NANDHA ENGINEERING COLLEGE

ERODE–638052 (Autonomous)

(Affiliated to Anna University, Chennai)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

22AIC14 – INTERNET OF THINGS AND ITS APPLICATIONS

MINI PROJECT REPORT ON

TOPIC - WATER LEVEL, PUMPING AND QUALITY MONITORING SYSTEM

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IN

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

NANDHA ENGINEERING COLLEGE

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled " WATER LEVEL, PUMPING AND QUALITY MONITORING SYSTEM " is the Bonafide work of BHARANI S (22AI004), BHARANIDHARAN G (22AI005), KEERTHIVARSAN D (22AI022) who carried out the work under my supervision.

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WATER LEVEL, PUMPING AND QUALITY MONITORING PROJECT

AIM:

The aim of the water level, pumping, and quality monitoring system project is to automate and optimize water management through real-time monitoring of water levels and quality, while enhancing pumping operations for efficient resource use and sustainability.

SCOPE:

The scope of this Water Level, Pumping, and Quality Monitoring System is to automate the monitoring and management of water levels and quality. It ensures efficient water usage by controlling the pump based on water levels, preventing overflow or dry running. Additionally, it monitors water quality by measuring pH levels, ensuring the water remains within safe or acceptable parameters. This system minimizes human intervention, enhances water management, and ensures safe water conditions.

BRIEF HISTORY:

The Water Level, Pumping, and Quality Monitoring System project evolved from the need for efficient water management in various applications like agriculture, water treatment, and residential water systems. Initially, water level monitoring was done manually, leading to inefficiencies such as overflow or dry running of pumps. With the advancement of sensors (ultrasonic for level detection and pH sensors for quality monitoring), automated systems became more feasible. This project integrates these technologies to create a fully automated solution for real-time water management and quality monitoring, improving operational efficiency and reducing human intervention.

PROPOSED METHODOLOGY:

The methodology for the Water Level, Pumping, and Quality Monitoring System involves:

1. System Setup: Select components like the ultrasonic sensor for water level detection, pH sensor for water quality, and a pump motor controlled by a microcontroller.
2. Water Level Monitoring: Use the ultrasonic sensor to measure distance, calculate water level, and control the pump based on thresholds (ON/OFF).
3. pH Monitoring: Measure water pH using the pH sensor, and display whether the water is acidic, neutral, or alkaline.
4. User Interface: Display water level and pH on an LCD and show pump status (ON/OFF).
5. Integration: Integrate all components into a system that continuously monitors and manages water level and quality.

COMPONENTS REQUIRED:

S.NO	HARDWARE	QUANTITY
1	Arduino UNO	1
2	Ultrasonic sensor (HC-SR04)	1
3	pH sensor	1
4	Relay module	1
5	DC motor	1
6	LCD display (16×2)	1
7	I2C module	1
8	Breadboard	1
9	Jumper Wires	As required
10	USB Cable	1
11	Power supply (Battery)	1

DESCRIPTION:

The Water Level, Pumping, and Quality Monitoring System is an automated solution designed to efficiently manage water levels and monitor water quality. It integrates multiple sensors and a microcontroller to automate the process of maintaining appropriate water levels and ensuring the water quality remains safe.

The system uses an ultrasonic sensor to measure the distance between the sensor and the water surface, allowing the calculation of the water level in the tank.

Based on preset thresholds, the system automatically controls a pump motor to either fill the tank when the water level is low or stop the pump when the tank is full. This prevents overflow and dry running, ensuring the pump operates efficiently.

Additionally, the system employs a pH sensor to continuously monitor the pH of the water, indicating whether the water is acidic, neutral, or alkaline. This is essential for ensuring water quality, especially in applications like irrigation or drinking water.

The real-time data from both the water level and pH sensor are displayed on a 16x2 LCD screen, providing clear and immediate feedback to the user. The entire system is controlled by a microcontroller such as an Arduino, which processes sensor data, controls the pump, and updates the display.

This system is suitable for various applications, including residential water tanks, agricultural irrigation, and industrial water management, offering an efficient, low-maintenance solution for water resource management and quality control.

PROTOCOLS:

- I2C Protocol:
  • Used for communication between the Arduino and the LCD with the I2C module.

  • Sends data using two wires: SDA (data) and SCL (clock).

- Digital Signals:
  • Used by the ultrasonic sensor for sending and receiving sound pulses.

  • Also used to control the pump through the relay module.

- Analog Signals:
  • Used by the pH sensor to send water quality data to the Arduino.
- Serial Communication:
  • Used to display system data (water level, pH, pump status) on the Serial Monitor via USB.

