insight to !nspiration

Nexplant

Safety

Companies need to take an entirely new and different approach, exert extra efforts to prevent risks where they conduct business, and remove barriers that prevent them from reacting promptly.

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Samsung **Nexplant Safety**

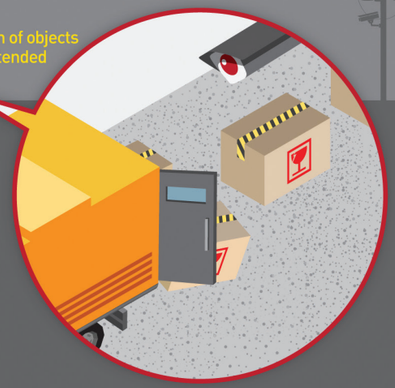
Controls

Safety check for workers
at entrances/exits

Entry/Exit control

Safety check for workers
inside work sites

Detection of
workers' hand signals



Detection of objects
left unattended

Samsung Nexplant Safety is an intelligent real-time video analytics solution that prevents accidents and responds to them promptly. It can be utilized in a variety of areas that follow standard operation procedures (SOPs) including workers' safety, event detection, dangerous materials management, crime and security.

Companies are both the main players of a society and the main drivers of change. They are asked to satisfy the safety demands and resolve safety-related issues inside and outside the company. Therefore, It is essential to identify the risks and opportunities related to safety, which will eventually bring financial benefits and lay the ground work for sustainable management.

A safety issue in a work environment can make or break a company's future. This is why many leading companies are taking safety issues seriously and taking preventive and enterprise-wide measures to resolve them.

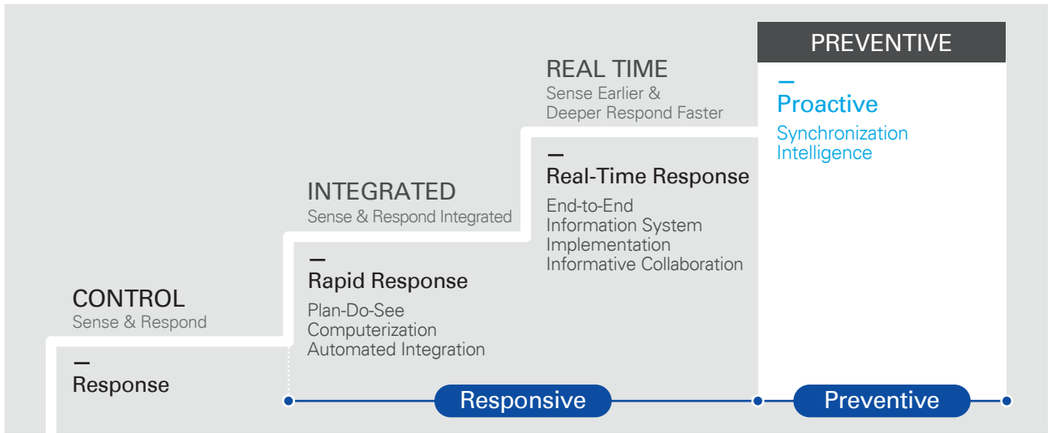
Environment Safety Trends

Safety incidents that occur at a work site sometimes wreak havoc on a company. The damage caused by accidents at manufacturing and construction sites has expanded as businesses have become complex, expand in size and operate around the globe. As a result, the parties affected by an accident are also diversifying and becoming more complex.

Because of the diversity and complexity, companies are striving to prevent potential risks in all areas and remove the barriers that get in the way of prompt responses. Some of the leading companies are moving away from passive, limited, regulatory compliance-focused and surveillance-focused approaches toward preemptive, enterprise-wide and preventive ones.

In order to establish a more aggressive response system, companies should see safety as a way to secure their future. Some companies still consider ROI when talking about safety or are reluctant to invest in safety stating that the possibility of an accident is relatively low.

Although investments in safety will not create direct benefits for companies such as value creation and an increase in revenue and cash flow, it will prevent the damage companies may suffer from accidents including manufacturing and construction delays, and lawsuits.



