TECH TALK
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ALLIANZ GLOBAL CORPORATE & SPECIALTY®

VIDEO IMAGE DETECTION

ALLIANZ RISK CONSULTING

AT-A-GLANCE

- Video image detection (VID) is a fire detection system that analyzes video images for the presence of smoke and/or flame.
- VID may be a good solution for some specific applications; however, it is not recommended when conventional fire detection is suitable.
- Several technologies have been developed, but very few are certified, listed or approved products.
- Select a reputable contractor for the design, installation, and maintenance of VID systems.

INTRODUCTION

Automatic fire detection systems are well known by Allianz Risk Consulting (ARC) clients. Most are aware of the different types of detectors and the importance of installing those that are certified, listed or approved by a nationally recognized testing laboratory. ARC clients are familiar with the two main types of fire detection devices and their use depending on the occupancy or hazard:

- Smoke detectors, such as ionization, photoelectric and air sampling
- Heat detectors, such as fixed temperature and rate-of-rise

However, when it comes to video image detection (VID), ARC engineers are often questioned by clients to better understand this new technology and if it is an acceptable alternative solution to traditional fire detection systems or even to video surveillance (CCTV).

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VID uses software to automatically analyze real-time images from video cameras to detect the presence of smoke and/or flame. VID systems analyze images for changes in features, such as brightness, contrast, edge content, loss of detail, and motion. Fires can be detected within the video camera's field of view.

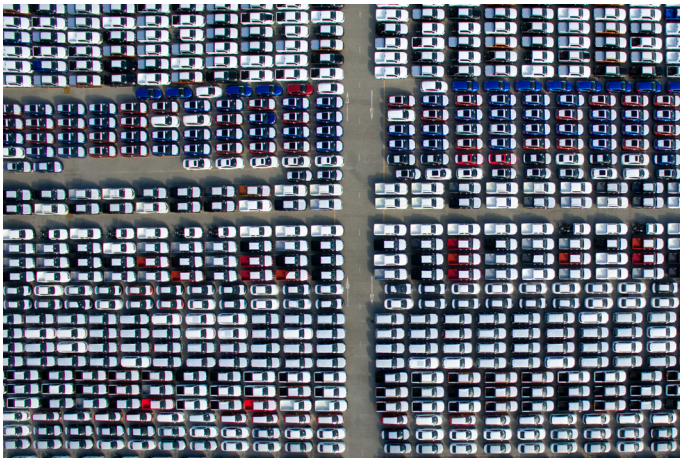
WHEN TO CONSIDER VIDEO IMAGE DETECTION?

VID may be suitable for applications where traditional smoke and heat detectors are not effective or practical. Some examples include:

- Outdoor combustible storage involving high values, such as yard storage of new cars or subway train parking
- Buildings with large interior spaces such as aircraft hangars or power plants
- "Dirty" environments where airborne debris is common, such as recycling facilities
- Complex industrial locations such as oil, gas and chemical processing areas

Subway train parking

Recycling plant



New car storage yard

Large outdoor pile of whisky barrels

While VID may be a good solution for some specific applications, it is important to remember that VID is not recommended when conventional fire detection devices are suitable.

UNDERSTANDING THE TECHNOLOGY

The two main technologies used for VID are image analysis based on the visible spectrum and infrared radiation.

VISIBLE SPECTRUM

Systems based on visible spectrum image analysis typically use video surveillance cameras that may be modified. These systems use specially developed algorithms that allow predetermined phenomena to be identified in the image. These algorithms can be integrated into the cameras or work in a remote server to process the transferred data. These algorithms perform pixel analysis, by group of pixels and by comparison between successive images, to identify smoke or flame emergence. Changes in colors and contrast, as well as characteristics, such as vertical displacements and oscillations of smoke or flames, can be identified.

Two main types of algorithms exist on the market:

- Algorithms that have been defined in advance and are designed to work with a single camera model. The proposed interface only allows the adjustment of areas of interest and sensitivity, often corresponding to the minimum number of pixels required to trigger an alarm.
- Algorithms that can work on any type of camera, which allow a wide range of settings depending on the area where the cameras are to be installed: angle, range of colors, etc. The proposed interface is therefore more complex and users of these algorithms need to be specially trained and familiar with the software.

The main constraint is image quality. The performance of the camera is of major importance, especially its ability to perform well in low light. In addition, the location where the camera is installed is important. The phenomena that are supposed to be recognized by the algorithms are sometimes not recognized due to the angle. Also, a camera located too far away will certainly face problems since the resolution will be insufficient to detect any phenomena. Such a system should therefore only be installed with the objective of detecting a fire. Cameras used for CCTV surveillance are not located in accordance with the above technical requirements. Therefore, cameras installed primarily for CCTV surveillance use should not be used for fire detection.

INFRARED RADIATION

Systems based on infrared radiation are capable of measuring the luminance or radiation power emitted by objects. They then build a graphic or visual called a thermogram, which helps to identify luminance variations. Software then converts this luminance into temperature, enabling these systems to detect a hot-spot in the area covered by the camera. However, if the heat source is not within direct view of the camera due to an obstruction, then infrared thermography detection will be inefficient since these devices only measure surface temperatures.

