

Cost-Effective Design of Self Activating Fire Extinguisher (S.A.F.E)

Deep Shrivastava*, Raina Shrivastava**

*Mechanical Department of Oriental Institute of Science and Technology Bhopal
** Electrical and Electronics Department of Vellore Institute of Technology, Vellore

ABSTRACT

The main idea behind this research paper is to propose a model focusing on cost effective design of a S.A.F.E i.e SELF ACTIVATING FIRE EXTINGUISHER. S.A.F.E is self-activating fire extinguisher which on sensing flame/smoke from the fire automatically activates and extinguishes the fire.

INDEX TERMS

Cost-Effective , Self Activating , Fire extinguisher , Simplified design

INTRODUCTION

The research relates to versatile fire extinguishers that self-activate via a heat or fire sensor and that distribute fire suppressant over a fire source with a nozzle . Several models of Self activating fire extinguisher are proposed so far , Such prior art models typically are either very expensive or ineffective. So this present invention of new Cost- effective design of Self activating Fire extinguisher fulfills all the needs of Self activating fire extinguishing system and minimizes the drawbacks of previously proposed design.

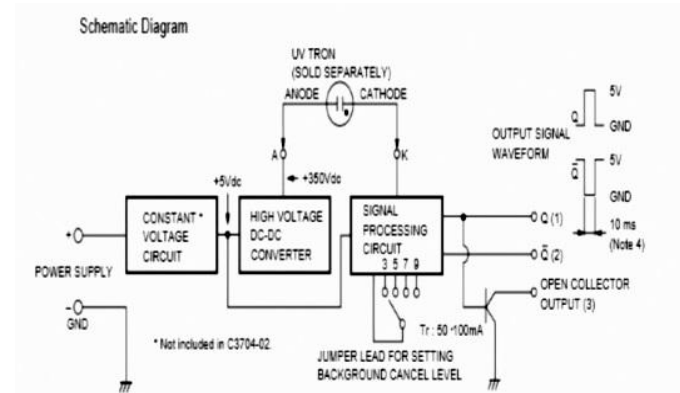
CONSTRUCTION OF S.A.F.E

The S.A.F.E consists of Battery which supplies current to the microcontroller unit i.e the brain of S.A.F.E which is connected to Flame sensor (UV Tron) which detects the temperate of the surrounding air . The microcontroller unit is connected to a motor through a relay which sends the current to motor when the temperature reaches above the desired cut off limit. The motor is attached to lever of fire extinguisher by nut bolt arrangement .

The microcontroller electronic circuit consists of :

- HIGH VOLTAGE D.C TO D.C CONVERTER**

This converts low D.C voltage coming from battery into suitable high D.C voltage . They are used because they offer a method to increase voltage from a partially lowered battery voltage thereby saving space instead of using multiple batteries to accomplish the same thing.



UV tron (Sensor) Characteristics :

CHARACTERISTICS (at 25°C)

Parameters	Rating	Units
Discharge Starting Voltage (with UV radiation)	280	Vdc Max.
Recommended Operating Voltage	325±25	Vdc
Recommended Average Discharge Current	100	µA
Background ^a	10	cpm Max.
Sensitivity ^a	5000	cpm Typ.

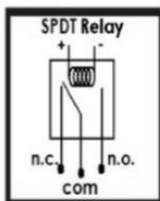
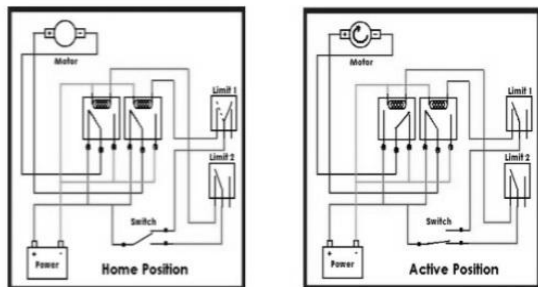
- FLAME SENSOR**

UVTRON is an ultraviolet ON / OFF sensor tube that uses the photoelectric effect of metal and gas multiplication effect of electric current by means of discharge. It has a very narrow range of sensitivity from 185 nm to 300 nm and is completely insensitive to visible light. Because it used the discharge phenomenon, its sensitive is high and an adequate output voltage is obtained, making it possible to design a high-sensitivity, quick response ultraviolet detection with simple circuitry.

- RELAY**

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a low-

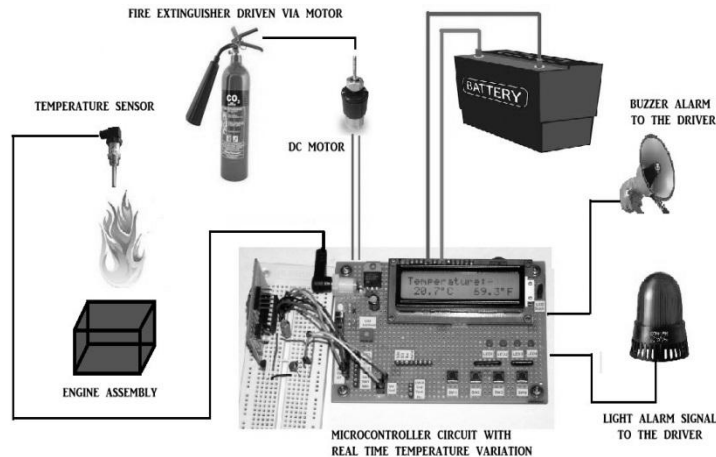
power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. Putting all of this together, here is a simple motor control circuit. The parameters of this circuit design call for a single continuous contact switch (such as a basic wall switch or toggle switch) to activate a motor to drive a load to a certain limit.



