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Fire Alarm Control System in Building Automation Using PLC

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Abstract— Fire alarm system is a combination of number of devices working together to detect and warn the people through a visual and audible appliances when smoke, fire are present .The alarm used in FAS may be activated from smoke detectors or heat detectors. Alarms can be either motorized bells or wall mountable sounders or horns. Fire alarm system plays the main role in maintaining and monitoring the safe of all kind environments and situations. However the usability of many existing fire alarm and detection system is well known but could be produce with high cost.. The main objective of this Fire Alarm Control System in Building Automation Using PLC is to make a fire control and suppression system with reliable cost. The Fire Alarm Control System in Building Automation Using PLC has three main systems, 1) the detection fire, 2) the monitoring system and 3) the appliance system in which the main door will get open and Lift will come to ground floor for safety purpose. The detection system operates as the fire detector. This detection system has components like bimetallic strips as a flame detector, smoke detector, heat detector.

Index Terms—Buzzer, DC motor, Fire detector, Relay, S7-1200PLC.

I. INTRODUCTION

This project is design and implementation of a fire alarm system using the PLC S7-1200 which operates the entire system. The detectors are placed in such a way that they are parallel in different levels. Any signal from each detector at any level is detected and monitored using monitoring system. The appliance system has components like buzzer for alarming and motor pump to stop the fire. Relay driver to make switch on/off relay according to PLC output. The entire system is controlled by PLC. The PLC is programmed in such way by using ladder diagrams. From the project done, the system can detects smoke, heat etc. are sensed by the detector, followed by the monitoring system which indicates smoke, heat etc. at that particular level. Finally when the sensors form each level triggered individually, the main buzzer operates and disconnect the AC power supply. Then it runs the emergency exit Door motor to escape, Lift comes to ground level and the water pump motor to the affected zone to stop the fire [1].

II. BASIC BLOCK DIAGRAM

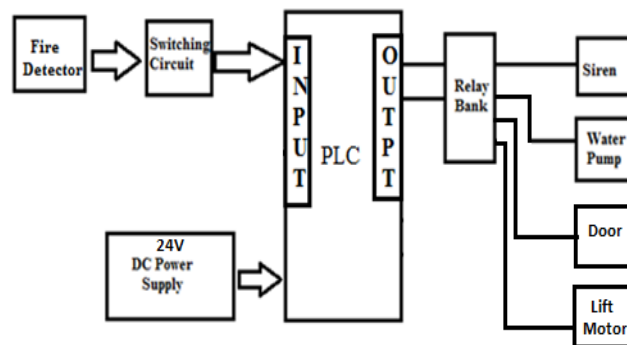


Fig.1: Basic block diagram of FAS

III. TECHNICAL SPECIFICATIONS

- S7-1200 PLC
- 24V SMPS
- Fire Detector(Bimetallic Strip)
- Switching Circuit(Transistor BC547)
- Relay 24V
- Buzzer/Siren

- Water Pump
- DC Motor

IV. CONVENTIONAL FAS ARCHITECTURE

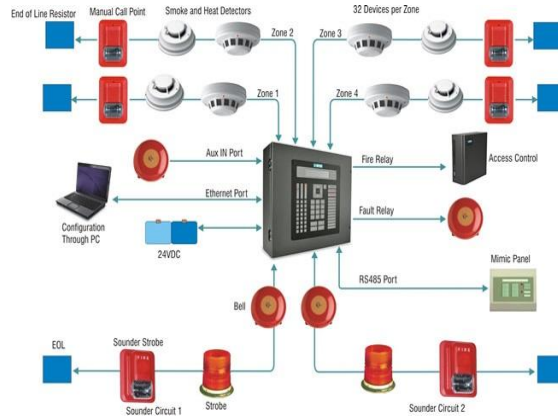


Fig.2: Conventional FAS System

V.S7-1200PLC

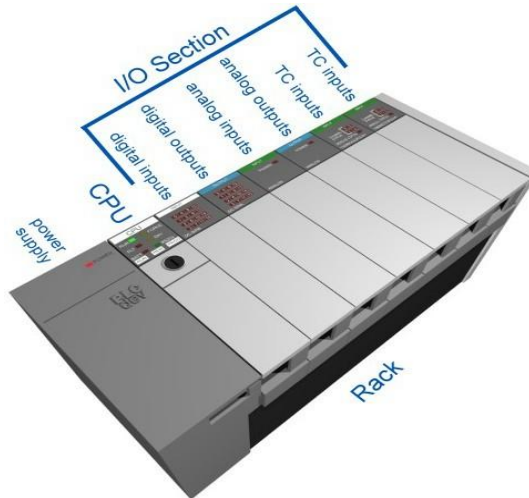


Fig.3: basic PLC structure

A Programmable Logic Controller is a special computer device used for industrial control systems. These are used in many process industries such as oil refineries, manufacturing industries, conveyor systems etc. If there is a need to control devices, the PLC provides a more flexibility to "software" the components together. The most important part of the PLC is a CPU (a computer processor) that is dedicated to run one program that monitors a series of different inputs and logically manipulates the outputs to the desired control. They are very flexible in how they can be programmed while also providing the advantages of high reliability, small in size, flexible and economical over traditional control systems [2].

VI. FIRE DETECTOR (BIMETELLIC STRIP)

The bimetallic strip having different coefficient of linear expansions. When the heat is generated the strip is heated the one end of strip which having greater coefficient of linear expansion result in mechanical connection between two ends. Due to mechanical contact between two ends current will pass through the circuit and fire will be detected [3].

