VIDEO FIRE RECOGNITION

How smart video analytics can protect your people, property and processes from fire.

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FAIP

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ARAANI
VISION ON SAFETY

Araani Introduction

- Founded 2014, Belgium.
- 13 team members.
- First certified video-based fire detectors worldwide:
  - SmokeCatcher Certified
  - FlameCatcher Certified
  - FireCatcher Camera

Araani Introduction

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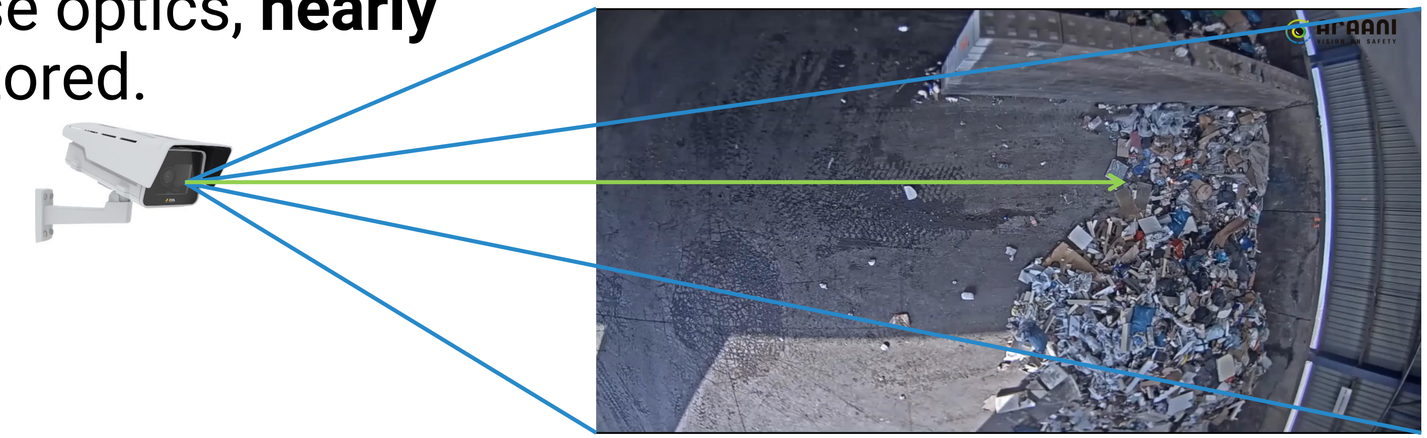
1. Technology

- Video Fire Recognition is based on the computer analysis of video images provided by an IP Camera. The system automatically identifies the particular motion patterns of smoke or flames and alerts the system operator to its presence in the shortest time possible.

- Recognition is performed by a software algorithm. Video images are analysed in real time by applying digital image processing techniques that allows smoke or flames to be detected.

1. Technology

- **Visual** spectrum
- **Fixed** camera, fixed field of view
- **Video analytics algorithm** “scans” video continuously on first sign of presence of smoke or flames.
- Camera settings and position are **optimised for smoke and flame detection**, not for surveillance !
- Dependent on choice of lense optics, **nearly every distance** can be monitored.



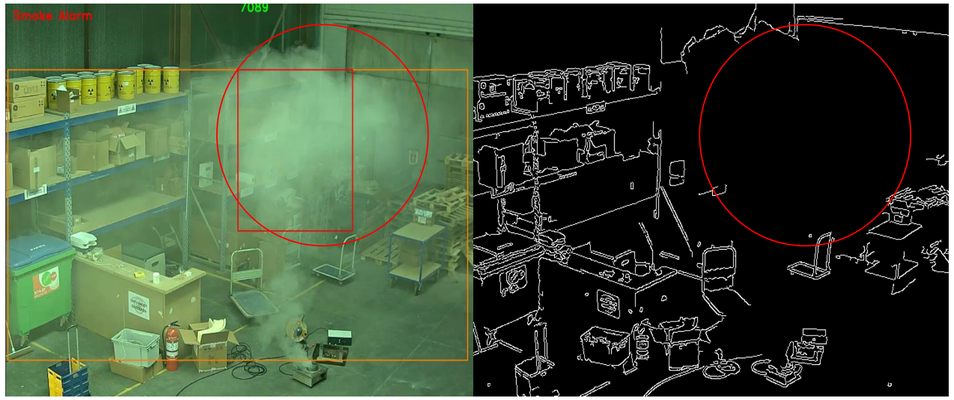
1. Technology – smoke recognition

Moving object detection + Edge analysis

1. Find “a moving object”
2. Analyze the edge
3. Evaluate the growth

+ Fast detection
- False alarms on ‘growing phenomena’
- No recognition of thin smoke
- Source of smoke is not always visible

Wavelet based energy analysis



Smoke causes obscuration, which is visually expressed in a loss of contrast.

