International Islamic University Chittagong

Open Ended Lab project

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Project Information

Project Name :	Infrared Presence Alarm
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Submitted To

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Remarks :

Contents

IR Presence Alarm:

In today's world, security and monitoring systems are increasingly important for protecting valuable objects and spaces. The IR Presence Alarm is a compact, hardware-based system that uses an infrared LED transmitter and receiver to monitor a designated area. When the infrared beam is interrupted—such as when an object is removed or someone crosses the detection path—the system triggers a buzzer to provide an immediate audible alert. This setup is similar in concept to museum display alarms, where items are secured and any unauthorized removal causes an instant warning.

Pointed Features of the Design:

The IR Presence Alarm offers a simple and cost-effective security solution using an IR sensor to detect obstruction in its path. When movement or object removal interrupts the IR signal, the circuit activates a buzzer to alert the user instantly. The system is low-power, easy to build, and suitable for doors, windows, showcases, or restricted spaces. With easily available electronic components and a straightforward functioning mechanism, this design provides a reliable DIY option for basic security and monitoring applications.

Circuit Description:
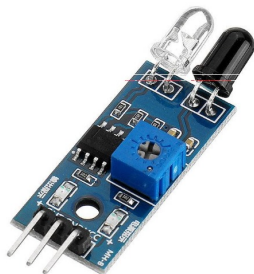
A. Hardware Description:

Figure 1: IR sensor detects infrared reflection. When the beam breaks, it signals the system to trigger an alarm.

Figure 2: Arduino Uno R3 controls the entire circuit, reads sensor values and drives output devices. It also receives code uploads via USB.
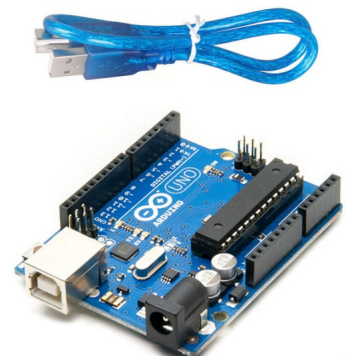
Figure 3: Yellow LED provides visual feedback — turns ON during alarm or system activity.

Figure 4: A buzzer sounds immediately when the IR beam is interrupted, providing an audible alert.

Figure 5: 10kΩ resistor stabilizes input signals acting as pull-up/pull-down resistance.

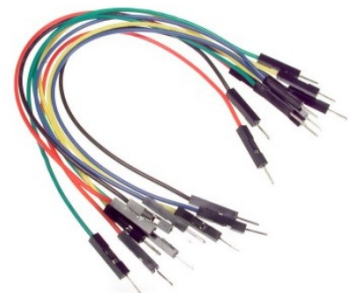Figure 6: Jumper wires ensure connections between Arduino, IR module, buzzer and LED.

Figure 7: 180Ω resistor protects the LED from overcurrent and prevents damage.

B. Software Description:

1. **Arduino IDE:** The Arduino hardware and software platform was designed for artists, designers, hobbyists, beginners, and anyone interested in creating interactive objects or environments. Arduino can easily interact with a wide range of components such as buttons, LEDs, motors, speakers, GPS modules, cameras, the internet, and even smartphones or TVs. The Arduino IDE allows users to write, compile, and upload code to the Arduino board efficiently, making it accessible for both learning and prototyping interactive projects.

2. **Cirkit Designer:** Cirkit Designer is a user-friendly online platform for designing and simulating electronic circuits. It is widely used by students, hobbyists, and educators to create, test, and visualize circuits before actual implementation. The software allows users to simulate the behavior of components such as LEDs, resistors, sensors, and microcontrollers, helping them understand circuit functionality and debug designs efficiently. Cirkit Designer offers an interactive interface with drag-and-drop components and provides real-time feedback, making it an ideal tool for learning electronics and prototyping projects without the need for physical hardware.

