Fire Alarm System

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1. Main System Mission

A fire alarm system's main purpose is to quickly identify the existence of fire, smoke, or other dangerous conditions inside a structure or area and to promptly notify emergency personnel and building occupants. The system's early detection mechanisms sound an audible and visual alert, triggering an expedient evacuation procedure in an effort to reduce the risk to human life and property. Continuous sensor and component monitoring to guarantee operational readiness and the capacity to interface with other building systems for improved safety measures are essential to its operation. Adherence to regulatory guidelines and periodic examinations and upkeep reinforce the dependability and efficiency of the system in preserving lives and assets from the potential danger of fire crises.

2. Functional Requirements

- **Detection Capabilities:**

The system must include smoke detectors, heat detectors, carbon monoxide detectors, and flame detectors capable of promptly detecting the presence of fire or smoke.

- **Alarm Activation:**

Upon detection of fire or smoke, the system must promptly activate audible and visual alarm notification devices to alert building occupants.

- **Manual Activation:**

The system must include manual pull stations or break glass stations located at readily accessible locations throughout the building, allowing occupants to manually activate the fire alarm in case of emergency.

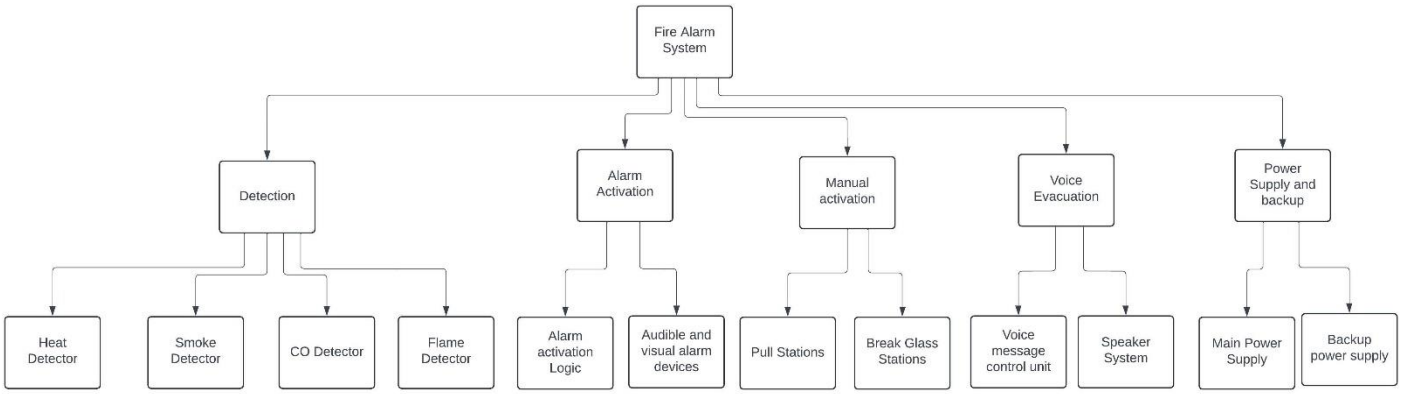
- **Voice Evacuation System:**

In larger or complex buildings, the system may require a voice evacuation system capable of broadcasting clear, intelligible voice messages to guide occupants to safety during an emergency.

- **Alarm Zoning and Identification:**

The system should provide the capability to zone alarms, allowing for the identification of the specific location of the alarm activation.
This feature aids emergency responders in quickly locating the source of the fire and coordinating evacuation and suppression efforts.