<Figure 1> The measures companies take to create a safe work environment

There is a growing need for real-time intelligent video analytics solutions as surveillance targets are becoming more diverse and complicated.

Video Analytics Technology Trends

Many companies have adopted CCTVs, video management systems (VMS), video surveillance and other time-tested video security technologies to prevent accidents and ensure safety.

While these technologies mostly rely on human observation, offline-analysis, and simple logic, advances in IT have led to a shift in video security from analog to IP-based digital cameras, and from independent to integrated digital networks. Such changes are also driving the evolution into an integrated system that uses not only video images but also other digital data. In addition, a growing interest in societal and work environment safety is leading to more diverse and complicated surveillance targets, including persons, objects, and accidents, as well as an increasing call for more accurate real-time surveillance. To ensure accurate surveillance, large volumes of high-definition video data must be collected and the complicated elements in video data must be analyzed accurately.

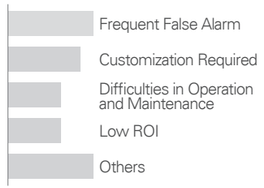
As a result, intelligent video analytics technology that enables accurate event (anomaly) detection, facilitates tracking, and collects high-definition images in real time by combining and analyzing many different elements in video image is becoming increasingly important. The rapidly increasing volumes and complexity of video data will further add to the importance of intelligent video analytics.

Video Collection	Real-time Detection	Event Comprehension	Intelligent Reasoning
Zero IQ(10~)	Average IQ(80~)	High IQ(115~)	Superio IQ(140~)
_Video surveillance by monitoring agents _Event check done with the naked eye through a playback	_Real-time video analysis _Behavioral analysis based on simple logic _Simple logging and transmission of logs in the case of an event	_Comprehending the situation in the video _A comprehensive analysis of diverse elements _Provision of detailed information and other related data in the case of an event	_Overcoming limited concentration and memory _Past and present comparison, causality, and other reasoning functions

<Figure 2> Video Analytics Technology Roadmap

The currently available video analytics solutions that many companies use to create a safe work environment have many issues to be resolved. This is why companies should choose an intelligent, real-time video surveillance and analytics solution that is capable of monitoring more diverse and complicated surveillance targets, including persons, objects and accidents.

Issues in introducing and operating Video Analytics



Video Analytics Operation Issues

According to the survey we recently conducted, companies face the following issues when introducing and operating a video analytics solution for a safe work environment:

- **Frequent false alarms resulting in low efficiency**

  Unlike tailored solutions that take into account each company's surveillance targets and detection processes, ready-made solutions frequently result in false alarms.

- **The need for a tailored solution**

  Many companies want a tailored video analytics solution that takes into account their own attributes such as the type of business, work environment, risk factors and SOPs.

- **Inefficient control support**

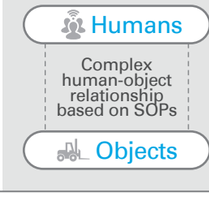
  Most of the controls are highly dependent on the staff at control center due to an inefficient, inconvenient, or lacking control support system and a disconnect between systems.

Key Elements of Video Analytics

In order to resolve the issues stated above, companies should adopt a solution that is capable of detecting all kinds of anomalies involving persons, objects and a combination of the two. The solution should also be able to take prompt measures after an accident and support operation and maintenance efficiently.

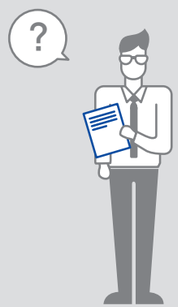
Key Success Factor

Detection of abnormal behavior and events that involve diverse and complex human-object combinations



Key Function

Human and object recognition, complex event search, high-performance tracking, abnormal event prediction



Companies that are considering implementing a video analytics system to secure a safe environment or that already have one must consider the following:

—
Can the system detect and analyze diverse and complicated abnormal behavior and events that may occur at manufacturing or construction sites?

—
Does the system support swift and efficient controls?

—
Is the "reuse" of investment possible? Does the system ensure effective investment?

