

SMART FIRE EXTINGUISHER SYSTEM (SFES)

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SITUATION:

Most fires in the UAE occur in warehouses in industrial areas. Current firefighting systems in warehouses rely heavily on firefighters to manually extinguish fires. Due to heavy congestion in these areas, firefighters' emergency response time is too high to prevent loss of human lives and reduce major property damage.



AED 388m
PROPERTY DAMAGE
IN 2013 [2]

20
WAREHOUSES BURNT
SHARJAH IN 2014 [3]

The Smart Fire Extinguishing System (SFES) is an automated, immediate and efficient emergency response solution that can save lives and reduce fire damages.

PROBLEMS & SOLUTIONS

CHEMICAL COMPOSITION & STORAGE TANK

PROBLEM

- | Decision of which element to remove from the fire triangle to ensure most efficient fire suppression depending on the class of fire (Figure. 1).
- | Selection of chemicals that are not toxic or impractical for widespread usage.

SOLUTION

- | Creating a system that uses a combination of CO₂, H₂O and foam to fight fire.
- | Ensuring elimination of oxygen from the fire triangle, thus extinguishing the fire
- | Addressing classes A, B and C of fires [4].
- | Confirming no lasting toxicity and convenient availability.



Figure 1: Fire Triangle [4]
Credits: scholastic.com



Figure 3: Smoke Ventilation System [6]
Credits: fireblindsystems.com

SMOKE CONTROL SYSTEMS

PROBLEM

- | Prevention of lateral movement of smoke in the building.
- | Extraction of smoke in a quick and efficient manner.

SOLUTION

- | Using automated smoke curtains that can prevent lateral smoke movement [6].
- | Implementing the Louvred Natural Ventilator to extract smoke and allow flow fresh air (Figure. 3).

TURRET & PUMPING SYSTEM

PROBLEM

- | Adjustment of size of turret to compensate for its heavy weight (Figure. 2).
- | Customization of currently used turrets to be fitted in warehouses.

SOLUTION

- | Scaling down the turret for a reasonable size which also reduces weight [5].
- | Redesigning the turret so it can be fitted on the walls or ceilings.



Figure 2: Turret System [5]
Credits: metzfirerescue.com

THE SMART CONTROL UNIT

The smart control unit coordinates all the components in the system to respond to an emergency situation without any human interference.

The control system takes preliminary measures to suppress the fire, hence reducing response time, which is a key factor in saving lives.



Figure 4: Infrared Heatmap [7]
Credits: uspto.gov

CONTROL UNIT ALGORITHMS

PROBLEM

- | Detection of human presence in the room.
- | Design of a fallback system that avoids false alarms to ensure that people respond to alerts promptly.
- | Identification of the source of the fire to target pumping systems using mathematical algorithms.

SOLUTION

- | Using thermal imaging sensors with raw that can be wirelessly transmitted [7] (Figure 4).
- | Employing Delaunay Triangulation algorithm to locate source of fire.

PROCESS

SFES

Detection of Fire
Alert fire department



Detect human presence.
Get locations and head count.



Trigger Circuit Breaker
Cut off electricity



Create Alert
Emergency response



Locate Fire Source
Trigger pumping system



Trigger Ventilation System
Create exit alerts



Save Lives
with immediate response system



EVALUATION

- | Instantaneous response to any fire detected within the warehouse.
- | Efficient removal of smoke allows for more lives to be saved.
- | Higher reliability and efficiency than standard fire extinguishing systems.
- | Independently tackles fire without need of human interference.
- | Reduces losses and damages by 30%.
- | Confines the spread of fire to one area and extinguishes it promptly.

30%
DAMAGE REDUCTION

Cost Analysis (per 1000 sq.ft)

Storage Tank & Chemicals	AED 12,850
Smoke Ventilation System & Smoke Curtains	AED 17,980
Turret & Pumping System	AED 24,840
Smart Control Unit	AED 9,000
Total Cost of SFES	AED 64,670
Cost of Traditional System:	AED 51,520

Figure 5: Cost Analysis Table [6]

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