Unlike systems using the visible spectrum, these systems do not require a minimum level of light to operate. Certain points require particular attention, however, especially when setting up the parameters for triggering a fire alarm. Many phenomena can activate false alarms, such as reflections or solar radiation. Therefore, installations of this type should be careful to exclude objects that could potentially generate false alarms. It is also a common misconception that a camera based on infrared radiation can detect smoke – in fact they are unable to detect that type of phenomena. In addition, thermal cameras currently benefit from lower resolutions than visible cameras and the spatial resolution of the cameras is an important factor limiting the quality of the temperature measurement.

CONCERNS

TECHNICAL

Several aspects regarding the use of VID devices should be considered:

- Detection distance is a fundamental point for the deployment of VID. The overall capacity to detect a fire (flame or smoke) should be determined based on the worst-case scenarios (light and distances). Then there is the issue of digital image resolution, which should be sufficient, and the technological limitations of the camera.
- The angle of a camera is typically limited. Therefore, an installation for a large area may require a large number of cameras.
- These systems are expensive and therefore only make sense when conventional fire detection systems are ineffective. As with any technology, make sure that the choice of VID is based on having the right technology in the right environment.
- The solutions available on the market vary greatly, making the decision difficult for a non-expert. Even people with some understanding of these technologies may have problems deciding whether an application is acceptable or not.

STANDARDS

There are no prescriptive standards for VID design or installation, making each project a performance-based design. The main standards available are:

- NFPA 72 covers the application, installation, location, performance, inspection, testing and maintenance of fire alarm systems, including video image smoke or flame detection.
- ISO/TS 7240-29 specifies requirements, test methods and performance criteria for video fire detectors, which operate in the visible spectrum, for use in fire detection and alarm systems.
- FM 3232 is an approval standard that describes the performance requirements for Video Image Fire Detectors and Video Image Fire Detection Systems.
- UL 268 provides the requirements for smoke detectors and accessories in accordance with NFPA 72, while UL 268B utilizes UL 268 and additional requirements for the evaluation of video image smoke detectors.

Both UL and FM Approvals standards specify comprehensive evaluation methods, but allow the manufacturer to decide the configuration of the evaluation as well as the requirements. It is therefore important to understand the configuration limits when performing tests.

- CNPP LPMES DEC 18 005 is a French technical specification defining the minimum technical requirements to achieve for VID material.

It is important to ensure that the specifications of the products are detailed and clearly stated. For example, the quality of the images provided by the camera, the detection time, how the test was performed, etc.

ARC RECOMMENDATIONS

The following recommendations are provided to improve the reliability and effectiveness of VID systems for property insurance purposes. Please contact your local ARC representative to discuss a pragmatic approach.

- Use only dedicated VID cameras for fire detection. VID cameras can transmit video signals to other systems for other uses, such as surveillance, but their primary function should be fire detection.
- Ensure the equipment selected works with a low luminance (e.g., up to 15 or 20 lux). Adequate lighting should be installed to ensure the system will be operational 24/7.
- Choose a system capable of transmitting a trouble signal when the camera is not able to detect fire due to:
  - Light level too low
  - Lens blocked
  - Lens out of focus
  - Tampering
  - Power failure
- Select a reputable contractor that has significant experience in the design, installation and maintenance of VID systems. Furthermore, the equipment should be at least approved, certified or listed as a fire detection system by a nationally recognized laboratory (i.e., UL, FM, CNPP, etc.). Although ARC does not approve companies, a list of competent suppliers may be provided upon request.
- Install devices suitable for the environment (e.g., waterproof, dust proof, etc.)
- Make sure that the following factors are taken into account:
  - Backlight
  - Combustion engine exhaust gases (i.e., cars, trucks, buses, forklifts, emergency generators, etc.)
  - Dust
  - Rain, ice, fog or snow
  - Fumes or steam generated by the process
- Plan the acceptance tests as follows:
  - Ensure that a competent third party or the owner and designer of the concept (i.e., algorithm, products, etc.) will commission the system installed by the selected supplier. This part is often considered as excessive, but is vital in ARC's experience. This is a new technology and real application knowledge, including the limits of the system, are only truly known by the creator of the system. ARC considers that their involvement, along with their local partners, is required to ensure the best engineering practices are applied and the system is adequately designed and installed.
- Maintenance
  - Inspect, test and maintain the systems and devices in accordance with supplier guidelines and NFPA 72 or other recognized international codes.
  - Special attention should be paid to completing the following:
    - A calibration test at least once a year.
    - Cleaning of the lens on all cameras at adequate intervals and at least once a year.
- Integrate the VID into a new or existing fire alarm system.
- VID may be used to confirm a fire, but not the absence of a fire. Before resetting any fire alarms, a person should visit the location to confirm there is no fire.

REFERENCES

- NFPA 72, *National Fire Alarm and Signaling Code*
- FM Approvals Standard 3232, *Video Image Fire Detectors for Automatic Fire Alarm Signaling*
- UL Standard 268, *Smoke Detectors for Fire Alarm Systems*
- UL Standard 268B, *Outline of Investigation for Video Image Smoke Detectors*
- ISO/TS 7240-29, *Fire detection and alarm systems – Part 29: Video fire detectors*
- CNPP LPMES DEC 18 005, *Test method specific to smoke and/or flame detection systems by image analysis*

QUESTIONS OR COMMENTS?

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Tech Talk is a technical document developed by ARC to assist our clients in property loss prevention. ARC has an extensive global network of more than 100 property risk engineers that offers tailor made, customer focused risk engineering solutions.

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