Fire Protection Association

RISCAuthority

ACTIVE FIRE PROTECTION GUIDE
Detection Systems: Video Fire Detection Systems

This document has been produced by the RISCAuthority Active Suppression & Detection working group to provide information and outline guidance on the application of Video Fire Detection (VFD) Systems.

Summary

Refer to AFPG-30 Detection Series Overview.

Video fire detection systems:

- analyse video imagery from CCTV cameras in real time for signatures of fire which can include smoke, flame, and off-site flame flicker. If the cameras also form part of a security system, it may also report on motion detection and other security processes such as numberplate and facial recognition
- can perform in environments that other methods find very demanding (large area/high ceiling/outdoors) and have an emerging role to play in the protection of waste sites, forests, and supporting intelligent closed-loop detection/extinguishing robotic systems¬
- differ (based on two principal forms of the technology) in whether the processing is done centrally, or at the camera. Some devices just monitor for smoke, others additionally detect flaming
- feature video-based analytical fire recognition algorithms which use different techniques to identify the fire characteristics and can be based on spectral, spatial, or temporal properties including assessing changes in brightness, contrast, shape, edge content, motion, frequency, and colour matching
- are used in both indoor and outdoor applications where large area coverage is required
- benefit from providing instant situational awareness and can record stills and video imagery of the alarm event for later analysis
- are typically applied in: aircraft hangars, oil and gas installations, large compartments, heritage, waste recycling (indoors and out) and open outdoor areas including grassland and forest fires
- should not be confused with video flame detectors which, although using similar methods, are dedicated to the detection of highly flammable substances.

Video fire detection systems

The earliest forms of VFD used standard analogue cameras connected to a central computer processing unit that analysed the video content for signs of fire. The processing unit provides standard relays so that it can be integrated into the building's fire detection and alarm system by normal means. More recent versions allow for the processing and decision making to happen onboard the camera which means they can be used as stand-alone devices or be integrated into a site-wide network-based CCTV system.

In integrated devices the Internet Protocol (IP) digital camera and lens can be better optimised for fire detection and additional security requirements that might involve motion detection, and numberplate and facial recognition services. The Achilles heel of all video detection systems is the level of ambient lighting. Some systems seek to address this by the use of low-light cameras, or infrared (IR) illuminators and IR sensitive

cameras, but often, the provision of additional lighting is an integral component of the system.

BS 5839-1 recognises this vulnerability of VFD and recommends that: *'Video smoke detection systems should be capable of detecting smoke reliably in the absence of the normal lighting in the building and the absence of the mains power supply to any lighting provided specifically to aid the detection of smoke.'*

All VFD systems are capable of being connected to common fire protection electrical infrastructure that interprets signals, communicates alarms, and controls other fire systems (see AFPG-30). Additionally, if part of the site's computer network, the system may be remotely monitored which can assist with fire and security event confirmation and a timely response from the fire and rescue services or police.

VFD system installation must conform to the requirements of BS 5839-1 but often they are used as an additional measure to the fire detection and alarm system for property protection purposes.

How VFD works

VFD systems analyse successive frames of video for changes that could be attributable to fire emissions. The algorithms used have commonly been 'taught' from real fire scenarios, learning the combinations of brightness, contrast, colour, shape, motion, and many other factors besides that may uniquely identify the event. The event is then encapsulated by the system by way of a visual overlay on the video to assist the viewer. Depending upon the confidence level of the identification in comparison to reference data, a pre-alarm, or full alarm may be raised. All systems seek to identify smoke, but some additionally seek to isolate flames through analysis of their brightness, shape form, and flicker rate, and some even detect off-site (out of view) flaming events by looking for reflected flicker on surfaces such as walls and floors.

Key benefits of VFD systems

- The ability to protect very large areas and volumes without having a dependency upon the building's ceiling to channel or hold smoke
- They are suitable for use in outdoor applications such as oil platforms, industrial sites, waste sites, and forests
- The provision of immediate situational awareness of cause upon detection via the camera network
- The recording capability assists with event post-mortem, and false or unwanted alarm analysis
- The ability to partition the field of view and alter sensitivity pertinent to what is in each area, and the ability to mask out areas where no risk exists but might cause false alarms
- Where the system is used to detect flames and the view is available to more than one camera, the system can be configured to report accurately where the fire is and provide a robotic response
- They can be used where the aesthetics of a space cannot tolerate spot type detection
- By encapsulating the event within the screen overlay, VFD systems can be used in intelligent systems to report on whether the fire event is growing or being controlled.

General guidance

- Camera lenses should be selected to give the sensitivity and detection range appropriate to the area being protected
- VFD cameras must have an unobscured view of the protected space
- The system should be able to indicate the location of the fire by display and signal output
- Cameras should be mounted to detect smoke before significant dilution
- Supplementary lighting may be required to ensure the 24/7 effectiveness of the system
- Lens shades may be required to protect against direct and reflected light from the sun and other light sources
- The integrity of the system must consider the protection of the cameras, cabling routes, power supplies, processing unit and data storage
- VFD systems are not the correct choice in applications that produce smoke-like images such as those that generate steam, exhaust fumes, visible vapours, dusts, and sprays. In the outdoor setting, capability will be reduced during times of fog, mist, snow, rain and insect swarms.

Challenges and considerations

Design: The selection of a suitable camera lens for the light conditions and desired field of view is extremely important and may require a site survey.

Lighting levels: VFD systems fail to detect smoke in good time if lighting levels are too low. Conversely, bright lights directed at the camera my blind the sensor.

Configuration: VFD systems need to be tuned to the environment they are installed within. Many iterations may be required to get the correct balance between sensitivity and false alarming.

Camera vibration: If the camera is not solidly mounted, vibration may be misread by the algorithm as movement of smoke and surfaces within the frame of view.

Data protection: **The capture and storage of video data** that might include images of persons and children needs consideration.

Trial recommendation: The system should be trialled within the proposed environment for a period of time to prove its suitability prior to commitment.

Installation guidelines: The environment forms an integral part of the detector, and it is therefore very difficult to measure and assess the performance of a VFD when separated from its environment in a reliable and repeatable manner. This facet complicates development of equipment approval regimes and installation guidance (see FIA Fact File 90).

Management of false and unwanted alarms: Additional guidance is given in RISCAuthority document RC47: *Recommendations for the management of fire detection and alarm systems in the workplace.*

Applicable standards

BS 5839-1 *Fire detection and fire alarm systems for buildings Part 1: Code of practice for design, installation, commissioning and maintenance of fire detection and fire alarm systems in non-domestic premises.*

ISO/TS 7240-29 *Fire detection and alarm systems Part 29: Video fire detectors.*

ISO/TS 7240-30 *Fire detection and alarm systems Part 30: Design, installation, commissioning and service of video fire detector systems.*

FIA Fact File 90: *Video Fire Detectors and Detection Systems.*

FIA Guidance on Video Smoke Detection Technology (VSD).

Schemes

BAFE SP203-1 Design, Installation, Commissioning and Maintenance of Fire Detection and Fire Alarm Systems Scheme.

LPCB LPS 1014 Scheme requirements for certificated fire detection and alarm system firms.

Best practice

All providers of systems should be third party certificated to approved schemes.

Fire Services should be consulted on their requirements and necessary provisions for supporting the fire safety of the property.

The provision of Regulation 38 information is essential so that the role the detection and alarm system plays in the overall fire safety management plan of the building remains front and centre.