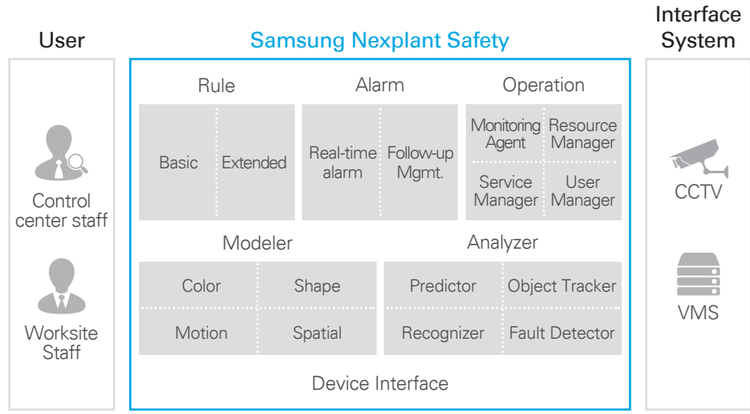
Samsung
Nexplant Safety

“Fast, Accurate, and Convenient”

Preventing accidents and making swift responses requires a video analytics solution that provides greater detection accuracy and enables intelligent / integrated video utilization and management. Samsung Nexplant Safety is the “Fast, Accurate, and Convenient” video analytics solution you need.

Samsung Nexplant Safety

Samsung Nexplant Safety is an intelligent real-time video surveillance and analytics solution that prevents accidents and incidents caused by humans or objects and enables a swift response. Equipped with environmental safety-specific analytics, seamless control support, and an integrated platform, Samsung Nexplant Safety consists of six main modules, including Rule, Alarm, and Operation, and can be connected to standard control equipment.



<Figure 3> Samsung Nexplant Safety Conceptual Diagram

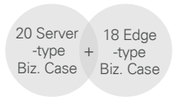
Functionality

Rule	SOP-based environment safety video analytics business rules are managed.
Alarm	Event notifications are given in real time.
Operation	Operation and repair / maintenance are facilitated.
Modeler	Functions for modeling of objects of interest are provided by performing linkage analysis of color, shape, motion, and space.
Analyzer	Functions to recognize and track objects of interest, and functions for prediction of specific situation are provided.
Device Interface	A seamless connection to CCTVs, VMSs, and other standard control equipment is ensured.

The VA Technology Specialized for Keeping Work Sites Safe

A perfect analysis of complex events in a variety of work environments and business cases is made possible by applying business-specific rules and using distinctive VA technology.

38 Biz. Case



Work environment-specific Biz. Case

Profiles for different Biz. Case

Edge type basic functions and servertype extended functions

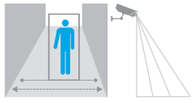
Rule application and easy modification

Background Subtraction

Background Subtraction

The foreground and background in video footage are separated to minimize inaccuracy due to diverse and complicated changes in the surrounding environment and to enable continuous tracking of targets.

2D Video-based 3D Data Processing



2D Video-based 3D Data Processing

Object and lane information in 2D video is automatically read and the location of relevant zones and cameras is calculated, enabling accurate determination of the speed of a moving entity and the direction in which it is headed.

In the case of video analysis, the use of expensive specialized cameras and hardware is minimized, improving ROI and cutting costs.

Backbone Extraction for Motion Recognition

Object and Motion Recognition through Skeletone Analysis

Computational geometry approach to recognition of shape and motion of an object of interest.

Predefined motion patterns can be recognized through conversion of raster image to geometric network object.

Information awareness and interaction-based analysis

Video Analytics Using Multi-camera

If an object that is being monitored by one camera moves in another direction, the camera transmits the information of the object to another camera, enabling continuous analysis.

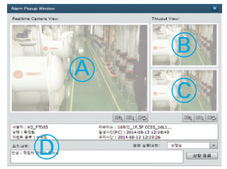
Video clips from different cameras are combined into a multi-camera sequence by changing the region of interest.

State-of-the-art intelligent analytics is provided as cameras share information about objects by interacting with each other, thereby intelligently recognizing and monitoring objects.

Perfect Control Support

An event is notified in real time via alarm so that proper measures can be taken immediately. Setting a rule through the workflow UI enables fast application of rules at a site in the event of changes in the environment.

