to refill or restore the water supply.

4. Enhancing Water Conservation

• To contribute to water conservation efforts by minimizing wastage through automated control of water inflow and outflow.

• To create awareness about water management by providing real-time data about water usage and availability.

5. System Reliability

• To ensure the reliability of the system by using durable and accurate sensors (e.g., float sensors, capacitive sensors, or ultrasonic sensors) that provide consistent data under different conditions.

• To include fail-safe mechanisms that maintain operation in case of sensor or system malfunction, such as backup alarms or manual override options

6. Environmental Impact

• To design the system in a way that minimizes its environmental impact by using eco-friendly materials, energy-efficient components, and by promoting water saving.

1.3 PROBLEM STATEMENT

In many domestic, agricultural, and industrial settings, water tanks are often filled or emptied without proper monitoring, leading to issues such as:

• Overflow and water wastage.
• Dry-run conditions, which can damage pumps.
• Lack of timely awareness about low water levels, causing inconvenience or operational inefficiencies.

1.4 LITERATURE SURVEY

This paper focuses on limiting the amount of water supplied to each household. When this system is installed in a house, it continuously monitors the total water usage of that house. Once the amount of water used reaches a threshold value, the flow of water entering the house is reduced by a fraction of the original, the system sends a message to the consumer via email once the water limit reaches 80% and 100%. Also, it periodically updates the user about the volume of water spent, along with information about the exact points in the house where consumption is maximum. [2] This Project mainly focuses on minimizing water and electricity wastage by building an efficient automated water pump. Some sophisticated automation materials have been established in order to set some works automatically such as Arduino microprocessor, which enables to control the electrical circuits logically.

CHAPTER 2

2.1 CIRCUIT DIAGRAM

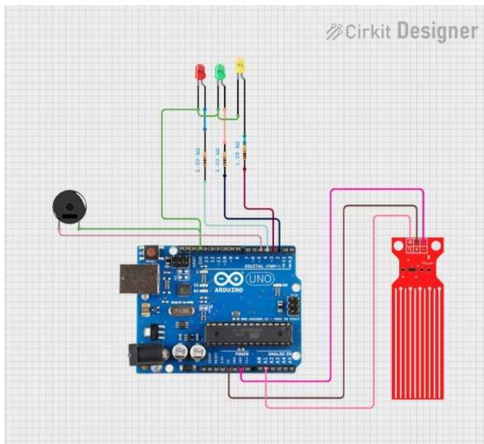

Fig (2.1) circuit diagram of water level indicator

2.2 ARDUINO UNO

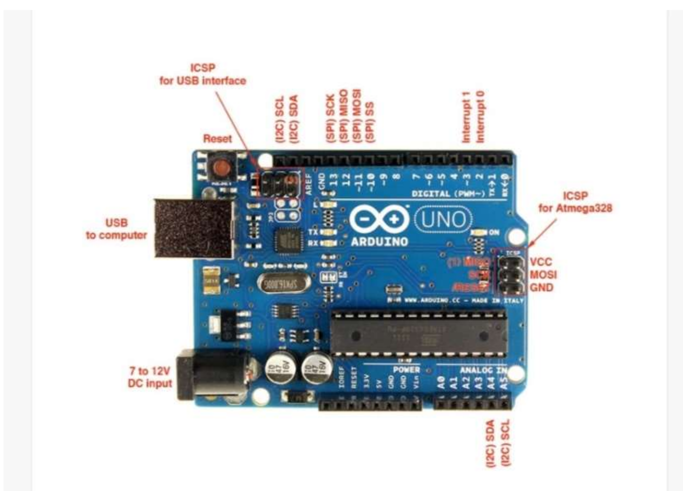

Fig (2.2) Arduino uno board with DIP ATMega328P

The Arduino uno is a microcontroller board based on the ATMega328. It has 14 digital inputs/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a lower jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; apply connect it to a computer with a USB cable or power it with an ac to dc adapter or battery to get started. The uno differs from all preceding boards in that it does not use the FTDI USB to serial driver chip. Instead, it features the ATmega8U2 programmed as a USB to serial inverter.

