Sludge detection in water tanks

By Siddharth Nair

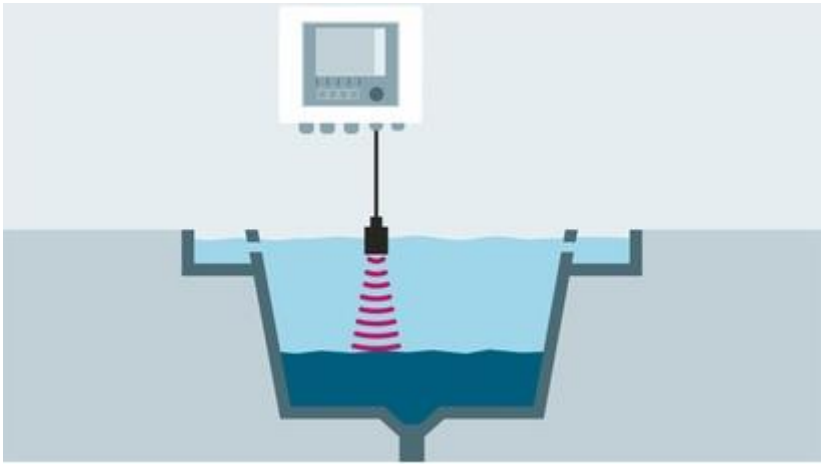
Problem Statement

Water tanks, especially those used in residential, commercial, and industrial settings, often accumulate sludge over time due to sedimentation and impurities. The buildup of sludge can contaminate water, reduce storage capacity, and damage equipment. Regular cleaning is essential, but manual monitoring is inefficient and unreliable. There is a need for an automated system to monitor sludge levels and alert users when cleaning is necessary. Hence, we develop a microcontroller based prototype which will alert the user to clean the water tank as the sludge level is more

Scope of solution

This solution aims to develop a microcontroller-based prototype that monitors sludge levels in water tanks and provides alerts when the sludge exceeds a predetermined threshold. The system is designed to be low-cost, easy to install, and reliable.

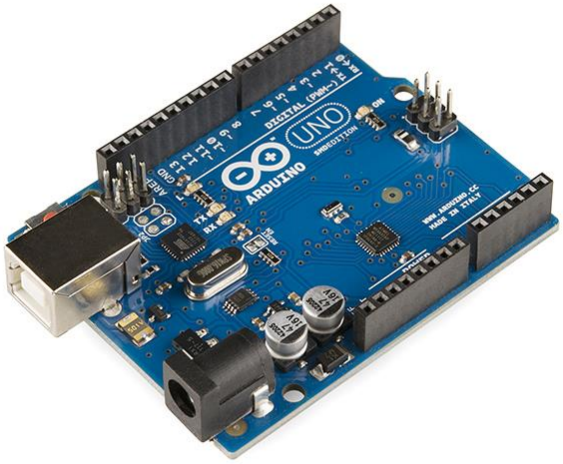
The microcontroller-based prototype acts as a starting point for a clean water tank alert system. It uses an ultrasonic sensor to monitor sludge level and triggers visual (LED) alerts when it exceeds a set threshold. While offering a basic local alert system, it doesn't include remote notification or sophisticated cleaning automation. However, the core concept can be expanded upon to include features like Wi-Fi connectivity for remote monitoring, advanced cleaning control with pumps or valves, data logging for analysis, and a user interface for interaction. By incorporating these potential advancements, the system can evolve into a comprehensive and user-friendly solution for clean water tank management.