Pop-up Alarm



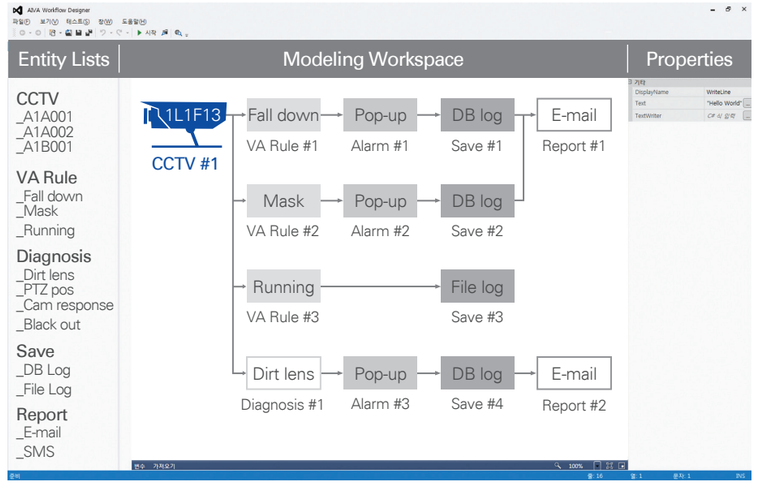
Event Processing and Log Analysis

Any anomalies and errors in servers and equipment detected through VA are quickly notified to the staff at the control via pop-up alarm.

Ⓐ pop-up screen shows a live video footage, Ⓑ a screen capture image of the moment the event occurred and Ⓒ video footage replay around the time the event occurred, Ⓓ Management of the history of the measures taken.

Function Management

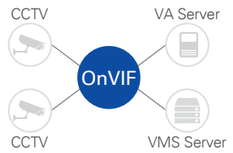
The workflow-type UI allows managing a variety of CCTVs rules, alarms and logs, and makes the reporting function easy to use.



<Figure 4> Workflow-type UI of function management

Integrated Operation Platform

The add-on function that is made possible through the standard OnVIF(Open network Video Interface Forum) interface will reduce initial investment and operation costs, and a software development kit (SDK) allows for the addition of new functions. Parallel calculation processing technology enables real-time high-speed video processing.

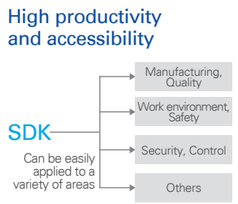


OnVIF Standard I/F

Active interface between the existing equipment (CCTV,VMS)

Flexible application in different environments

High productivity and accessibility

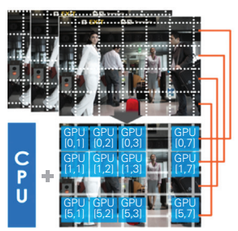


Flexible Architecture (SDK provided)

A flexible architecture in which new functions can be added in order to efficiently respond to changes such as changes in safety compliance and SOPs

Software Development Kit (SDK) is provided for an easy addition of new functions

Parallel processing for high-speed computing



CPU + GPU Parallel Calculation Processing

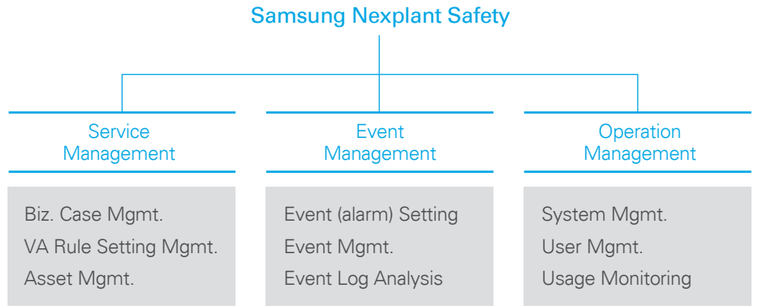
Maximized accuracy of analysis, and high-performance architecture for large capacity video and complex event processing

Use High-Performance Computing (HPC) technology including General-Purpose Graphics Processing Units (GPGPU) to analyze high-definition and high frame rate video sources.