2.3 WATER LEVEL SENSOR

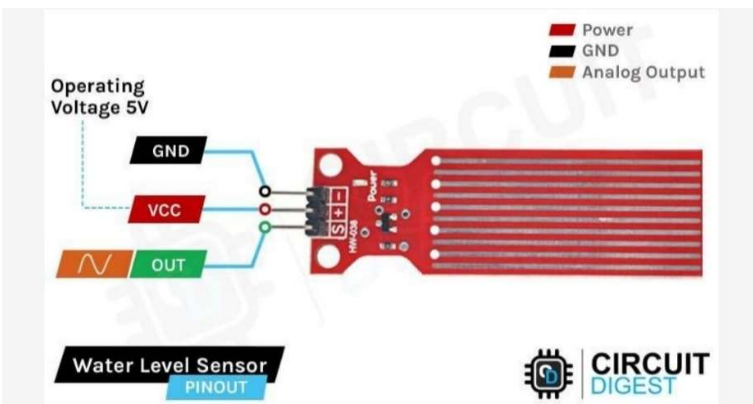

Fig (2.3) water level sensor

This is an analogue water level sensor module (HW508). It is commonly used to detect and measure the level of water in a container or tank. It has an operating voltage of 3.3 V to 5 V. It has three interface pins. This measures the level of water by detecting the change in resistance between its exposed chasers when submerged in water, analog output, signal correspondence to the water level, loving you to monitor it with the micro control and like Arduino.

CHAPTER 3

METHODOLOGY

3.1. System Design

- **Objective**: Design the architecture and components of the system.

3.1.1. Component Selection:

- **Water Level Sensors**: Choose between ultrasonic sensors, float switches, or capacitive sensors based on accuracy, cost, and the size of the tank.
- **Microcontroller**: Select a microcontroller (e.g., Arduino Uno, ESP32, or Raspberry Pi) to process sensor data.
- **Indicators**: Choose LEDs for visual indication (red, yellow, green) and a buzzer for auditory alerts.

3.1.2. System Flow:

Design the logic flow to ensure the system behaves as expected based on water levels:

- Low level = Red LED
- Medium level = Yellow LED.
- Full level = Green LED

- **Diagram**: Create a wiring schematic for connections between sensors, microcontroller, indicators, and the pump.
- **Output**: A finalized system design with all components selected, connections mapped, and the system's flowchart ready for implementation.

3.2. Hardware Development

- **Objective**: Assemble the hardware components based on the design.
- **Activities**:

3.2.1. Sensor Setup:

- For **ultrasonic sensors**, mount the sensor at the top of the tank to measure the distance between the sensor and the water surface. The microcontroller will calculate the water level based on this distance.
- For **float switches**, install them at various levels in the tank to indicate specific water heights.

3.2.2. Controller Setup:

- Wire the microcontroller to the sensors, ensuring proper connections for input and output.
- Install the **LEDs** to indicate low, medium, and full water levels.
- Connect the **buzzer** to the microcontroller to provide an alert when the water level is critical (either low or high).

3.3. Software Development

- **Objective**: Write the program to control the system logic and sensor data processing.
- **Activities**:

3.3.1. Sensor Data Processing:

- Write code to read data from water level sensors (either analog or digital).
- For **ultrasonic sensors**, calculate the distance to determine the water level.
- For **float switches**, set thresholds that trigger the appropriate actions when the water level passes specific points

3.3.2. Logic Implementation:

- Create logic for the water level thresholds (low, medium, high) based on sensor inputs.
- Implement functions to control the LEDs and buzzer depending on the water level.
- Program pump control: Turn the pump on when the water level is low and off when the tank is full.

3.4. System Integration

- **Objective**: Integrate the hardware and software to ensure the system works as a whole.
- **Activities**:

Connect All Components: Integrate the microcontroller, sensors, actuators, indicators, and power supply.

Run Full System Test: Conduct a test where the system is powered up, and all components are checked to ensure they function as expected:

- Verify sensor readings for different water levels.
- Ensure that the LEDs light up in the correct order (Red, Yellow, Green) based on the water level.
- Check that the buzzer sounds when the water level is either too high or too low.

3.5. Testing and Calibration

- **Objective**: Validate the system's performance and fine-tune for real-world usage.
- **Activities**:

➢ **Test Different Water Levels**: Simulate various water levels in the tank and observe the system's response to confirm that the indicators, alerts, and pump control mechanisms function correctly.

- **Sensor Accuracy**: Fine-tune the sensor calibration if necessary to match actual tank dimensions and ensure accurate level detection.
- **Test Alerts**: Verify that the buzzer alerts the user when the water level is too low or too high.