+ No typical ‘smoke plume’ shape required
+ No false alarms on normal ‘growing phenomena’
+ No need to see the source of the smoke
- Minimum basic contrast is required

1. Technology – flame recognition

- Moving object detection
- Color (R,G,B): R >= G >> B
- Detection of the frequency of flames in and at the edges of the fire: 0,5 – 20 Hz with a peak at 10 Hz.

+ Very sensitive and fast detection.

- False alarms on red/orange rotating beacons or luminous object (welding, reflections…).

- Only recognition in the visual spectrum (unlike IR flame detectors).

1. Technology – edge based architecture

- Analytics on the CPU of the camera
- Camera + analytics = 1 UNIT
- Video is only used for visualisation:
  - compressed video -> lower bandwidth -> lower cost
- Point of failure limited to 1 camera
- Integration in existing fire safety system via dry contacts

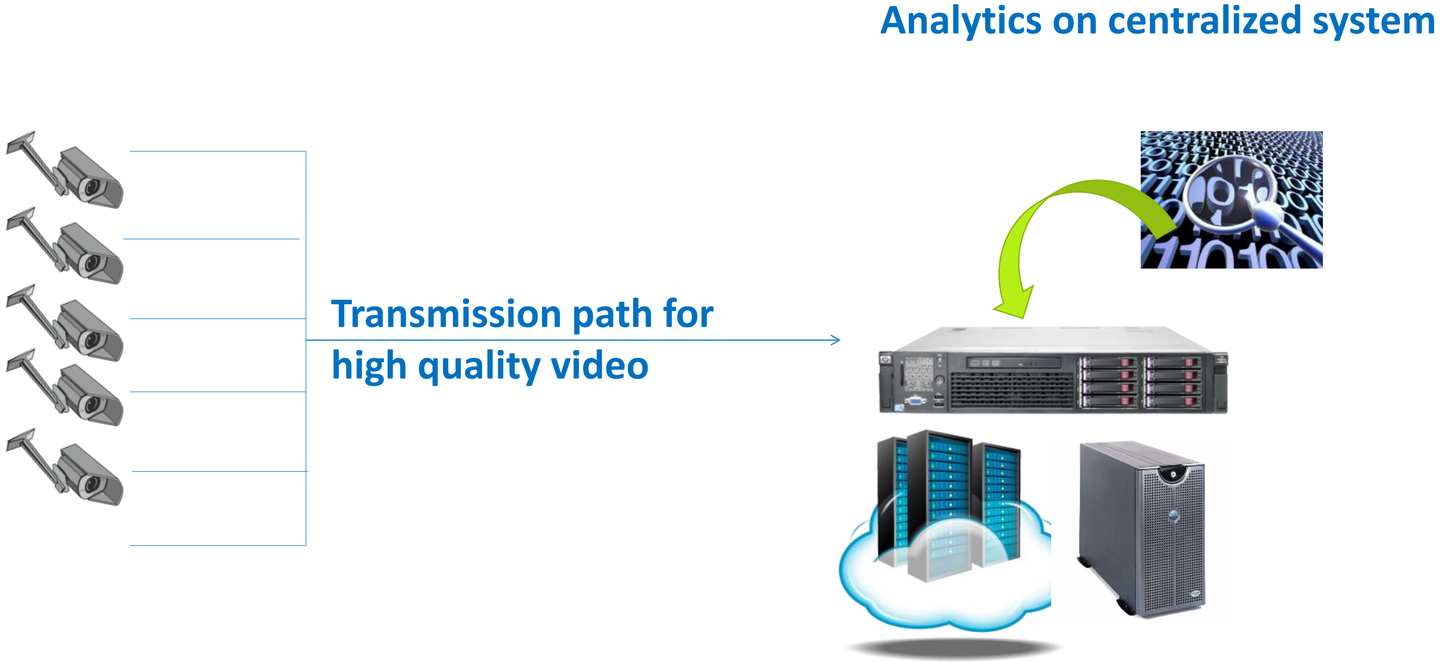
1. Technology – server based architecture