BASIC MOTOR CONTROL AND RELAY LOGIC

WORKING OF S.A.F.E

The mechanical arrangement consists of a motor mounted on the upper arm of the fire extinguisher which is attached to a bolt such that the bolt rotates on the axis of the shaft of the motor i.e the bolt and the shaft of the motor are in the same line and a nut is fixed at the lower arm of the fire extinguisher. The bolt is partially fastened in the nut the threading prevents the screw and motor arrangement to move back i.e it provides a temporary lock, so as soon a fire is detected by the flame sensor the electronic circuit activates the relay which provides current to motor and as soon as shaft of the motor rotates along with the bolt it gets fasten in the nut and thus converting rotary motion to linear motion which in turn moves the upper arm of fire extinguisher in downward direction and thus extinguishing fluid comes out of the nozzle and fire extinguishing action takes place automatically



ADVANTAGES OF S.A.F.E OVER THE OTHER MODELS OF S.A.F.E PROVIDED IN THE PAST

- **Reduced heat and smoke damage** - Significantly less heat and smoke will be generated when the fire is extinguished at an early stage
- **Immediate alert** - S.A.F.E will notify the people and emergency response personnel of the developing fire as automatic fire alarm system is installed in it.
- **Ease of installation** - As the this arrangement simple in nature and occupy very less space.
- **Cost effective** – Due to simplicity in arrangement and use of cheap materials like bolt, nut, motor etc make it very cost effective in nature thus can be widely implemented in any type of vehicle as well as fire prone areas.
- Can be used in high-risk area where most fires are likely to start, it will self activate upon reaching the appropriate temperature and extinguish the fire.
- **Easily available** – As this arrangement requires no complex mechanisms and materials so it can made widely available.

RELIABILITY OF S.A.F.E

The reliability of individual fire protection strategies such as detection, automatic suppression, and construction compartmentation is important input to detailed engineering analyses associated with performance based design. here are several elements of reliability, including both operational and performance reliability. Operational reliability provides a measure of the probability that a fire protection system will operate as intended when needed. Performance reliability is a measure of the adequacy of the feature to successfully perform its intended function under specific fire exposure conditions. The former is a measure of component or system operability while the latter is a measure of the adequacy of the system design. The overall reliability of a system depends on the reliability of individual components and their corresponding failure rates, the interdependencies of the individual components that compose the

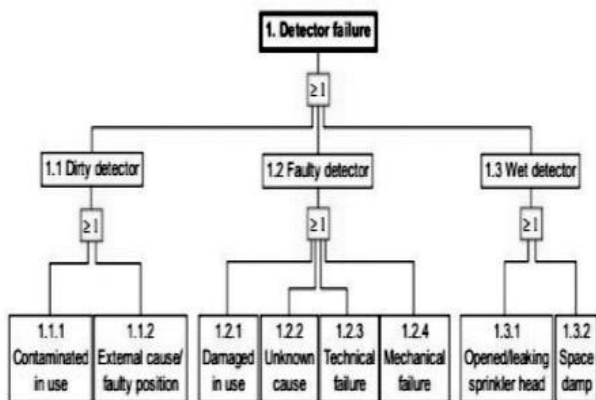
system, and the maintenance and testing of components and systems once installed to verify operability. All of these factors are of concern in estimating operational reliability. Performance reliability estimates require data on how well systems accomplish their design task under actual fire events or full scale tests. Information on performance reliability could not be discerned directly from many of the data sources reviewed as part of this effort due to the form of the presented data, and therefore, it is not addressed as a separate effect.

A literature review of reliability data of fire detection and alarm systems was made resulting to rough estimates of some failure frequencies. No theoretical or technical articles on the structure of reliability models of these installations were found. Inspection records of fire detection and alarm system installations by SPEK (Spesifikasi) were studied, and transferred in electronic data base classifying observed failures in failure modes. This tree is for demonstration of the dependencies, and not strictly a fault tree in the mathematical sense, since the number of components in various branches or even within a branch are not the same. These fault trees are used to evaluate the performance and thus reliability of the fire extinguishing systems can be estimated.

FAULT TREES



Fault tree of fire detection and alarming system divided into six subunits by cause of failure.



Fault tree of detector failure.

RELIABILITY OF FIRE ALARM AND FIRE DETECTORS (SENSORS)

CONCLUSION

So this invention of S.A.F.E if effective a well within the reach of every person . If considerable amount of time is spend on its further research and development it could really prove to be a effective product in the fire safety department and for the common household.

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AUTHORS

Deep Shrivastava,
Bachelors in Engineering (Mechanical engineering) ,
Oriental institute of science and technology Bhopal and
deepshrivastava2493@gmail.com

Raina Shrivastava
Bachelors in Engineering(Electrical and Electronics Engineering)
Vellore Institute of Technology , Vellore and
rokingraina@gmail.com