C. Circuit Diagram:
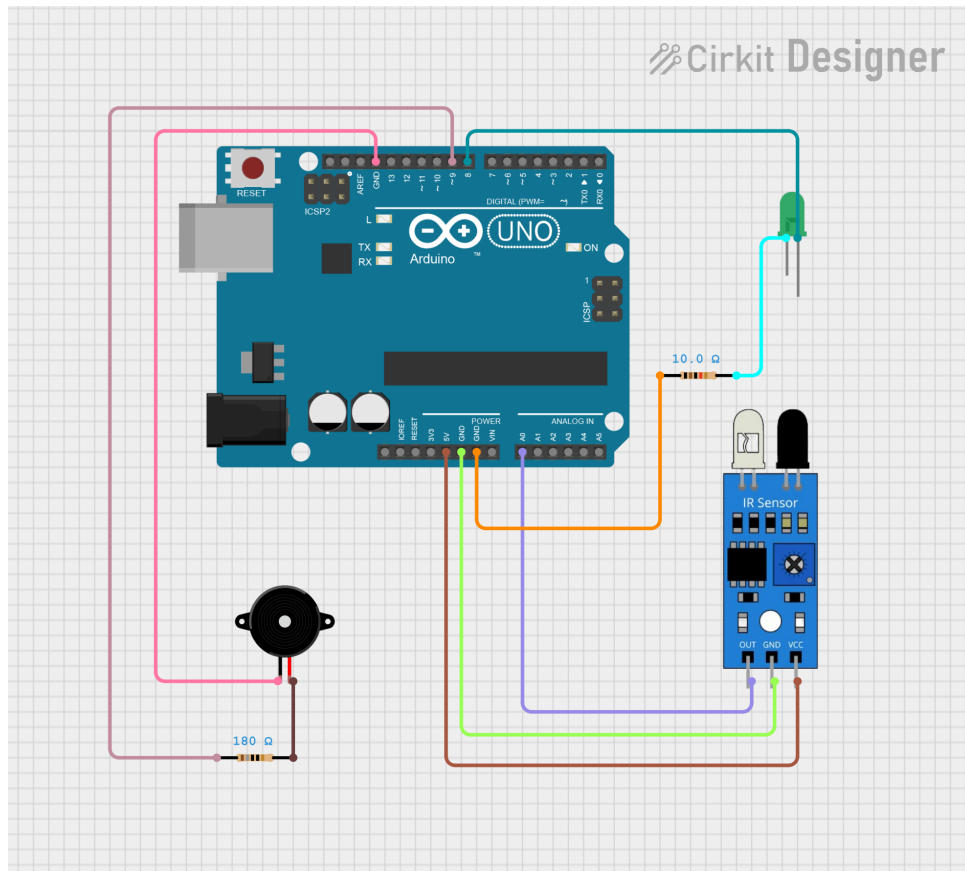

Figure 9: Circuit Diagram for IR Presence Alarm.

Description of the program/code:

```
int sensor = A0;                                    // IR sensor pin at A0.
int buzzer = 9;                                     // Buzzer pin at 9.
int led = 8;                                        // LED pin at 8.
int threshold = 80;                 // Detection threshold; adjust per calibration.
void setup() {                              // Setup function for initial setup.
    pinMode(buzzer, OUTPUT);                      // Buzzer pin as output.
    pinMode(led, OUTPUT);                           // LED pin as output.
    Serial.begin(9600);                         // Start serial at 9600 baud.
    digitalWrite(buzzer, LOW);                    // Buzzer off initially.
    digitalWrite(led, LOW);                          // LED off initially.
}
void loop() {                                 // Loop function that repeats.
    int val = analogRead(sensor);                 // Read IR sensor value.
    Serial.println(val);                          // Print value to serial.
    if(val <= threshold) {                          // If object detected.
    digitalWrite(buzzer, LOW);                          // Buzzer off.
    digitalWrite(led, LOW);                                // LED off.
    }
    else {                                              // If no object.
    digitalWrite(buzzer, HIGH);                         // Buzzer on.
    digitalWrite(led, HIGH);                               // LED on.
    }
    delay(100);                             // Delay 100ms for stability.
}
```
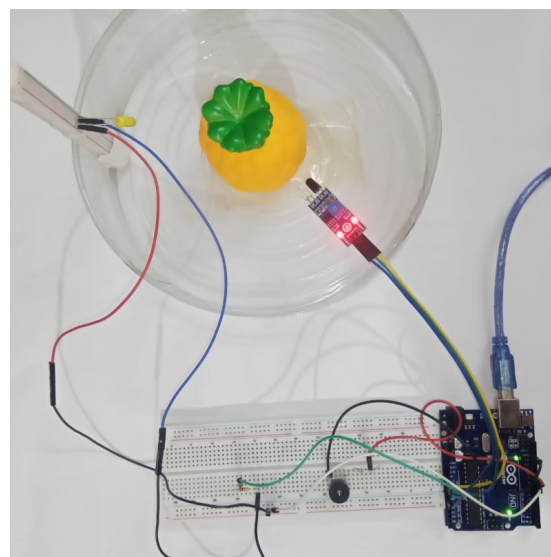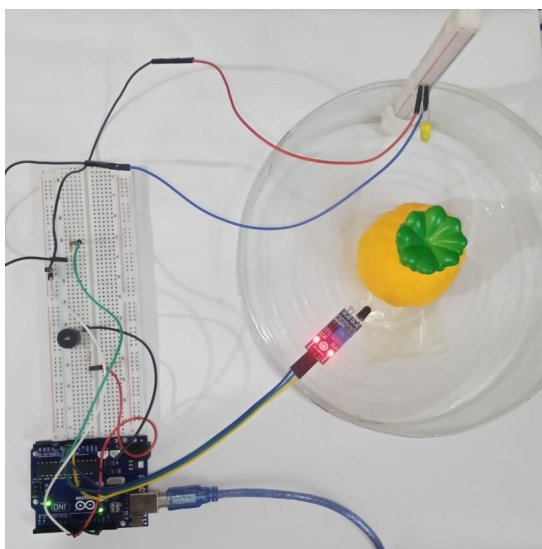
Hardware Working Snapshots:

