

Sludge Level Monitoring

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Problem Statement:

The problem statement is to create a prototype using a microcontroller that can alert the user when the sludge level in a water tank exceeds a certain threshold, indicating that the tank needs cleaning. In other words, the goal is to design a system that monitors the sludge or sediment level in the water tank and provides a timely notification to the user when maintenance or cleaning is required to ensure the water quality and tank efficiency.

Extending the problem statement to an IoT system enhances its capabilities by providing real-time monitoring, predictive alerts, and potential automation, making it a more sophisticated and user-friendly solution for water tank maintenance.

Scope of Solution:

1. Measurements considered while tank is empty.
2. In real time, the sludge level need to be considered based on outlet valve diameter.
3. Throughout the calculation, considered only sound travel in air.
4. Speed of sound in air is considered 343m/s at 20°C (ambient varies)

This project has wide applications and can replace the traditional sludge indicators in Power plant, Paint plant, leather industry, Die and clothing industry, Chemical industry, Ro and water treatment plant.

Note:

- If we have to measure the sludge level in the water, we need insulated ultrasonic sensors.
- For project purpose, we use non-insulated ultrasonic sensors based on availability.

Components Used:

IDE: Arduino IDE

Software/Programming Language: C++

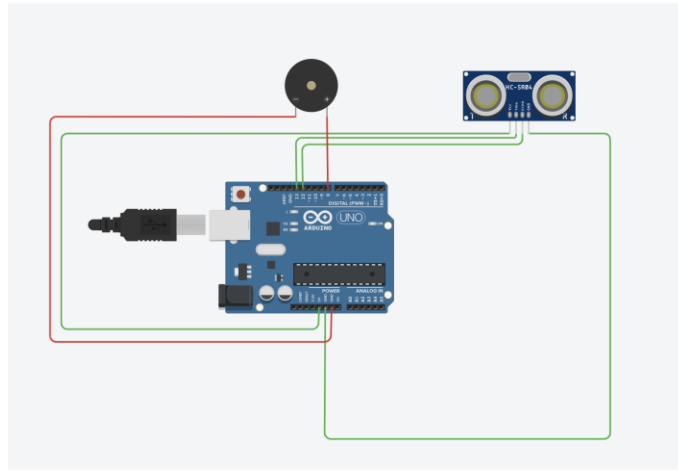
Hardware Components: Arduino UNO R3 board, Ultrasonic Sensor (HC-SR04), Piezo Buzzer

Simulated Circuit:

Platform TinkerCAD:

Link:

<https://www.tinkercad.com/things/8AwyxCqZljW>



Demo:

Google Drive link for Hardware Demo:

https://drive.google.com/file/d/1WaAStDnz8XK_UjMz4r0-shEL-f6jo5h/view?usp=sharing

Code for Solution:

```
#include <Ultrasonic.h>

int trigPin=13;
int echoPin=12;// Trig pin (13), Echo pin (12)
int buzzerPin = 8; // Change this to the actual buzzer pin
int sludgeLevelThreshold = 4; // Threshold distance in centimeters
long duration, distance;
void setup() {
  Serial.begin(9600);
  pinMode(trigPin,OUTPUT);
  pinMode(echoPin,INPUT);
  pinMode(buzzerPin, OUTPUT);
}

void loop() {
  delay(100); // Delay to stabilize readings
```

```

digitalWrite(trigPin, LOW);
delayMicroseconds(5);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance= duration/58.2; //conversion for centimeters
Serial.println(distance); //in centimeters
Serial.println(" cm");

if (distance < sludgeLevelThreshold) {
  Serial.println("Sludge level high!");
  soundBuzzer();
}
}

void soundBuzzer() {
  // Generate a tone on the buzzer
  tone(buzzerPin, 1000, 1000); // 1000 Hz for 1 second (1000 milliseconds)
  delay(1000); // Pause for 1 second

  // Stop the tone
  noTone(buzzerPin);
}

```

Gerber File:

Uploaded in GitHub Repository

Github Repository Link: <https://github.com/SrilakshmiPriyaV/Project.git>

Result:

The circuit has been implemented using a non insulated ultrasonic sensor. Hence, we measure the sludge level assuming the tank is empty. To measure the sludge level when under water in the tank, we require sensor which is insulated for the water condition.

Recommendations:

- Adding a sensor which measure temperature and humidity measurements can help in the accuracy of the measurement of speed of sound.

- For calculating sludge in presence of water like half filled or full filled tank, speed of sound travels between air and water. So water level measurement sensor additioned to the circuit can help accurately measure the distance of sludge based on the level of water.