3. Functional Block Diagram



4. FMECA Worksheet

System: Fire Alarm **Date:** 18/4/2024

Indenture Level: **Sheet:** _____ of _____

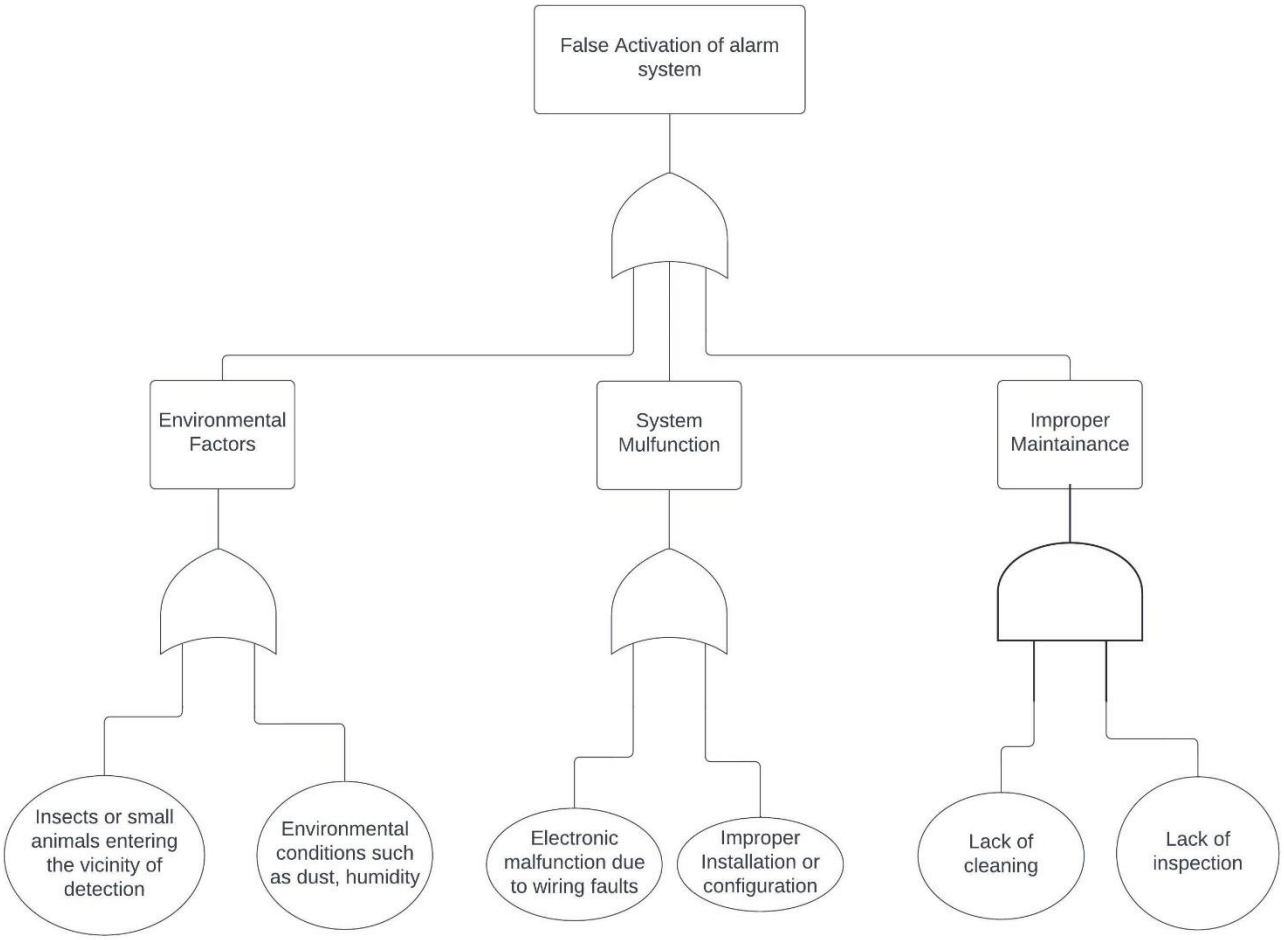
Reference Drawing: **Compiled By:** _____