Required Components

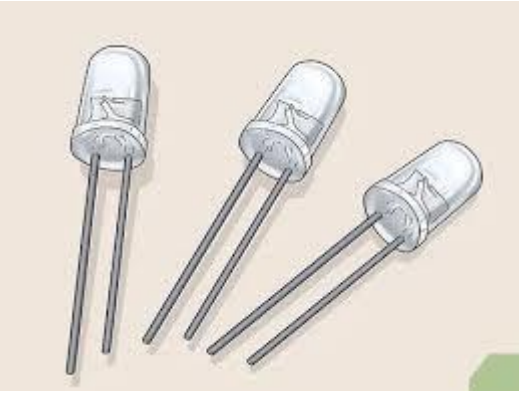
1. Hardware components

- Arduino UNO

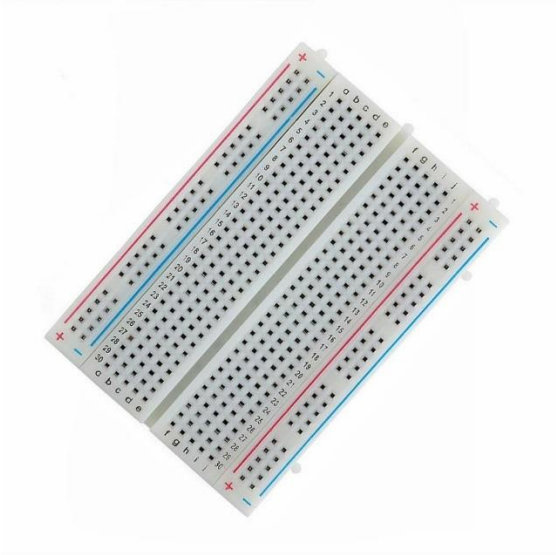


- Ultrasonic sensor (for measuring sludge level) HC-SR04

- LED (for visual alert)



- Breadboard



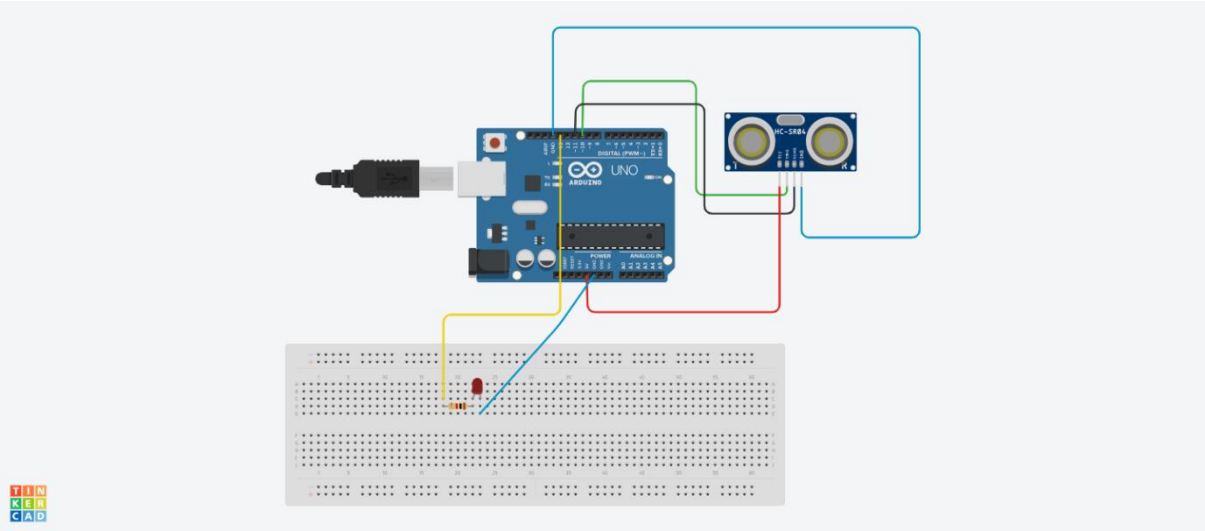
- Jumper wires

- Transparent box

2. Software components

- Arduino IDE

Simulated Circuit



Connections for Ultrasonic sensor

- VCC to 5V on the microcontroller.
- GND to GND on the microcontroller.
- Trig to a digital pin 10 on the microcontroller.
- Echo to a digital pin 11 on the microcontroller.

Connections for led

- Connect a resistor to the anode of the LED and connect the other end of the resistor to digital pin 13.
- Connect the cathode to GND on the microcontroller.

Gerber File

It is not required in this prototype

Code of the solution

Code written in embedded C

```
#define trigPin 10 // Trigger pin for ultrasonic sensor
#define echoPin 11 // Echo pin for ultrasonic sensor
#define ledPin 13  // LED pin
#define threshold 10  // Threshold distance for sludge level (cm)

long duration; // Stores echo pulse duration
int distance;     // Stores calculated distance

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(ledPin, OUTPUT);
  Serial.begin(9600); //setting baud rate as 9600
}

void loop() {
  // Trigger ultrasonic sensor
```

```
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Measure echo pulse duration
  duration = pulseIn(echoPin, HIGH);

  // Calculate distance
  distance = duration * 0.034 / 2;

  // Check sludge level
  if (distance < threshold) {
    digitalWrite(ledPin, HIGH);  // Turn on LED
  } else {
    digitalWrite(ledPin, LOW);   // Turn off LED
  }
Serial.print("Distance:");
Serial.print(distance);
Serial.print("cm");

}
```