- Analytics centralized:
  - Dedicated server / PC
  - VMS-server
  - Cloud server

  = Extra point of failure with fall-out of large area
- Transmission path for video: requires high bandwidth for high quality video

  = High installation cost

  = Extra point of failure



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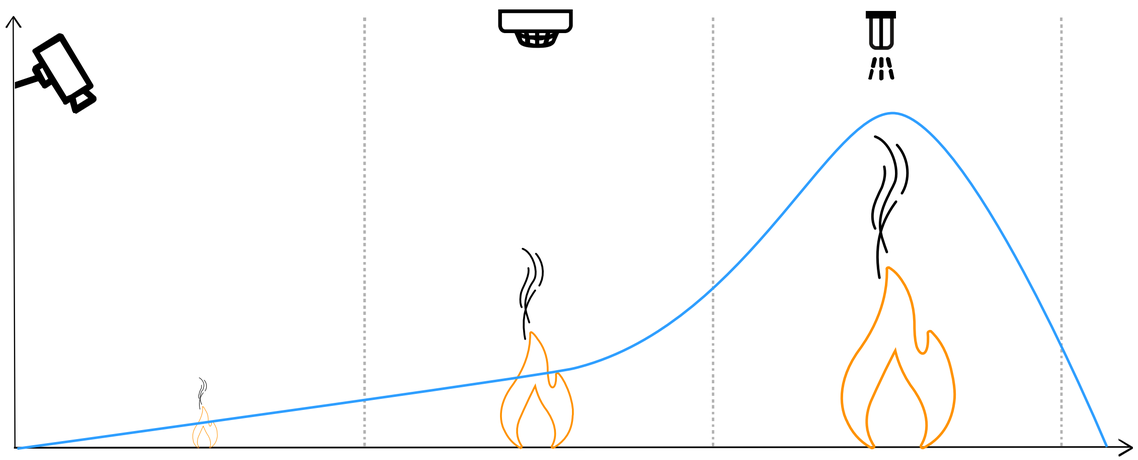
2. Advantages

1. Detection at source

- As traditional smoke detection is based on physical contact between the smoke and the detector, we see that only from the growing phase detection is possible. For sprinklers, temperature is the trigger, but then probably you are just too late.
- VFR does its detection by visual recognition, so even in the smouldering phase an alarm can be triggered. You don’t need to wait for the smoke to reach the detector.



2. Advantages

2. Visual verification

- Exact location of the incident
- Information on presence of people/victims
- Information on nature of combustion
- Real-time progress of the incident
- Pre- and post-incident evidence

2. Advantages

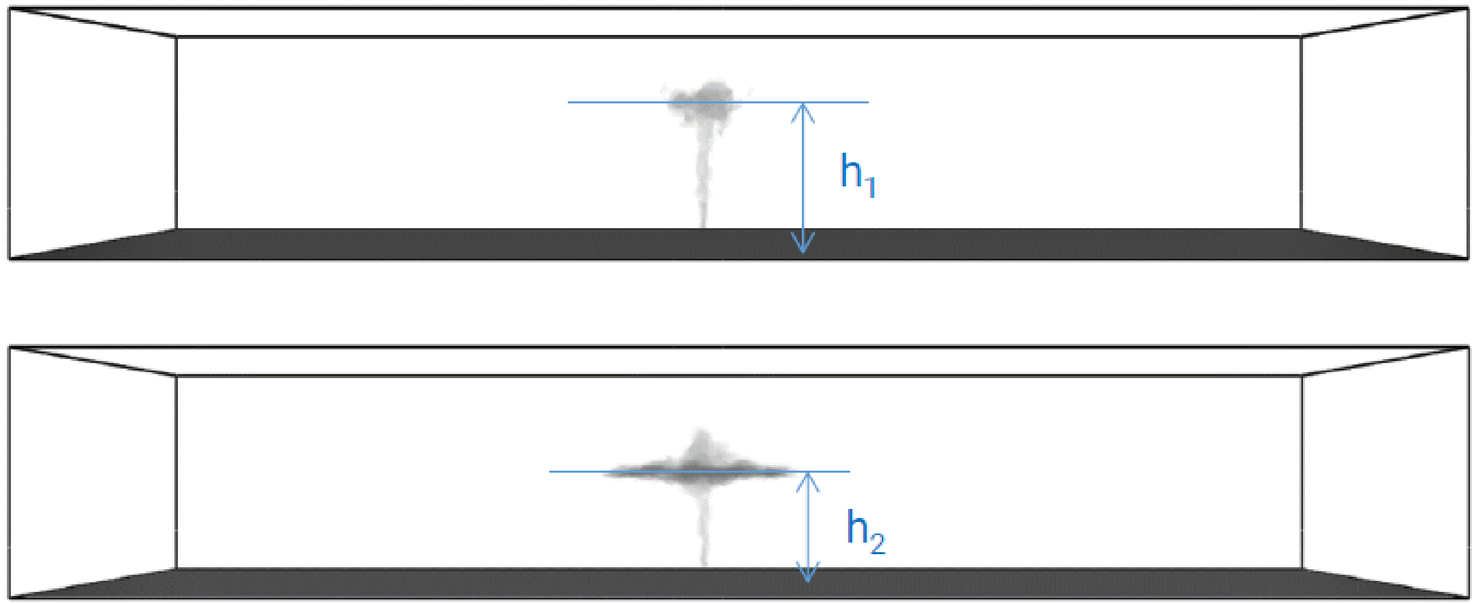
3. Traditional detection can be inadequate

