

**IUBAT - International University of Business Agricultural and Technology**

**Final Assignment**

**Project Title:** Fire Alarm

**Course Code:** CSC-329

**Course Title:** Logic Design and Switching Circuit

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**Introduction:**

Fire safety is a critical concern in buildings of all types. Early detection of a fire is essential for minimizing damage and ensuring the safety of occupants. Fire alarm systems play a vital role in achieving this goal by automatically detecting a fire and raising an alert.

This lab report details the simulation of a basic fire alarm system using Proteus, a circuit design and simulation software. The purpose of this simulation is to explore the fundamental principles of fire detection and alarm activation through a virtual environment.

**Designed model:**

The designed fire alarm model consists of the following components:

* **Fire Sensor:** This component simulates a real-world fire sensor, which detects the presence of a fire based on factors like heat or smoke. In Proteus, a suitable model can be chosen, such as an LM35 temperature sensor for heat detection or an MQ-2 smoke sensor model.
* **Comparator:** This component compares the output signal from the fire sensor to a pre-defined threshold voltage. When the sensor detects a fire, the signal level exceeds the threshold, triggering the alarm.
* **Alarm Mechanism:** This component represents the system that generates an audible or visual alert in case of fire detection. In Proteus, a buzzer or LED can be used to simulate the alarm.
* **Power Supply:** A DC power source provides the necessary voltage to operate the circuit components.

The fire sensor, comparator, and alarm mechanism will be connected appropriately using wires and resistors.

**Methodology:**

The following steps were taken to complete the lab:

1. **Component Selection:** Suitable models for the fire sensor, comparator, and alarm mechanism were chosen from the Proteus library.
2. **Circuit Design:** The components were placed in the Proteus schematic editor and connected with wires. Resistor values were selected based on the chosen components' specifications.
3. **Simulation Setup:** The simulation parameters, such as supply voltage and simulation time, were defined.
4. **Scenario Testing:** The simulation was run under different scenarios:
5. **Normal operation:** No fire is present, and the sensor output remains below the threshold.
6. **Fire detection:** The sensor output exceeds the threshold, simulating fire detection, and triggering the alarm.
7. **Result Analysis:** The simulation outputs, such as voltage levels at various points in the circuit, were observed and recorded.

**Result Discussion:**

The simulation results will be presented in terms of voltage waveforms or digital logic states depending on the chosen components.

* **Normal Operation:** During normal operation, the fire sensor output should remain below the comparator threshold. This indicates that no fire is detected, and the alarm mechanism should remain inactive.
* **Fire Detection:** When a fire is simulated in Proteus (by increasing sensor output or manipulating the simulation parameters), the sensor output should exceed the comparator threshold. This triggers the alarm mechanism, activating the buzzer or LED, indicating fire detection.

The observed results will be compared to the expected behavior of the fire alarm system to verify its functionality. Any discrepancies will be analyzed to identify potential errors in the design or simulation setup.

**Source Code:**

//Arduino Flame Sensor

const int buzzerPin = 12;

const int flamePin = 11;

int Flame = HIGH;

int redled = 3;

int greenled = 4;

void setup() {

pinMode(buzzerPin, OUTPUT);

pinMode(redled, OUTPUT);

pinMode(greenled, OUTPUT);

pinMode(flamePin, INPUT);

Serial.begin(9600);

}

void loop() {

Flame = digitalRead(flamePin);

if (Flame == LOW) {

digitalWrite(buzzerPin, HIGH);

digitalWrite(redled, LOW);

digitalWrite(greenled, HIGH);

} else {

digitalWrite(buzzerPin, LOW);

digitalWrite(greenled, LOW);

digitalWrite(redled, HIGH);

}

}

**References:**

* Proteus Design Software Manual.
* <https://www.youtube.com/watch?v=iCqc9nJkvVs&list=WL&index=3&t=323s>
* For the additional file - <https://github.com/officialdanielamani/proteus-library-collection>

**Conclusion:**

This lab successfully simulated a basic fire alarm system using Proteus. The designed model effectively demonstrated the core functionality of fire detection and alarm activation. The simulation provided valuable insights into the operation of fire alarm systems and the role of each component in ensuring proper functionality.

The limitations of the simulation, such as not accounting for real-world factors like sensor sensitivity or environmental variations, will be acknowledged. Potential improvements to the model, such as incorporating additional features or using more advanced sensor models, can be discussed for future exploration.

This lab experience has solidified the importance of fire alarm systems in fire safety and highlighted the capabilities of Proteus for circuit design and simulation.