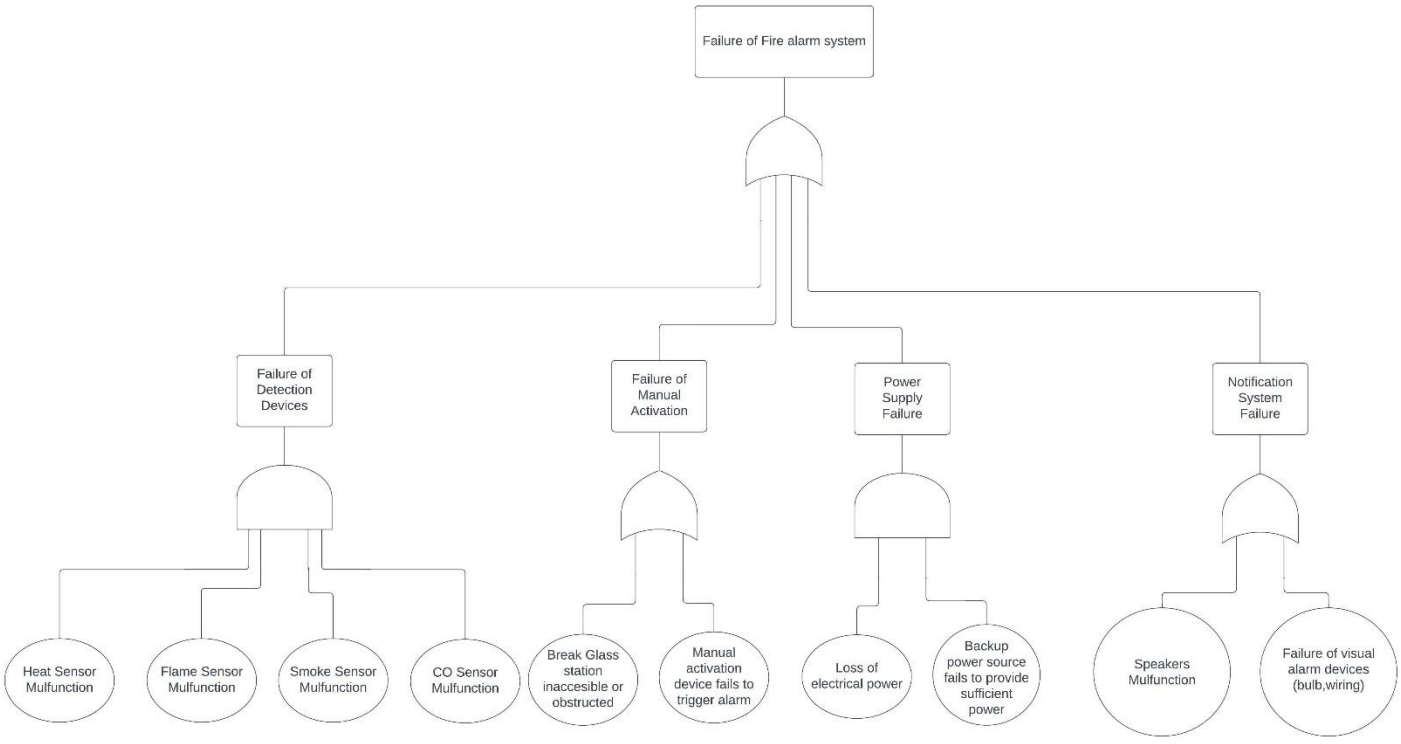
Mission: **Approved By:** _____

FAILURE MODE, EFFECTS & CRITICALITY ANALYSIS

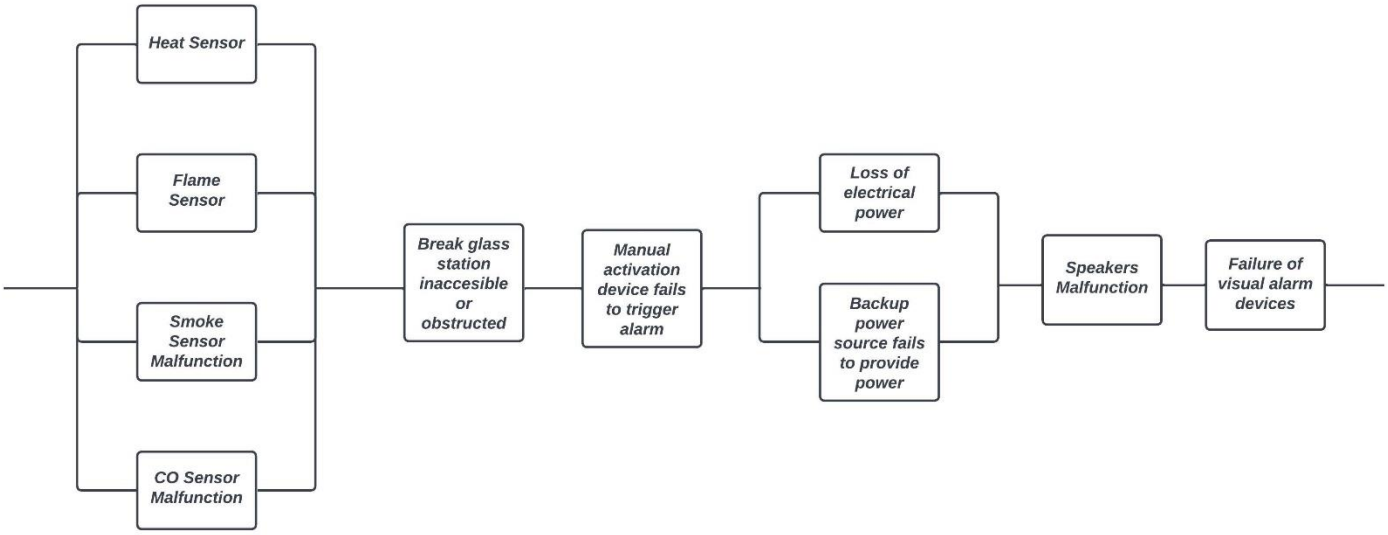
Description of unit			Description of failure			Effect of Failure		Failure rate	Severity ranking	Risk reducing measures	Comments
Ref. no	Function	Operational Mode	Failure mode	Failure cause or mechanism	Detection of failure	On the subsystem	On the system function				
1	Detect smoke	Normal	Failure to detect smoke	Dust accumulation	Visual inspection, Smoke test	Smoke Detectors	Early warning to occupants	Low	High	Regular cleaning and maintenance	Dust accumulation can impair sensor sensitivity
2	Detect heat	Normal	Failure to detect heat	Sensor degradation in heat detector	Periodic testing, Visual inspection	Heat Detectors				Replacement of sensors on schedule	Heat detectors should be replaced periodically to maintain reliability
3	Receive signals from detectors and activate notification devices	Normal	Control panel power failure	Electrical outage	System monitoring, Battery backup test	Control Panel	Activation of notification devices			Implementing backup power source (e.g., UPS)	Uninterruptible Power Supply (UPS) ensures continuous power supply to the control panel
4	Emit audible and visual alarms upon activation	Normal	Failure to activate notification devices	Wiring damage	Audible and visual inspection, System test	Notification Devices	Alert occupants			Regular inspection of wiring and connections	Wiring should be regularly checked for signs of wear or damage