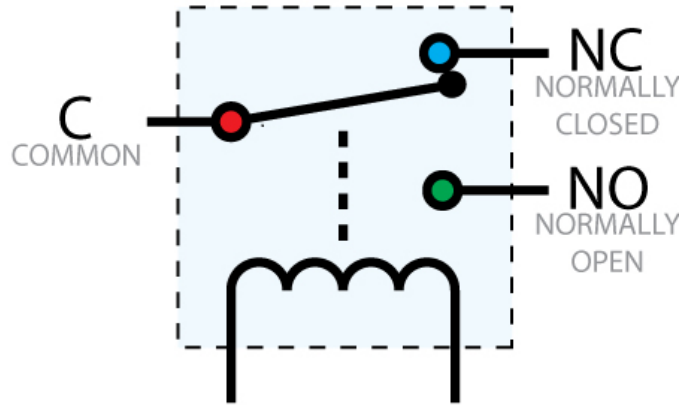


Fig.4: Mechanical Relay

A relay is switch operate on electrical power used to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuit). A relay that handle the high power required to directly control an electric motor or other loads is called a contactor.

VIII. INDICATING DEVICES (BUZZER/SIREN)

The indicating devices used in FAS may be alarm, light; speaker etc. This gives a warning or information about the existence of the fire. A buzzer is an electromechanical device which is used for an audio signaling purpose. It Alert the building occupants to a fire condition or stage and the need of the evacuation[4].

IX. FIRE SUPLIMENTARY OPERATION

Elevator Capture

When the fire is generated people try to use the lift or elevator .For the safety purpose the elevator stop on the ground floor with door opens.

When elevator captured

1. Stop transporting people to wherever they were going.
2. Returns to the primary escape floor.
3. Opens the doors to let the people out
4. Just sits there

Extinguisher System Interface

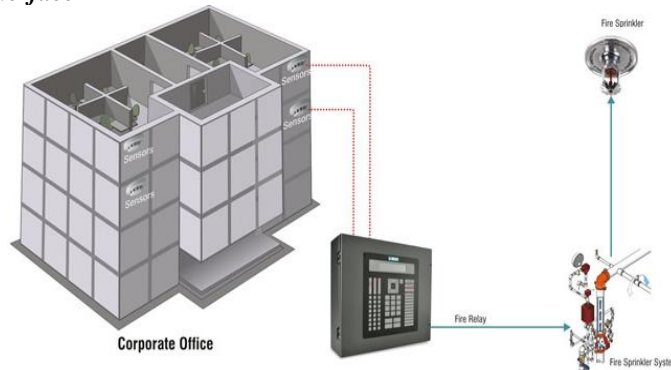


Fig.5: Fire Suppression system

Automatic fire suppression system controls the fires without human interface. It includes fire sprinkler system, gaseous fire suppression and condensed aerosol fire suppression. The fire sprinkler system is mostly used for parking zone and the gaseous suppression used when the system zone consist of electrically operated equipment.

Gaseous fire suppression system uses the inert gases and chemical agents to suppress the fire. It is also called Clean Agent Fire Suppression System. The Agent used in this system is governed by the NFPA standards for Clean Agent Fire Suppression System. NFPA 72 provides the safety provisions, inspection, testing, location, performance, installation and maintenance of the fire alarm system [5].

X. GUIDELINES FOR PLACEMENT OF DETECTORS:

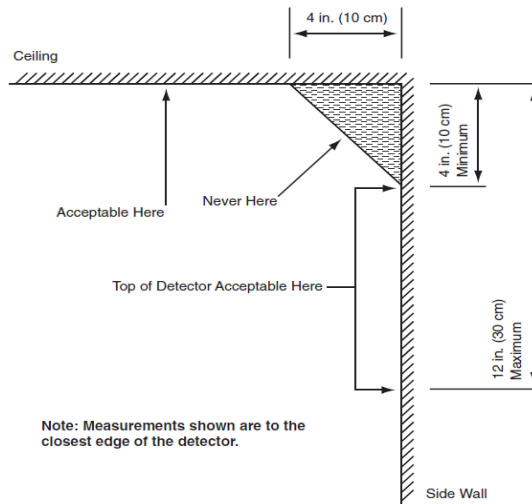


Fig.6: Wall Mounted Detector – Placement

LOCATION

- Spot-type heat-sensing fire detectors shall be located on the ceiling not less than 4 in. (100 mm) from the sidewall or on the sidewalls between 4 in. and 12 in. (100 mm and 300 mm) from the ceiling.
- Line-type heat detectors shall be located on the ceiling or on the sidewalls not more than 20 in. (500 mm) from the ceiling.

SPECING

One of the following requirements shall apply:

- The distance between detectors shall not exceed their listed spacing, and there shall be detectors within a distance of one-half the listed spacing, measured at a right angle, from all walls or partitions extending to within 18 in. (460 mm) of the ceiling.
- All points on the ceiling shall have a detector within a distance equal to 0.7 times the listed spacing (0.7S). This is useful in calculating locations in corridors or irregular areas [6].

XI. ADVANTAGES

- The main advantages of fire alarm system are early warning to the building occupants.
- It increases the evacuation time for building occupants before a fire spread out of control.
- Automatic fire suppression saves the valuable properties and assets.

XII. APPLICATION

- Commercial buildings such as hospital, bank, schools etc.
- Parking
- Homes
- Industries

XIII. CONCLUSION

This paper implement the PLC controller to control the not only detect the fire ,but also suppression of the fire .In this paper the plc programming is done to perform the operations using pro-logix .In performance of model is superior than other controllers. The fire is detected with bi-metallic strip and suppressed with sprinkler system. The



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model is designed with power supply and relay devices, when the detector sense the heat simultaneously PLC perform the output operations.

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