**Intruder Detection System Using Arduino Uno**

**Components Required:**

1. **Arduino Uno**
2. **Ultrasonic Sensor (HC-SR04)**
3. **Buzzer**
4. **LED**
5. **Resistor (220 ohms for LED)**
6. **Breadboard and Jumper Wires**
7. **Ultrasonic Sensor (HC-SR04)**
   * VCC to 5V on Arduino
   * GND to GND on Arduino
   * Trig to Digital Pin 9 on Arduino
   * Echo to Digital Pin 10 on Arduino
8. **Buzzer**
   * Positive terminal to Digital Pin 11 on Arduino
   * Negative terminal to GND on Arduino
9. **LED**
   * Anode (long leg) to Digital Pin 12 on Arduino
   * Cathode (short leg) to one end of the resistor
   * Other end of the resistor to GND

**Explanation of the Working Process:**

1. **Ultrasonic Sensor**: The HC-SR04 ultrasonic sensor emits a sound wave and measures the time it takes for the echo to return. This time is used to calculate the distance to an object in front of the sensor.
2. **Triggering the Sensor**: In the code, the **trigPin** is set to HIGH for 10 microseconds to trigger the ultrasonic sensor. After that, it is set back to LOW.
3. **Measuring Distance**: The **pulseIn()** function reads the duration of the echo signal on the **echoPin**. The distance is calculated using the formula: [ \text{Distance} = \frac{\text{Duration} \times 0.034}{2} ] where 0.034 cm/µs is the speed of sound.
4. **Intruder Detection**: The system checks if the measured distance is less than a predefined threshold (20 cm in this case). If an object is detected within this range, the buzzer and LED are activated.
5. **Buzzer and LED Activation**: When an intruder is detected, the buzzer sounds an alarm, and the LED lights up to indicate the presence of an intruder. If no intruder is detected, both the buzzer and LED are turned off.
6. **Looping**: The **loop()** function continuously checks for the distance and updates the state of the buzzer and LED accordingly.

**Conclusion:**

This Intruder Detection System is a simple yet effective way to monitor a designated area. By using an ultrasonic sensor, it can detect objects within a certain range and alert users through sound and light. This project can be further enhanced by integrating additional features such as remote notifications or a camera for visual monitoring.

**PROJECT LINK: https://wokwi.com/projects/414797835925569537**