Ultrasonic Distance-Based LED Indicator

This Arduino project is designed to **measure distance** using an **ultrasonic sensor** (HC-SR04) and visually represent that distance through a set of **four LEDs**. As the object gets farther from the sensor, more LEDs light up to indicate the range.

Hardware Components Used:

- **Arduino Uno**
- **HC-SR04 Ultrasonic Sensor** (trigPin = 9, echoPin = 10)
- **4 LEDs** (led1 to led4 connected to pins 2 to 5)
- **Resistors for LEDs** (typically 220Ω)
- **Breadboard & Jumper Wires**
- **Power Source**

Working Principle:

1. The **HC-SR04 sensor** sends out an ultrasonic pulse from the **trigger pin**.
2. It waits to receive the echo on the **echo pin**.
3. Based on the time it takes to receive the echo, the distance is calculated using the formula: (distance = duration * 0.034/2;)
4. Depending on the distance range, a different number of LEDs are turned ON:

    - **20–40 cm**: LED1 ON
    - **41–60 cm**: LED1 & LED2 ON
    - **61–80 cm**: LED1, LED2 & LED3 ON
    - **81–100 cm**: All LEDs ON
    - **Other distances** (below 20 or above 100 cm): All LEDs OFF

Purpose / Applications:

- **Obstacle detection system**
- **Water level indicator**
- **Social distancing alert system**
- Educational tool for learning sensor integration and conditional control in embedded systems.

Project Highlights:

- Simple yet effective use of ultrasonic sensing
- Real-time distance feedback
- Clear visual representation with LEDs
- Scalable to more LEDs or LCD displays