



**East West University**

**CSE251: Electronic Circuits**

**Section: 9**

**Semester: Spring 2025**

**Project Report**  
**“A Simple Fire Alarm”**

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# Fire Alarm Circuit

## Introduction:

In this project, we have designed a **simple fire alarm system** using easily available electronic components. The system is based on the principle of infrared (IR) light sensing. When a fire or flame is brought close to the IR sensor (infrared LED), it activates a transistor switch (BC547), which in turn triggers an LED and a buzzer, indicating the presence of fire.

## Objectives:

The primary goal of this project is to build a cost-effective and compact fire detection system suitable for basic fire hazard warning purposes. It serves as a practical demonstration of how infrared radiation from flames can be used to activate a simple alarm system.

## Features of Fire Alarm Circuit:

### 1. Simple and Cost-Effective Design

Uses basic electronic components that are inexpensive and readily available in the market.

### 2. Easy to Assemble

Can be built on a breadboard without the need for soldering or complex tools, ideal for beginners and educational projects.

### 3. Low Power Consumption

Operates efficiently on a standard 9V battery and consumes minimal current when in idle mode.

### 4. Quick Response Time

Detects the presence of fire almost instantly due to the sensitivity of the infrared LED and transistor circuit.

### 5. Dual Alert Mechanism

Provides both visual (LED) and audible (buzzer) alarms, ensuring clear indication of fire presence.

### 6. Compact and Portable

Small in size, making it easy to place in tight or hidden areas such as cabinets, small rooms, or storage boxes.

### 7. No Programming Required

The circuit functions without the use of any microcontroller or software, making it accessible to non-programmers.

## Components Used:

Component	Specification/Value
Transistor	BC547 (NPN)
Resistor	460 ohm
Infrared LED	Standard IR (Infrared) LED
Indicator LED	5mm LED
Buzzer	5V Passive Buzzer
Power Supply	9V Battery
Breadboard	For circuit assembly
Connecting Wires	Jumper wires

## Circuit Description:

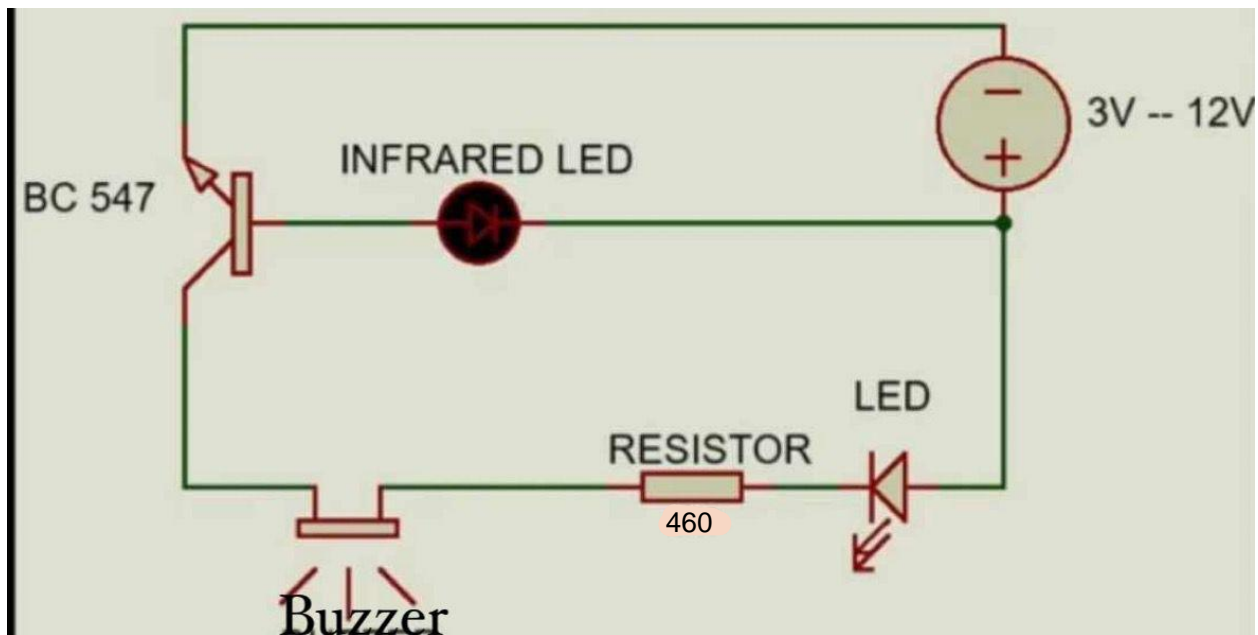
- The **infrared LED** constantly emits IR rays.
- The **BC547 transistor** acts as a switch and is activated when the base receives enough current from the IR LED circuit.
- In the presence of fire, the flame emits infrared radiation, which affects the IR LED's behavior (either by reflecting or interrupting IR beams depending on positioning).
- The transistor gets triggered and allows current to flow from collector to emitter.
- This turns ON the **indicator LED** and activates the **buzzer**, providing a visual and audible fire alert.
- A **460-ohm resistor** is connected in series with the LED to limit the current.

