Case Study: Video Analytics Oil Mist Detection
Introduction

Video Analytics for Engine Rooms
Fike Video Analytics Server detects flame, smoke and oil mist by processing video from off the shelf IP cameras in areas such as machinery spaces or mooring decks.

The Fike Server is installed and connected to the existing camera LAN, detection event alarms and live video may be monitored in the engine control room and elsewhere, sent digitally to the Video Management System (VMS), Safety Management and Control System (SMCS) or viewed through the Fike SpyderGuard VMS.

Software alarm/exclusion zones and alarm verification functionality, combined with Fike’s unique algorithm sensitivities, allow for endless configuration options to suit specific fire, smoke and oil mist detection requirements.

There are three, mutually exclusive analytics algorithms used; smoke, flame and reflected flame detection. The smoke detection algorithm is used to detect smoke, oil/fuel mist or spray from a leak under pressure and oil vapor that is generated when fuel or oil leaks onto a hot surface.

Oil mist may form when high pressure fuel oil, lubricating oil, hydraulic oil, or other oil is sprayed through a narrow crack, or when leaked oil connects with a high temperature surface, vaporizes and comes in contact with low air temperature.

When the concentration of oil mist increases and reaches the lowest explosion level (LEL; 50 mg/l, as defined by the IACS), explosion may occur when the mist contacts surfaces of over 200 °C (392 °F) or a spark.
Example System Setup

The following is an example of a system on board a cruise ship fitted with IP cameras and monitored by an existing video management system.

Fike Video Analytics (FVA) Servers are installed in the CCTV server racks and connected to the camera LAN. The Fike servers are capable of analyzing video from 16 cameras and have 6TB of recording space, providing average 2 weeks of recording time.

The video management system client software is running on a PC in the Engine Control Room and broadcasting live video on four, 40” CCTV screen monitors. The FVA management system, SpyderGuard, was installed on the PC as a means for configuration management of the analytics and, in the event of detection, pops-up live video, with analytics overlay, to one of the large CCTV monitors. Audible and visual alarms are also provided.

Prior to installing a video analytics detection system, a hazard analysis is performed to identify areas for detection, covering engines, purifiers, thermal oil heaters and other equipment involving flammable liquids.

With these areas in mind, camera location is best if installed with a tilt of approximately 45 degree angle looking down and approximately 20ft from the equipment. When the camera is installed and connected to the server, the analytics settings can be modified to target specific areas for highest sensitivity.

Smoke (oil mist) alarm zones are configured above the equipment so that alarm will occur inside the zone. The analytics track the detection through the entire field of view, however will not alarm until detection reaches alarm zone.

Oil mist is hot and under high pressure, therefore rises, and airflow in the spaces also works to move the mist into the zones.

Areas with low potential for origination of smoke, mist or flame, such as the walkways will be excluded from the detect zones to avoid unwanted detections.
The analytics identify areas of light contrast in motion and movement across pixels, the outline of a person close to the camera can cause false detections. Time delays, sensitivity and alarm zone adjustments are made while monitoring normal operation of the crew.

By configuring alarm zones throughout the field of view, avoiding areas where personnel are normally present, and smoke (oil mist) detection sensitivity can be set to High. High sensitivity allows detection and tracking of minute mist particles, often invisible to human monitoring.

*Oil mist is hot and/or under high pressure, therefore rises, and airflow in the spaces also works to move the mist into the 3-dimensional zones.*

Flame and reflected flame detection are configured to Medium sensitivity as they are enabled in the entire field of view and a brief delay is added to avoid transient events that could cause false detections.

Below are screenshots with smoke alarm zones highlighted within the blue frames.
The following are two images indicating targeted zoning with dark blue lines and smoke detections at engine startup. The light blue outline is one smoke detection algorithm display, there are also light blue tiles representing detection from another algorithm, barely visible, well into the zones.

**High sensitivity smoke detection is enabled in the entire camera field of view.** Smoke is detected anywhere in the field of view and tracked. When smoke breaks the plane of the zone, there is an alarm immediately and the detection indication expands to all areas where there is visible smoke.
When the water mist fire suppression systems were tested, the mist migrated to adjacent engines. The analytics detected the mist that looked very similar to oil mist or smoke; 8 cameras detected mist during one of the tests. Below are pictures of the water mist detections.

Water mist detections
Above is water mist detection, smoke type detections are represented either by a blue outline or blue transparent tiles overlay. Light smoke can be generated when engines are first started. The following images are detections from these events.
Engine startup smoke
Above are screenshots during tests in machinery spaces using a calibrated smoke emitter. Although smoke detectors were directly above the smoke emitters, none of the existing detectors went into alarm.

Flame from welding was detected
Video Analytics Oil Mist Detection

Smoke emitter tests were also conducted on mooring decks

SpyderGuard Browser
Features of SpyderGuard Video Management System

- View live video with analytics overlay of detection
- Configure analytics settings
- View and download videos of previous detections
- Provides alarm light and voice notification of alarm
- Smoke detection Maintenance Mode

A number of SpyderGuard software modifications were accomplished by the Fike software engineers based on feedback from the engineering crew. These were primarily related to annunciation and acknowledgement of alarms.

One significant new feature to reduce human interference detections is the Maintenance Mode for use when personnel are working directly on monitored equipment. When turned ON, smoke detection on a camera is disabled for an amount of time designated by the crew. Flame and reflected flame continue to operate normally.

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