Reduce the Hardware cost to a minimum when establishing a system by resolving CPU load issue and supporting high-speed calculation.

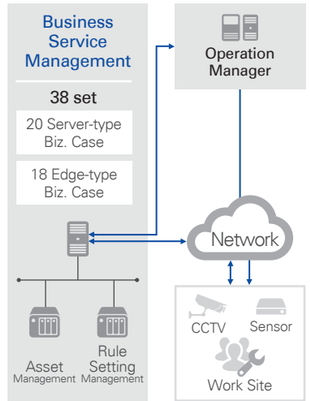
Samsung Nexplant Safety Key Features

Samsung Nexplant Safety supports addressing security issues based on video analytics with its service, event amd operation management features.



Service Management

Samsung Nexplant Safety supports easy operation of services by allowing flexible rule-setting according to the type of business and work environment based on 38 Biz. Case



Biz. Case Management

Service setting according to work environment and type of business

Biz. Case for different industries, a region of interest and cause for safety accidents / incidents

Basic: 18 + Extended: 20

VA Rule Setting Management

Rule-setting management (Preset)

Rule application, option management

Rule record management

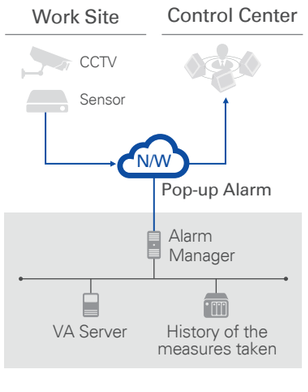
Asset Management

Asset Profile management
(Camera, sensor registration / modification / deletion)

Remote control

Event Management

The VA detects any anomalies in the live CCTV footage. The information, including anomalies detected by sensors, is automatically sent to the control center staff in the form of a pop-up screen so that the staff can address the situation in real time.



Event (alarm) Setting

Set various conditions for events
System interface information management
Event type management

Event Management

Take the measures necessary for the event (cancellation, measures completed, confirmation)
Alarm data management

Event Log Analysis

View measures taken
Provide statistics
User management

Operation Management

The administrator can comprehensively manage the system operation status by using a monitoring client to check real-time operation status and checking the history information displayed in multiple views.

System Management

System information management
System error detection and control
Remote control management

User Management

User management
System administrator authority management

Usage Monitoring

Real-time surveillance monitoring
Asset status, event status and log analysis

Samsung Nexplant Safety Deployment

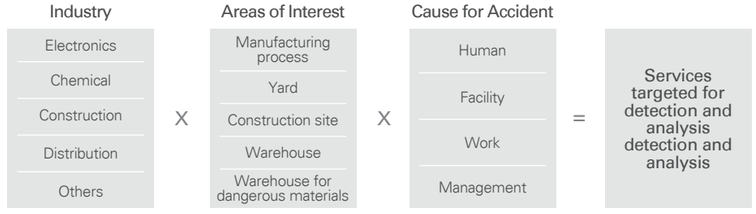
Samsung Nexplant Safety is available in two versions: standard and extended. Choose one by taking into account the scale and type of your business, costs, and targets for implementation.

	Standard	Extended
Target	Small-sized companies that need video analysis on a standard Biz. Case level	Companies that need video analysis and main control functions customized for large companies
Description	Video detection and analysis Real-time alarm Post-alarm management	Video detection and analysis Real-time alarm Post-alarm management
	A. Standard Biz. Case 18 ready-made accident risk analysis functions	A. Extended Biz. Case Standard Business 20 additional accident risk analysis functions on top of standard Biz. Case Management of assets related to camera and video analysis
	B. Option Management of assets related to camera and video analysis can be included in the Option Pack.	B. Option Consulting and implementation
Method	Solution License Solution Deployment	Solution License Solution Deployment Solution Consulting & Customizing
Scale	Real-time video analysis involving 50 CCTVs included in the standard version	Real-time video analysis involving 50+ CCTVs
Strengths	Standard accident risk analysis functions Standard control functions Recommended for small-sized companies that do not require customization Stable system operation	Suitable if additional company-specific accident analysis functions are needed Suitable if additional company-specific control functions are needed Easy to connect to other internal systems Recommended for large companies

Samsung Nexplant Safety Services

Samsung Nexplant Safety is capable of real-time, intelligent video detection and analysis of Biz. Case that contain all types of incidents / accidents according to industry, areas of interest and the cause for accident.