## Working Principle:

1. When there is no fire, the IR LED signal is stable, and the transistor remains OFF, keeping both the LED and buzzer inactive.
2. When fire is brought close to the IR LED, the flame's IR radiation interferes with the circuit.

3. This causes a small current at the base of the BC547, switching it ON.
4. As a result, the current flows through the collector-emitter path, turning on the LED and activating the buzzer.

### Circuit Diagram:



### Applications:

1. **Household Fire Detection**  
This circuit can be placed in kitchens, storerooms, or near electrical appliances to detect early signs of fire and provide an alert.
2. **School and College Projects**  
Ideal for science fairs, engineering coursework, or electronics practicals to demonstrate basic principles of fire detection using IR technology.
3. **Offices and Small Shops**  
Can be installed in small business premises for affordable early fire warning in case of short circuits or flammable material exposure.
4. **Storage Areas**  
Useful in closets, lockers, or inventory storage rooms to detect accidental flames before they spread.

## 5. **DIY Safety Solutions**

Hobbyists can use or expand this basic design to create more advanced home safety systems.

### **Advantages:**

#### 1. **Low Cost**

The components used are affordable, making this a budget-friendly fire detection solution.

#### 2. **Beginner-Friendly**

No microcontroller or programming is involved, making it suitable for students and beginners in electronics.

#### 3. **Fast Response**

The system quickly reacts to fire presence due to the direct influence of IR radiation from flames on the circuit.

#### 4. **Low Power Usage**

Operates on a 9V battery with very low idle power consumption, making it energy efficient.

#### 5. **Easy to Understand and Build**

Simple connections using a breadboard help in easy testing and modification.

#### 6. **Portable**

The compact design allows it to be easily moved and placed anywhere fire detection is needed.

### **Limitations:**

#### 1. **Short Detection Range**

The IR LED and sensor work effectively only in close proximity to the flame (a few centimeters), limiting its use in larger spaces.

#### 2. **False Positives**

Other heat or IR-emitting sources like sunlight or halogen lamps may interfere and trigger the alarm.

#### 3. **Not Weatherproof**

This circuit is not designed to function reliably in outdoor or harsh environmental conditions.

#### 4. **Limited Coverage**

Unlike smoke detectors, this fire alarm detects only visible flames, not smoldering fires or heat buildup.

#### 5. **No Data or Remote Notification**

The system has no connectivity features to alert users remotely (e.g., no SMS, app, or cloud integration).

### **Conclusion:**

This project successfully demonstrates the use of an IR LED and a transistor to detect fire and activate an alarm system. With further enhancement, this simple system could be adapted for larger and more complex environments by integrating sensors with higher sensitivity and microcontroller support.

### **References:**

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