Harsh Environment

Great heights

STRATIFICATION

Smoke stratification occurs when there is a hot layer of air under the ceiling of an enclosed area. When the hot layer of air is warmer than the smoke plume, it will prevent the smoke reaching ceiling-mounted point-type or beam detectors.



CFD simulation:
H: 16 m
t: 200s

T_{floor}~= 20°C
$T_{ceiling}$~= 40°C

T_{floor}~= 20°
$T_{ceiling}$~= 50°C

$h_2 < h_1$


the belgian

2. Advantages

3. Traditional detection can be inadequate

Harsh Environment

Great heights

(semi) Outdoor situations

2. Advantages

4. Maximize production uptime

Sometimes fire safety is subordinate to the cost of downtime.

Thanks to the detection at source and visual verification, there is a time window to make the right decision:

1. Make sure production continues.
2. Take care of the fire.

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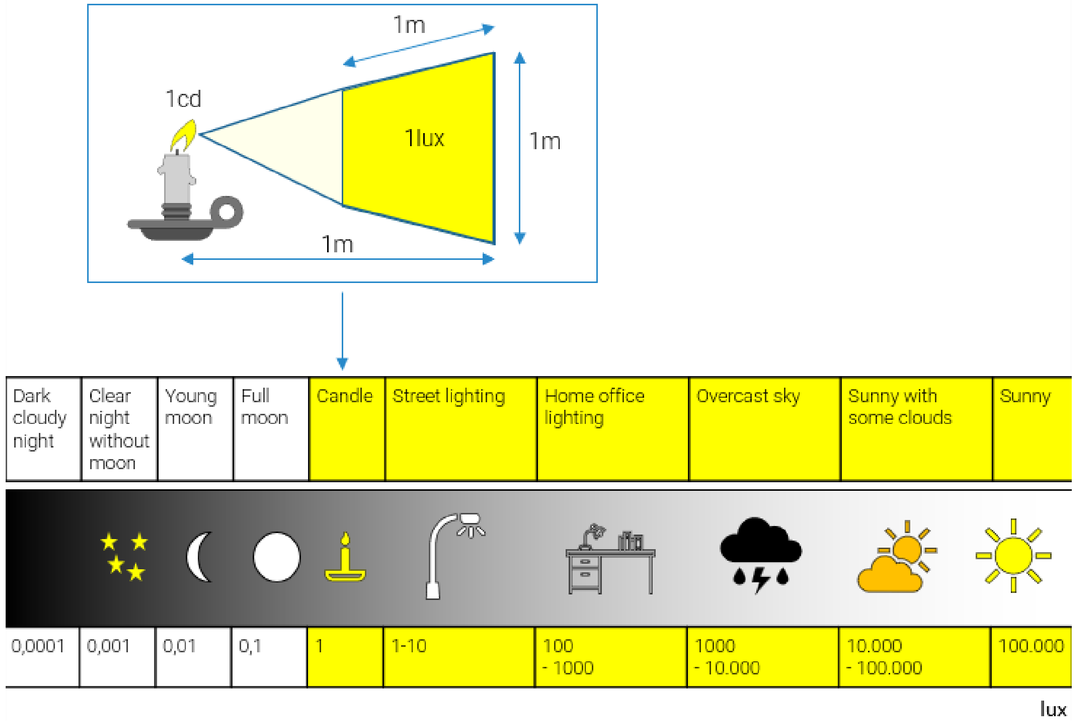
3. Applications - guidelines