CODING:

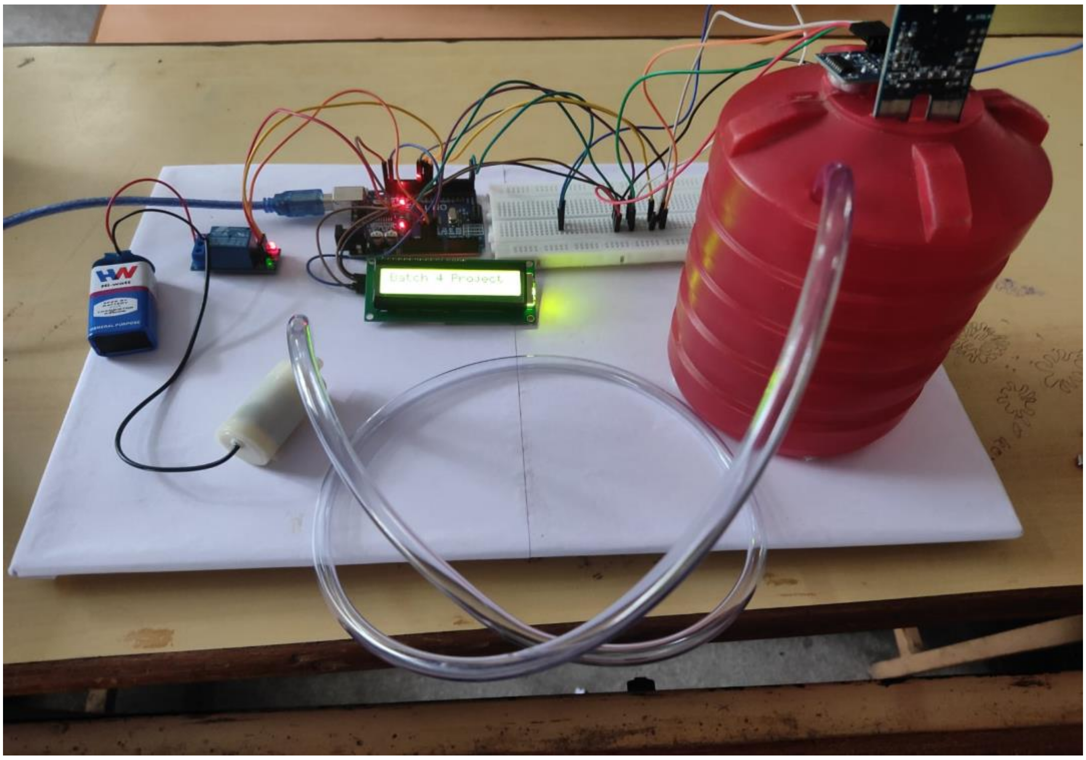
```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2);

#define PH_PIN A0


const float offset_voltage = 2.5;

const float voltage_to_pH_slope = -5.0;


float voltage, pH_value;

#define TRIG_PIN 9

#define ECHO_PIN 10

#define PUMP_PIN 8


const int MIN_DISTANCE = 2;

const int MAX_DISTANCE = 10;
```