Figure 10: Side-by-side hardware snapshots of the IR Presence Alarm(Working video posted on :GitHub).

Cirkit Designer Simulation Output:

All circuit components for the IR Presence Alarm were created and configured in Cirkit Designer for simulation purposes. However, the IR sensor module is not available in the simulator, so its behavior has been represented using equivalent components and logic to demonstrate the system's response. The simulation allows verification of the buzzer and LED activation when the detection conditions are triggered. Although the IR sensor is not available in Cirkit Designer, the physical module was tested separately to verify its proper operation in the real circuit.

Comparison of Cost:

Component	Quantity	Cost (BDT)
Long-range IR Sensor	2	1500
Arduino Mega2560	1	1200
Buzzer	1	20
Pushbutton	1	2
470Ω Resistor	1	3
NPN Transistor	1	5
Jumper Wires	1 set	20
Total cost	-	2750

Table 1: Components and cost of reference project

Contrast with the reference project, we can undoubtedly decrease cost by using a single IR sensor module instead of two long-range IR sensors and replacing the Arduino Mega with an Arduino Uno. This shows that our design is a minimal expense yet effective solution for basic security applications.

Component	Quantity	Cost (BDT)
Arduino Uno R3 + USB cable	1	900
IR Sensor Module	1	30
Buzzer	1	20
LED (yellow)	1	2
$10k\Omega$ Resistor	1	3
180Ω Resistor	1	3
Jumper Wires	1 set	20
Total cost	-	978

Table 2: Components and cost of this project

We see that the total cost of this project is significantly lower than the reference project, about (2750 – 978) = 1772 BDT. This shows that our design is a minimal expense yet effective solution for basic security applications.

Discussion:

A significant amount of work has been done on basic security and intrusion-detection systems. In this project, we reviewed and compared different approaches based on their operational mechanisms, cost, and ease of use. Simple hardware-based solutions—such as our IR Presence Alarm—are low-cost, portable, and user-friendly, making them more practical for homes or small spaces compared to complex microcontroller-based systems. Although burglar alarms are widely used today, there remains considerable room for improvement, particularly for smart homes, offices, and connected monitoring systems. Continued development in this area can enhance the reliability, affordability and usability of security systems, making them more effective for everyday applications.

Project Resources:

The complete project files, code, and demonstration video can be accessed at: `https://github.com/afrahackerman/IR-Presence-Alarm`

References:

1. Arduino Uno Board Overview: Arduino Uno

2. All About Circuits: Motion Sensing Alarm with Arduino and IR Sensors: All About Circuits Project

3. YouTube Tutorial on IR Burglar Alarm: YouTube Tutorial

4. ElectroBES: IR Infrared Obstacle Avoidance Sensor Module for Arduino: ElectroBES Module

5. Electronics For You: Infrared Burglar Alarm Project: Electronics For You Project