1. Practical requirements

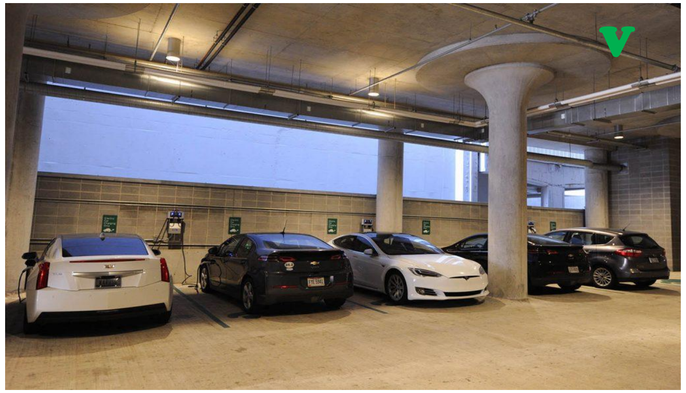
- Light:
  - Minimum required light:
    - Industry standard: 15 lux
    - Best in class: 1 lux
  - Illumination ration:
    - = brightest spot / darkest spot
- Indoor or roofed environments:
  - Do not point the camera to exterior windows and portals.
  - Avoid the presence of direct light sources in the field of view. Mask if they can't be avoided.
- Outdoor:
  - Avoid having horizon in the field of view of the camera.
  - Avoid East or West orientation.