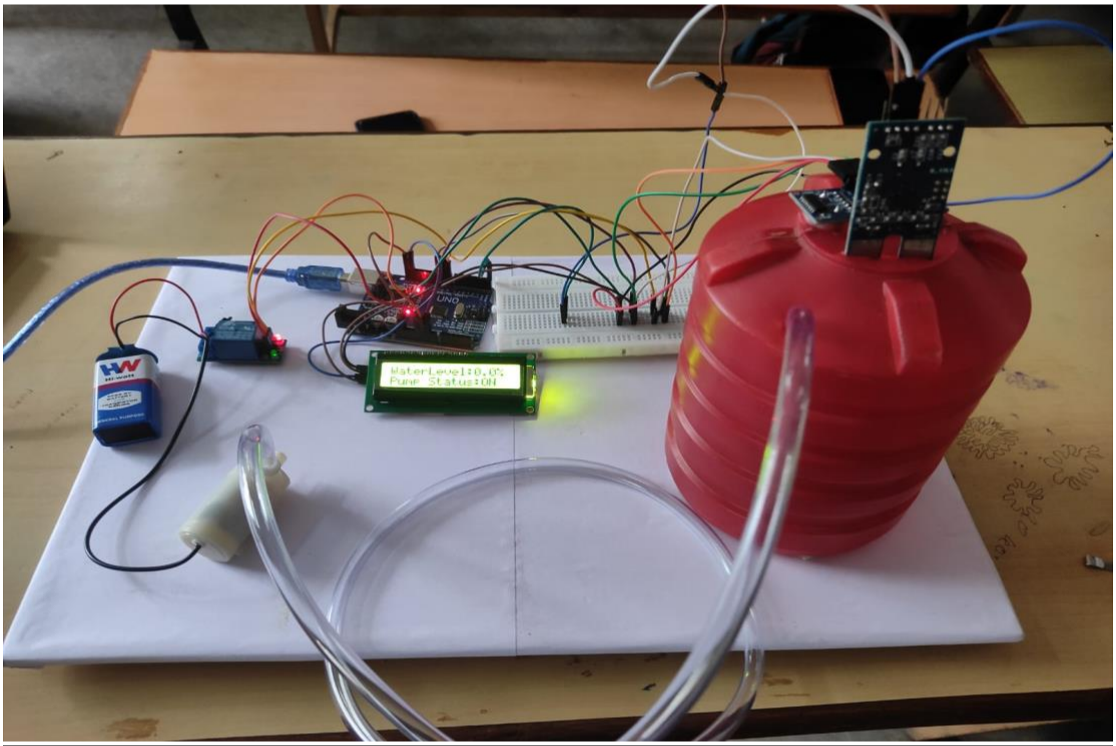
```
void setup() {
  pinMode(TRIG_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  pinMode(PUMP_PIN, OUTPUT);
  Serial.begin(9600);
  lcd.init();
  lcd.backlight();
  lcd.setCursor(0,0);
  lcd.print("Batch 4 Project");
  delay(2000);
  lcd.clear();
  pinMode(PH_PIN, INPUT);
}

void loop() {
  long duration, distance;
  digitalWrite(TRIG_PIN, LOW);
  delayMicroseconds(2);
  digitalWrite(TRIG_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG_PIN, LOW);
  duration = pulseIn(ECHO_PIN, HIGH);
  distance = duration * 0.034 / 2;
  int maxLevel = 12;
  int waterHeight = max(0, maxLevel - distance);
  float waterLevelPercentage = (waterHeight / (float)maxLevel) * 100;
  Serial.print("Water level: ");
  Serial.print(waterLevelPercentage);
```

```
Serial.print(" %");
lcd.setCursor(0, 0);
lcd.print("WaterLevel:");
lcd.print(waterLevelPercentage, 1);
lcd.print("%   ");
if (distance > MAX_DISTANCE)
{
  digitalWrite(PUMP_PIN, LOW);
  Serial.println("Pump ON");
  lcd.setCursor(0, 1);
  lcd.print("Pump Status:ON  ");
}
else if (distance <= MIN_DISTANCE)
{
  digitalWrite(PUMP_PIN, HIGH);
  Serial.println("Pump OFF");
  lcd.setCursor(0, 1);
  lcd.print("Pump Status:OFF ");
}
delay(3000);
const int numReadings = 10;
  float total = 0.0;
  for (int i = 0; i < numReadings; i++) {
      total += analogRead(PH_PIN);
      delay(10); // Short delay between readings
  }
  float averageReading = total / numReadings;
  voltage = (averageReading * 5.0) / 1023.0;
  pH_value = (voltage - offset_voltage) * voltage_to_pH_slope + 7.0;
```

```
  Serial.print("pH Value: ");
  Serial.println(pH_value, 2);


  lcd.setCursor(0, 0);
  if (pH_value >= 6.5 && pH_value <= 8.5) {
    Serial.println("Water is safe");
    lcd.print("Water Safe     ");
  }
  else
  {
    Serial.println("Water Unsafe");
    lcd.print("Water Unsafe     ");
  }
  delay(2000);
}
```

OUTPUT SCREENSHOT:





LIMITATIONS:

- Limited Water Quality Monitoring: The system only monitors pH levels, not other important water quality factors like turbidity, temperature, or chemical contaminants.
- Power Dependence: The system relies on a continuous power supply, making it vulnerable to power outages, which could disrupt operation.
- Lack of Remote Access: The system does not support remote monitoring or control, limiting its flexibility and real-time management from distant locations.
- Single-Tank Operation: The system is designed for monitoring and managing a single water tank, and would require modifications to handle multiple tanks simultaneously.

FUTURE ENHANCEMENTS:

Future enhancements for the Water Level, Pumping, and Quality Monitoring System could include IoT integration for remote monitoring and control, along with data logging to analyze trends and improve efficiency. Adding sensors for turbidity, temperature, and conductivity would enhance water quality monitoring. Advanced features like variable-speed pump control, solar power integration, and an alert system for critical conditions could further optimize the system. Additionally, multi-tank support, automatic sensor calibration, and fail-safe mechanisms would increase reliability. Implementing AI and machine learning could predict water usage patterns, making the system smarter and more responsive to user needs

CONCLUSION:

In conclusion, the Water Level, Pumping, and Quality Monitoring System provides an efficient automated solution for water management. Using ultrasonic and pH sensors, it monitors water levels and quality in real time. The system automatically controls the pump to maintain optimal levels, preventing overflow or dry running, while continuously assessing water quality. With a clear LCD display, it reduces manual intervention and ensures efficient water use. Ideal for residential, agricultural, and industrial applications, the system ensures reliable water management, quality control, and minimal water wastage.