WaterGuard Alert System Project Report

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Introduction

The WaterGuard Alert System is an Arduino-based project designed to monitor water levels using a water sensor and provide visual and auditory feedback through LEDs and a buzzer. The system aims to detect varying water levels and alert users through distinct LED indicators and buzzer patterns, making it suitable for applications such as flood detection, water tank monitoring, or environmental sensing.

Objectives

The primary objectives of the WaterGuard Alert System are:

- To accurately measure water levels using an analog water sensor.
- To provide visual feedback through three LEDs (Green, Yellow, Red) based on water level thresholds.
- To implement auditory alerts with a buzzer, producing distinct sound patterns for different water levels.
- To ensure reliable and real-time monitoring with clear user feedback.

Hardware Components

The system utilizes the following components:

- Arduino Uno

- Water sensor (analog output)
- LEDs: Green (Pin 8), Yellow (Pin 12), Red (Pin 13)
- Buzzer (Pin 7)
- Resistors (220Ω for LEDs)
- Breadboard and jumper wires

System Design

The system reads analog data from the water sensor connected to pin A0. Based on the sensor value, it activates one of three LEDs and triggers specific buzzer patterns:

- Low water level (20–100): Green LED on, single 500Hz beep.
- Medium water level (101–200): Yellow LED on, double 1000Hz beeps.
- High water level (>200): Red LED on, triple 1500Hz beeps.

The Arduino processes the sensor data in real-time, outputting values to the Serial Monitor for debugging and monitoring.

Implementation

The following Arduino code drives the WaterGuard Alert System:

```
#define LED_RED 13
#define LED_YELLOW 12
#define LED_GREEN 8
#define BUZZER 7

void setup(){
  Serial.begin(9600);
  pinMode(LED_RED, OUTPUT);
  pinMode(LED_YELLOW, OUTPUT);
  pinMode(LED_GREEN, OUTPUT);
  pinMode(BUZZER, OUTPUT);
}

void loop(){
  int sensor = analogRead(A0);
  Serial.println(sensor);

  // Reset all outputs
  digitalWrite(LED_GREEN, LOW);
  digitalWrite(LED_YELLOW, LOW);
  digitalWrite(LED_RED, LOW);
  noTone(BUZZER);

  if (sensor > 20 && sensor <= 100) {
    digitalWrite(LED_GREEN, HIGH);
```

```
    tone(BUZZER, 500, 200);
    delay(200);
  }
  else if (sensor > 100 && sensor <= 200) {
    digitalWrite(LED_YELLOW, HIGH);
    tone(BUZZER, 1000, 200);
    delay(200);
    noTone(BUZZER);
    delay(200);
    tone(BUZZER, 1000, 200);
    delay(200);
  }
  else if (sensor > 200) {
    digitalWrite(LED_RED, HIGH);
    tone(BUZZER, 1500, 300);
    delay(300);
    noTone(BUZZER);
    delay(100);
    tone(BUZZER, 1500, 300);
    delay(300);
    noTone(BUZZER);
    delay(100);
    tone(BUZZER, 1500, 300);
    delay(300);
  }
}
```

Setup and Operation

To set up the system:

1. Connect the water sensor to analog pin A0 and power it with 5V and GND.
2. Connect LEDs to pins 8 (Green), 12 (Yellow), and 13 (Red) with 220Ω resistors to GND.
3. Connect the buzzer's positive pin to pin 7 and negative pin to GND.
4. Upload the provided code to the Arduino.
5. Open the Serial Monitor at 9600 baud to view sensor readings.

The system activates automatically, providing real-time feedback based on water levels.

Results and Performance

The WaterGuard Alert System successfully detects water levels and provides distinct visual and auditory feedback. The LEDs clearly indicate the water level range, while the buzzer's unique patterns enhance user awareness. The system is responsive, with minimal delay, and the Serial Monitor output aids in calibration and debugging. Testing showed reliable differentiation between low, medium, and high water levels.

Challenges and Solutions

- **Challenge**: Sensor noise affecting readings.
- **Solution**: Implemented threshold ranges (e.g., >20) to filter out minor fluctuations.
- **Challenge**: Buzzer sound overlap.
- **Solution**: Added noTone() and delays to ensure clear, distinct beep patterns.

Conclusion

The WaterGuard Alert System is a reliable and effective solution for water level monitoring. It combines visual and auditory feedback to ensure users are promptly informed of water level changes. The project demonstrates the practical application of Arduino-based sensor systems and offers potential for further enhancements in environmental monitoring applications.