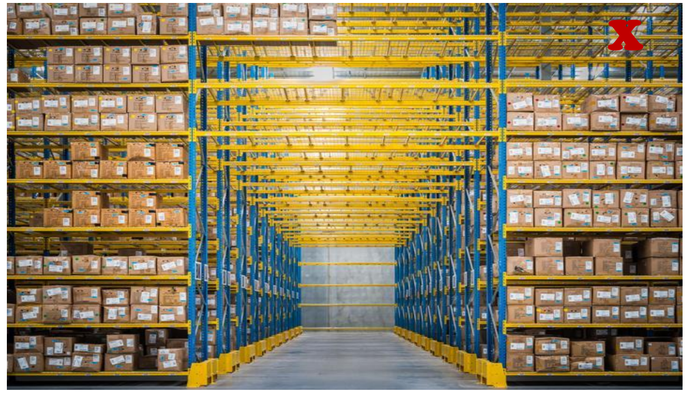


3. Applications - guidelines

1. Practical requirements

- Have a free field of view





3. Applications - guidelines

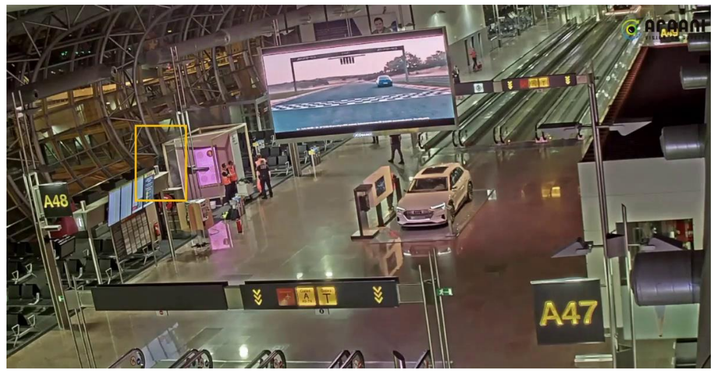
2. High impact environments

3. Applications - guidelines

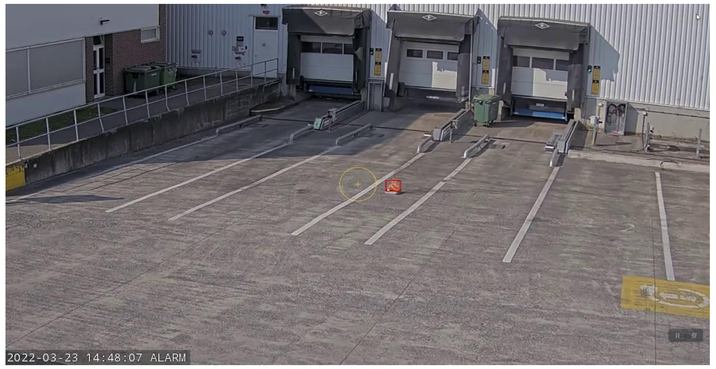
3. Traditional detection falls short

- too many false alarms

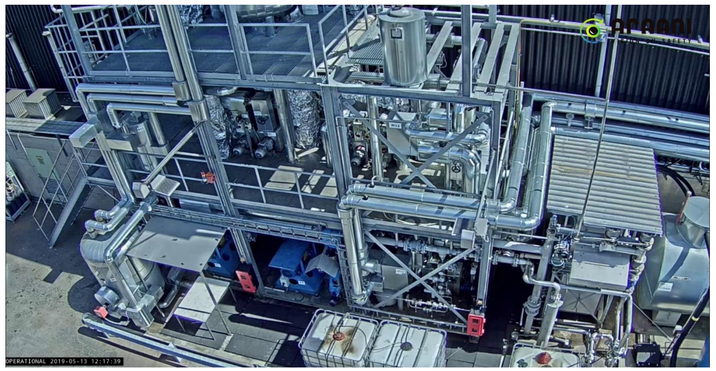
- the detection is too slow



- outdoor



- process monitoring

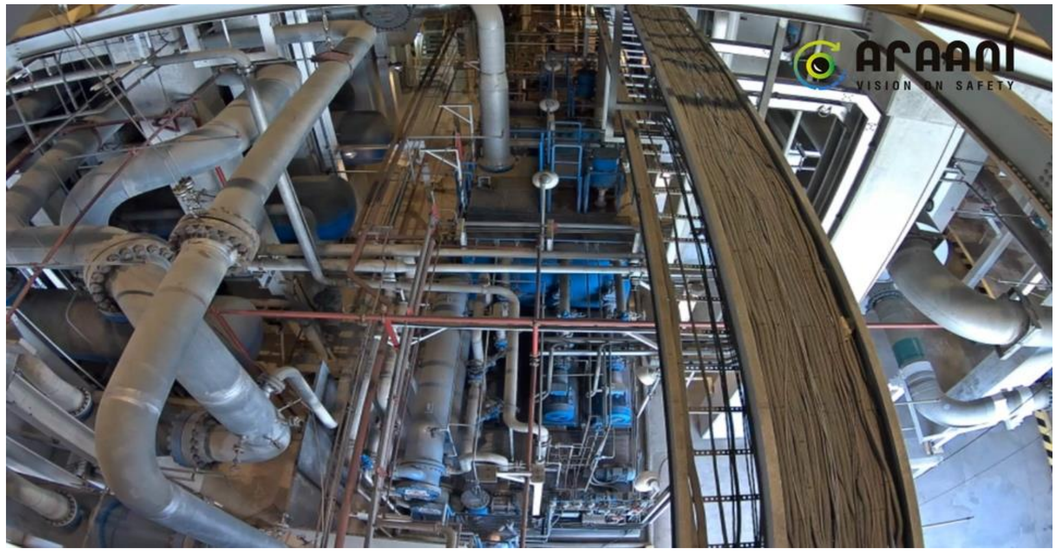


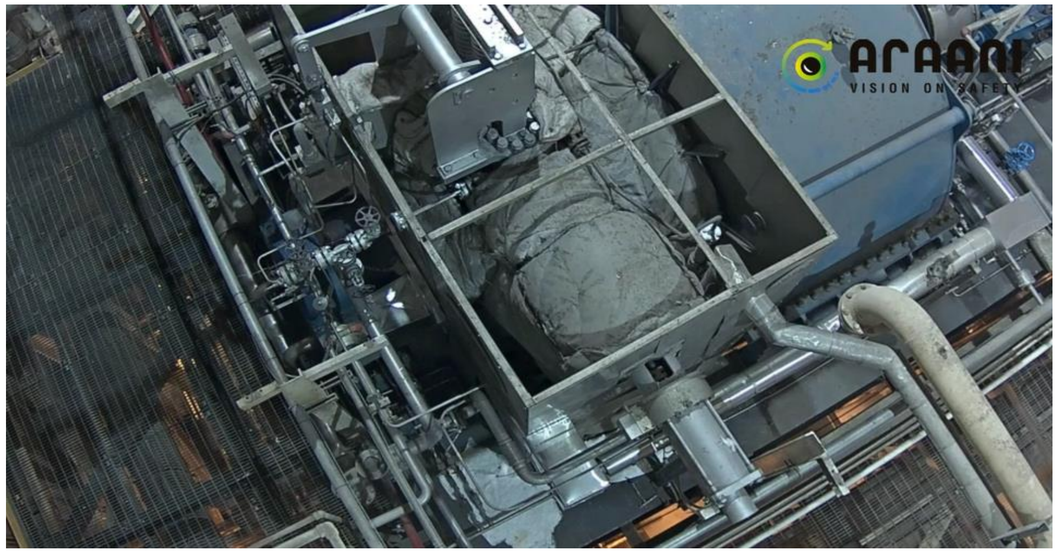
3. Applications – E-vehicles

- High risk of explosion when fire.
- Immediate visual verification:
  -> save neighbouring vehicles.
  -> save building.
- Open air or only roofed –> no traditional fire detection possible.

3. Applications – Process industry

- Secure critical areas of the process.
- 24/7 extra eye monitoring for smoke/flame.
- Any unwanted interruption has a big impact.
- Unwanted alarms avoided because of immediate visual verification.
- Remote monitor intervention of intervention instead of fire guard.





3. Applications – Substations

- Critical area.
- 24/7 extra eye monitoring for smoke/flame.
- Any unwanted interruption has a big impact.
- Mostly multiple remote rooms, in the basement, spread over the plant.