3.6 APPLICATIONS

Water level indicators find extensive applications in:

- **Domestic Use:** Ensuring efficient water usage in overhead and underground tanks.
- **Industrial Processes:** Monitoring liquid levels in industrial reservoirs to maintain operational safety and efficiency.
- **Agriculture:** Managing irrigation systems to optimize water usage and prevent water logging or under-irrigation.

CHAPTER 4

4. WORKING PRICNCIPLE

4.1. Water Level Measurement

The system begins by measuring the water level in the tank using water level sensors. There are several types of sensors that could that could be used, depending on the design of the system:

Water sensor: which detects the level of water in the overhead tank.

4.2. Signal Processing

- The sensor sends a signal to the **microcontroller** (e.g., Arduino), which processes the data to determine the water level.
- The microcontroller uses the distance or the number of closed contacts (in the case of float switches) to evaluate whether the water level is at the **low**, **medium**, or **high** threshold.

4.3. Indicator Activation

Based on the water level detected, the microcontroller activates various indicators:

- **Red LED**: When the water level is low, the **Red LED** lights up, and an **audible alarm** or **buzzer** is activated to notify the user.
- **Yellow LED**: If the water level is at a medium level, the **Yellow LED** is activated to show that the tank is partially filled.
- **Green LED**: When the tank is full, the **Green LED** turns on, indicating that the tank is at its maximum capacity.

4.4 RESULTS:

The water level indicator successfully demonstrates the ability to detect water levels in a container using a water level sensor module, Arduino, and LEDs.

- **Dry condition** (no water):
  The sensor detected no water, and the red LED lights up to indicate a low water level.

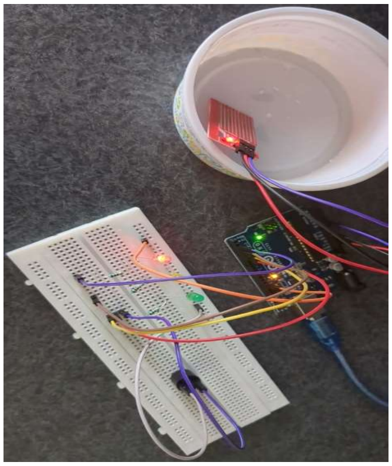

Fig (4.1)

- **Partial immersion:**
  When the water level partially covers the sensor, the system maintains an orange LED indication, showing the water level is still insufficient.

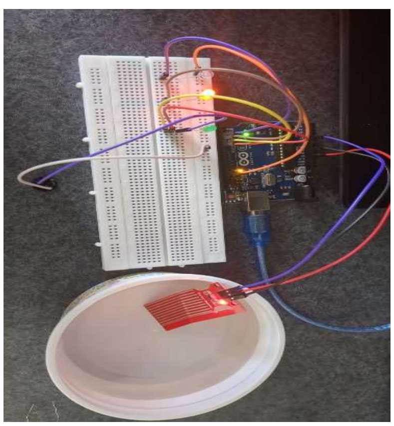

Fig (4.2)

- **Full immersion:**
  Once the water level is successfully immersing the sensor, the green LED is illuminated, indicating that the desired water level is achieved.

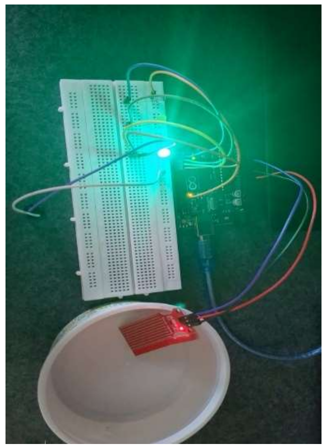

Fig (4.3)

5. CONCLUSION

The water level indicator with automation project successfully demonstrates and efficient and automated solution for monitoring and managing water levels in tanks and reservoir. By utilizing sensors and automated control system, the project ensures real time tracking of water levels, preventing overflow and optimizing water usage. The integration of automation through control system not only reduces human intervention but also minimize water wastage making the system both cost-effective and environmentally sustainable. In addition to its immediate benefits, the project also provides a scalable platform for future enhancement making it adaptable to a wide range of applications. The project not only highlights importance of automation and conserving resources but also contributes to the ongoing efforts in water conservation and sustainable resource management. Overall, this project provides a practical scalable solution for efficient water management in various applications

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