Samsung Nexplant Safety Identifies Services



Accident Detection

Run	Detection of pedestrians running
Collapse	Detection of people suddenly collapsing
Collision	Detection of collision between cars or between a car and a pedestrian
Traffic Light Violation	Detection of cars and pedestrians violating traffic lights
Speeding	Detection of cars exceeding speed limits

Crime

Loitering	Detection of persons loitering inside restricted areas
Abnormal behavior in the elevator	Detection of abnormal behavior in elevators
Theft	Theft detection inside the surveillance zone
Unattended Objects	Detection of objects left unattended inside the surveillance zone for a certain period of time
Quarrel	Quarrel detection inside the surveillance zone

Security

Face identification	Recognition and distinction of faces
Face detection	User information recognition through face identification
License plate number identification	Automatic license plate number recognition
Trespassing	Detection of persons or objects trespassing in restricted areas
Virtual fence	Detection of persons or vehicles invading the virtual fence
Passing through	Detection of persons passing through the designated routes

Dangerous Goods

Tilting of containers	Tilting of containers in which dangerous goods are stored
Indiscriminate moving of dangerous goods	Moving of containers to unauthorized spots
Letters on steel plates (safety labels)	Recognition of the letters on steel plates

Safe Environment

Fall	Detection of fall of dangerous objects in work sites
Jaywalking	Detection of jaywalking in certain areas

Disaster

Water level detection	Notification of dangerous water level through detection of changes in water level
Fire	Detection of fires inside the surveillance zone

Workers'Safety

Not Wearing Personal Protective Equipment (PPE)	Detection of workers who are not wearing PPE at a work site
Wrong Working Clothes	Detection of workers who are not wearing protective clothing at a work site
Check for Protective Clothing before entering	Check if workers are wearing protective clothing before they enter restricted areas
Hand Signal Recognition	Detection of pre-determined hand signals by workers

Control

Privacy	Putting a mosaic on certain areas within the surveillance zone
Incapacitation	Detection of anomalies in camera footage occurring due to external factors
Counting of persons entering / exiting	Counting of persons entering / exiting the surveillance zone
Assembly	Detection of an assembly forming inside the surveillance zone
Moving direction	Detection of entities moving in directions different to those designated in the surveillance zone
Route	Detection of entities moving in routes different to those designated in the surveillance zone
Tracking	Tracking of the route of a specific person or object in the surveillance zone
Emergence	Detection of the sudden emergence of a person or object in the surveillance zone
Disappearance	Detection of the sudden disappearance of a person or object
Sudden change of scene	Detection of a complete change in camera footage
Automatic tracking	Tracking of the route of a specific person or object using a number of cameras

Safety check for workers at entrances / exits

Detection of workers' hand signals

Controls

Detection of objects left unattended

Safety check for workers inside work sites

Entry / Exit control

Samsung Nexplant Safety, which has been successfully implemented at a number of business sites around the globe, will help your company ensure a safe work environment.

Samsung Nexplant Safety User Scenario

Persona	Safety Manager
Needs	Wishes that easily-recognizable alarms warning of diverse dangerous situations were given. Wants to prevent accidents through video analytics that takes into account the requirements on the ground.
Scenario Background	The safety manager monitors sites for which danger detection is critical due to dangerous work conditions.