3. Applications – Waste recycling

- High risk + high impact.
- Challenging environment: dust, damp, misting, exhaust fumes...
- Insurance:
  - High premiums.
  - No insurance.
  - More and more capital intensive.
- New challenge:
  - Lithium batteries.

Smoke vs. Flame detection at SRF storage

Real incident July 2017

3. Applications – Historical buildings

- Sense of urgency: fire of the Notre Dame de Paris.
- Traditional fire detection is difficult for technical and esthetical reasons.
- A big tendency to install security cameras in historical buildings.
- Video Fire Detection is an ideal combination of safety and security.

3. Applications – Lithium batteries

- Lithium-ion batteries are generally safe!
- But once thermal runaway has started the process is hard to stop.
- Causes of thermal runaway:
  - Mechanical
  - Electrical
  - Thermal
  - Manufacturing defects
  - Maintenance errors
- Phases:
  1. Off-gas generation
  2. Smoke generation
  3. Fire generation

1. Off-gas generation

2. Smoke generation

3. Fire generation

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4. Video Fire Detection vs Video Fire Monitoring

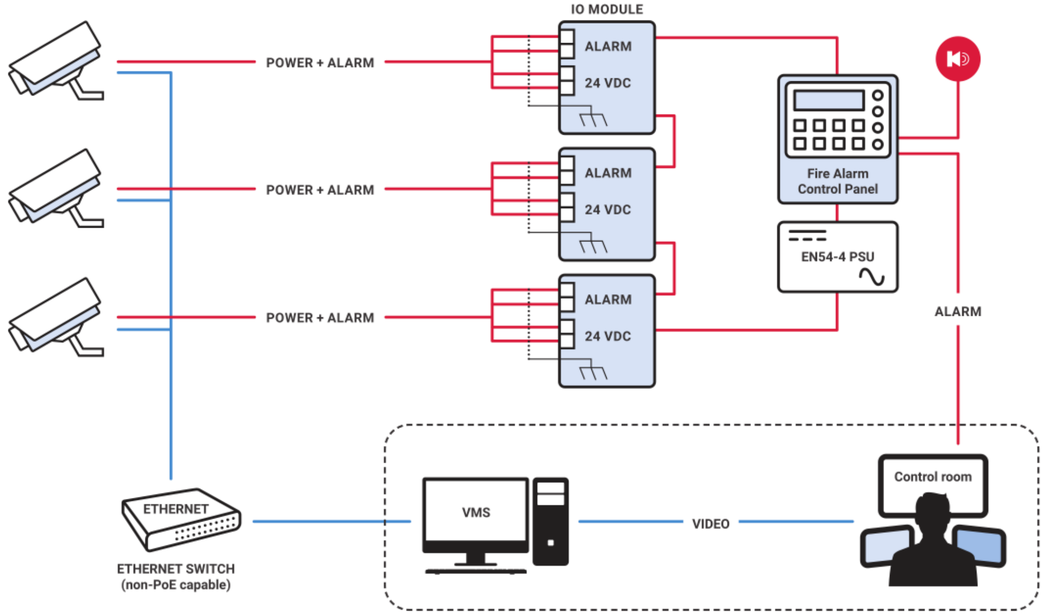
Video Fire Recognition

(= the technology to recognise fire phenomena by video analytics)