5	Transmit signals between components	Normal	Wiring short circuit	Wear and tear, Environmental factors	Visual inspection, System test	Wiring and Connections	Communication between components			Implementing surge protectors	Surge protectors prevent damage from electrical surges
6	Supply power to system components	Normal	Battery failure	Battery degradation, Lack of maintenance	Battery voltage monitoring, Scheduled replacement	Power Supply	Power supply to components			Scheduled replacement of batteries	Regular battery replacement ensures reliable power supply

5. Fault Tree Analysis





6. Reliability Block Diagram



7. Code (Heat Detection Logic)

main.adb

```
with Ada.Text_IO; use Ada.Text_IO;
with Ada.Float_Text_IO; use Ada.Float_Text_IO;
with Ada.Integer_Text_IO; use Ada.Integer_Text_IO;
with Ada.Numerics.Float_Random; use Ada.Numerics.Float_Random;

procedure main is

   Alarm_Threshold : constant Integer := 50;

   function Generate_Random_Number return Integer is
   Gen : Generator;
   begin
      Reset(Gen);
      return Integer(Random(Gen)) ;
   end Generate_Random_Number;

   function Check_Temperature return Integer is
      Temperature : Integer;
   begin

      Temperature := Generate_Random_Number *49 +20;
      return Temperature;
   end Check_Temperature;

   temp:Integer;
begin

   temp:=Check_Temperature;

   if temp > Alarm_Threshold then
      Put_Line("Fire alarm activated! Please evacuate the building!");
      Put_Line(Integer'Image(temp));
   else
      Put_Line("No Fire");
      Put_Line(Integer'Image(temp));
   end if;

end main;
```