Process		▶ Monitoring & Handling			▶ Preventive Measures	▶ Equipment Inspection
TO-BE	Technology components		Color+Shape Analyzer		Motion+Spatial Analyzer	Handling history management / Statistical analysis	Hardware check
	Scenario	1 Safety manager"A"checks a number of CCTV screens to monitor worksites.	2 Once the Envirety VA detects a worker not wearing protective gear through color and shape analysis, an alarm screen pops up."A"sees the alarm and learns there is someone who is not wearing protective gear.	3 "A"gives an annoucement to warn the worker not wearing protective gear. The worker is removed from the site for violating safety regulations.	4 Samsung Nexplant Safety detects a worker showing no movement through motion and spatial analysis and sends an alarm via a pop-up screen. Upon seeing the alarm,"A"observes the worker closely and realizes he is lying face down to take a closer look at the machines.	5 The types and frequency of abornaml events that took place in a given period are recorded and managed. The statistics data are reflected in future accident prevention measures.	6 "A"checks each site's CCTVs remotely and receives real-time automatic equipment monitoring results.
	Advanced	1	2 Workers without protective gear spotted	3 Warning announcement and removal from the site	4 Worker discovered not moving & Check for abnormal events	5 Management and analysis of abnormal events and their handling	6 Real-time CCTV status check through automatic monitorin
AS-IS	Current	1 Site monitoring	2	3 Worker not wearing protective gear gets into an accident.	4	5 Abnormal events and their handling are recorded but not tracked.	6 CCTVs are checked with the naked eye.
	Scenario	1 Safety manager"A"checks a number of CCTV screens to monitor worksites.		3 "A"is notified of the accident by another worker from the site and calls for help.		5 "A"writes a report on the accident and how it the situation was handled.	6 "A"visits each site to check the CCTVs in person.
	Pain point		2 In the case of typical camera-based monitoring, one must monitor more than two CCTVs with the naked eye, causing accuracy to fall more than 90 percent after 20 minutes have passed.	3 Abnormal events cannot be detected in real time, making it impossible to take timely countermeasures.	4 Motion-based detection is impossible unless additional equipment (more than two cameras / 3D cameras, etc.) is secured.	5 Abnormal events and their handling are not recorded / managed systematically, leading to the absence of an accurate cause analysis, and the reccurrence of dangerous situations.	6 CCTVs are checked manually, making it hard to swiftly deal with issues found in pan-tilt-zoom cameras.

Reference

Real-time detection of six main risks involving abnormal behavior

Manufacture S GCS (gas, chemicals, and slurry) complexes

Challenges

- Areas where gas, chemicals and slurry are handled
- Chemical drums and gas cylinders must be moved to authorized spots using only a set method.
- Gas shields and protective gear must be worn. No running allowed.
- It is critical to swiftly spot anyone injured early in an accident.

Solutions

- Video analytics focusing on safe chemical handling
- Real-time detection of six abnormal behavior / events for safety management
- Real-time analysis through the connection to the existing video management software and real-time abnormal event alarms sent to the control room

1. Wearing Safety Gear

2. Abnormal Movement (Running)

3. Fall Down Alert

4. Unapproved Behavior (Roll Object)

5. Unexpected Motion (Dragging)

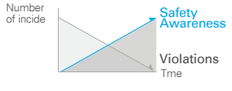
6. Unauthorized Gear (White gown)

Benefits

- Costs reduced with more efficient management
- While the number of safety violations keeps decreasing, safety awareness has increased among workers on the ground.

Labor costs

Enhanced safety awareness

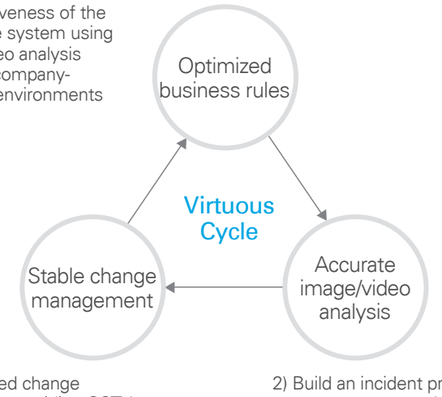


Benefits

Samsung Nexplant Safety is a solution optimized for workplace safety that enables a swift response and continuous change management through accurate event analyses. Such functionality builds a virtuous ecosystem in which accidents are prevented.

Building a virtuous ecosystem to prevent accidents

1) Increase effectiveness of the safety response system using customized video analysis which reflects company-specific safety environments



2) Build an incident prevention and response system based on real-time video analysis in order to prevent financial loss and corporate brand damages resulting from delayed incident response

3) Ensure site-based change management by providing CCTV monitor-friendly UI features

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