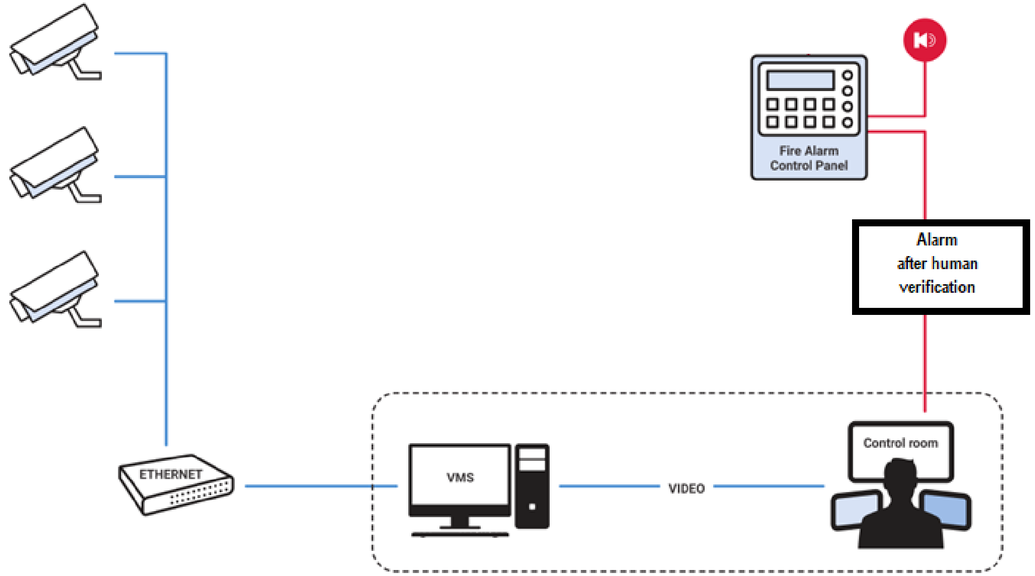
Video Fire Detection	Video Fire Monitoring
• **Detects** smoke & flames.	• **Monitors** for smoke & flames.
• Camera as a fire detector.	• Analytic as a support for a guard/controller.
• Linked with fire alarm control panel.	• Cannot be linked with fire alarm control panel.
• Can replace a mandatory fire detector.	• Cannot replace a mandatory fire detector.
• **Certified**	• **Not certified**

4. Video Fire Detection vs Video Fire Monitoring

- Video Fire Detection



- Video Fire Monitoring



4. Video Fire Detection vs Video Fire Monitoring

- Video Fire Detection

FireCatcher®
CAMERA

- Video Fire Monitoring

ARAANI® Fire Guard

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5. Video Fire Detection: regulatory

ISO

- ISO 7240-29:2024: Video Fire Detection

Europe

- No EN54 for Video Fire Detection yet -> application by Germany, Belgium and France to add VFD to EN54.

Belgium

BOSEC certification

- ISO/TS 7240-29:2017 + NTN 177-L + NTN 177-C
- Approved as a primary detector according to NBN S21-100-1.
  - ANPI: NTN 177-I
  - Other inspection bodies: NSN S21-100-1 annex F

France

CNPP certification

- ST LPMES – DEC18.005

Approved as a primary detector according to APSAD R7.

Germany

VdS certification

- VdS 3847: Visual fire monitoring

Not approved as primary detector.

Plans to develop certification as primary detector.

US

FM certification

- FM 3232

Approved as a primary detector according to NFPA 72.

US

UL certification

- UL 268B

Approved as a primary detector according to NFPA 72.

Old standard (2009) – is in revision.

United Kingdon

BRE certification

No current product standards that define the performance of VSD, however this technology is recognised as a means of verifying a fire (Section 21.1.7)

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