**Water Level Indicator**

**Overview**

The water level indicator system measures the water level in a tank and provides a visual and audio representation of the level. It can also control a water pump (using a relay) to automatically maintain the water level. The system ensures the prevention of water overflow or pump dry run.

**Components and Their Roles**

1. **Arduino Uno**  
   Acts as the main controller, processing sensor data and controlling outputs like the LCD, LEDs, and relay.
2. **Ultrasonic Sensor (e.g., HC-SR04)**  
   Measures the water level by sending ultrasonic waves and calculating the time taken for the echo to return.
3. **LCD Display (16x2)**  
   Displays the water level percentage and status messages like "Tank Full" or "Low Water Level."
4. **Potentiometer**  
   Adjusts the contrast of the LCD display for better visibility.
5. **Relay Module**  
   Controls the water pump based on the water level. It acts as a switch for the pump.
6. **Push Button**  
   Used to manually start or stop the water pump.
7. **Slide Button**  
   Toggles between automatic and manual pump operation modes.
8. **LEDs (Green, Yellow, Red)**  
   Indicate water levels visually:
   * Green: High level
   * Yellow: Medium level
   * Red: Low level
9. **Buzzer (Optional)**  
   Provides an audio alert for critical conditions like an empty or full tank.

**Working Principle**

1. **Water Level Measurement**
   * The ultrasonic sensor sends ultrasonic waves, which reflect from the water surface.
   * The sensor calculates the distance to the water level based on the time taken for the echo to return.
   * The Arduino maps this distance to a percentage of the tank's total height.
2. **Display and Indicators**
   * The measured water level is shown on the LCD in percentage.
   * LEDs light up based on the water level: Red for low, Yellow for medium, Green for high.
3. **Pump Control**
   * In **automatic mode**, the relay switches the pump ON when the water level is below a threshold (e.g., 30%) and OFF when it reaches a set level (e.g., 90%).
   * In **manual mode**, the pump can be controlled using the push button.
4. **Alert System**
   * The buzzer sounds an alert for critical water levels (e.g., below 10% or overflow).
   * LEDs visually represent the current water level.
5. **Adjustable Features**
   * The potentiometer allows adjustment of LCD contrast.
   * Slide button toggles between automatic and manual modes.

**Advantages**

* Prevents water wastage by automating the pump operation.
* Easy to monitor water levels remotely.
* User-friendly design with both automatic and manual control options.
* Alerts for critical conditions enhance safety.

Project Link:- https://wokwi.com/projects/415786025749136385