

# Intelligent Video Analysis System For the Early Detection and Containment of Wildfires



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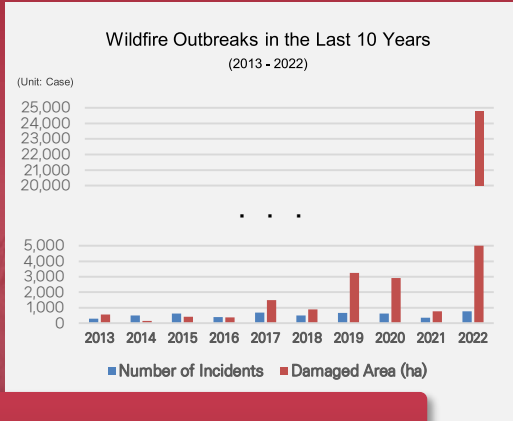
Intelligent video analysis system  
for the early detection and containment of wildfires



# 01. Introduction

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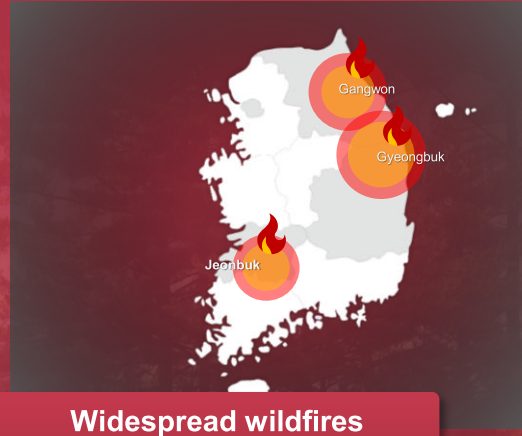
# Background of Product Development



## Recurring wildfires

An average of 537 wildfires per year over the last 10 years, damaging 3,560 ha

In particular, 2022 recorded the highest number of wildfire outbreaks (756) and the largest area burnt (24,797 ha)



## Widespread wildfires across the country

Occurring throughout the country except Jeju-do


The mountainous provinces of Gyeongbuk and Gangwon are the most affected by wildfires, both in number and area



## Simultaneous wildfires

Most occurrences in shortest period since 1986

From 2 to 4 April 2023, 53 wildfires occurred simultaneously across the country, burning four regions of over 100 ha each in just three days



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 **FIREWATCHER**

## 02. Necessity

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# Necessity

## Issues

① Difficulties in the early detection of wildfire outbreaks  
(As wildfires can spread up to 26 m per minutes, early suppression is critical.)

② Difficulties in detecting smoke for early wildfire suppression  
(It is hard for human eyes to distinguish smoke from clouds, fog, stream, etc.)

③ Difficulties in deploying full-time forest guards.  
Legacy CCTV control system requires manual review of multi-channel CCTV video (CCTV manual monitoring)



## Solution

Need for AI-based analysis technology to analyze the wildfire 'smoke' in large forest environments

## FIREWATCHER

**Early action can be taken with a wildfire early suppression solution that provides real-time smoke detection and wildfire location estimation**





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 **FIREWATCHER**

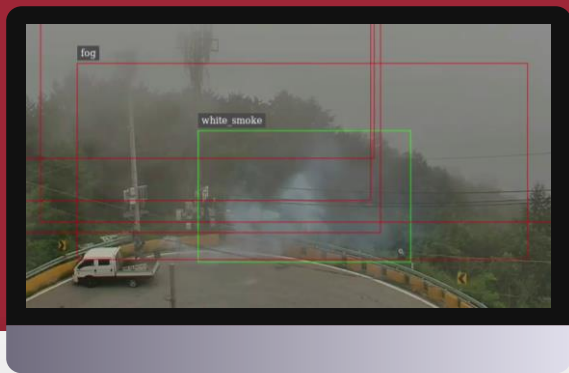
## 03. Overview

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# Overview

An intelligent wildfire situation analysis system that can assist in early suppression by detecting smoke and fire through deep learning image analysis technology

Detects 'smoke', not 'fire',  
to take prompt initial measures  
when a wildfire breaks out



Provides real-time and integrated  
wildfire and smoke monitoring  
in a multi-channel CCTV environment



Applies a deep learning model that  
minimizes the false detection of clouds,  
fog, etc. in videos that look like smoke




✓ Smoke detection through FIREWATCHER

✓ Simultaneous real-time multi-channel analysis

✓ Minimum false detections (clouds, fog, smog, etc.)





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## 04. Key Features

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# Key Features

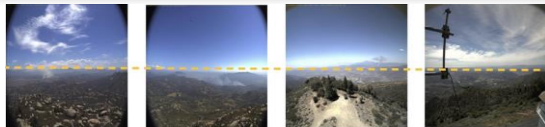
## Holding a lot of datasets related to wildfires in the Korean environment



✓ Captures images from domestic wildfire monitoring CCTVs **299,000 dataset images** and **3,000 hours of video** retained.

✓ Domestic datasets ensure a **more accurate wildfire detection model**.

## Dataset construction based on domestic CCTV



Viewing angles of overseas datasets

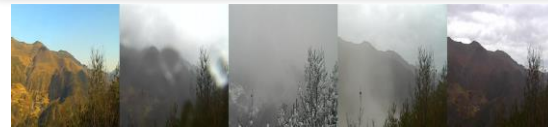


Viewing angles of domestic datasets

✓ Most of the few disclosed wildfire data are from overseas, **which leads to many false detections when applied in Korea**.

✓ **Established datasets with lower false positives** using data generated from **domestic CCTV camera angles**

## Datasets managed by season and time, tailored to the Korean environment



Datasets by season (meteorological changes)





Datasets by time

✓ Considering the distinct seasons in Korea, **datasets by season are required**.

✓ Datasets by time are managed under the categories of **sunrise, daytime, sunset, and night**.

✓ **Improved AI model accuracy** with datasets that include seasonal and temporal factors.



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## 05. Core Technologies

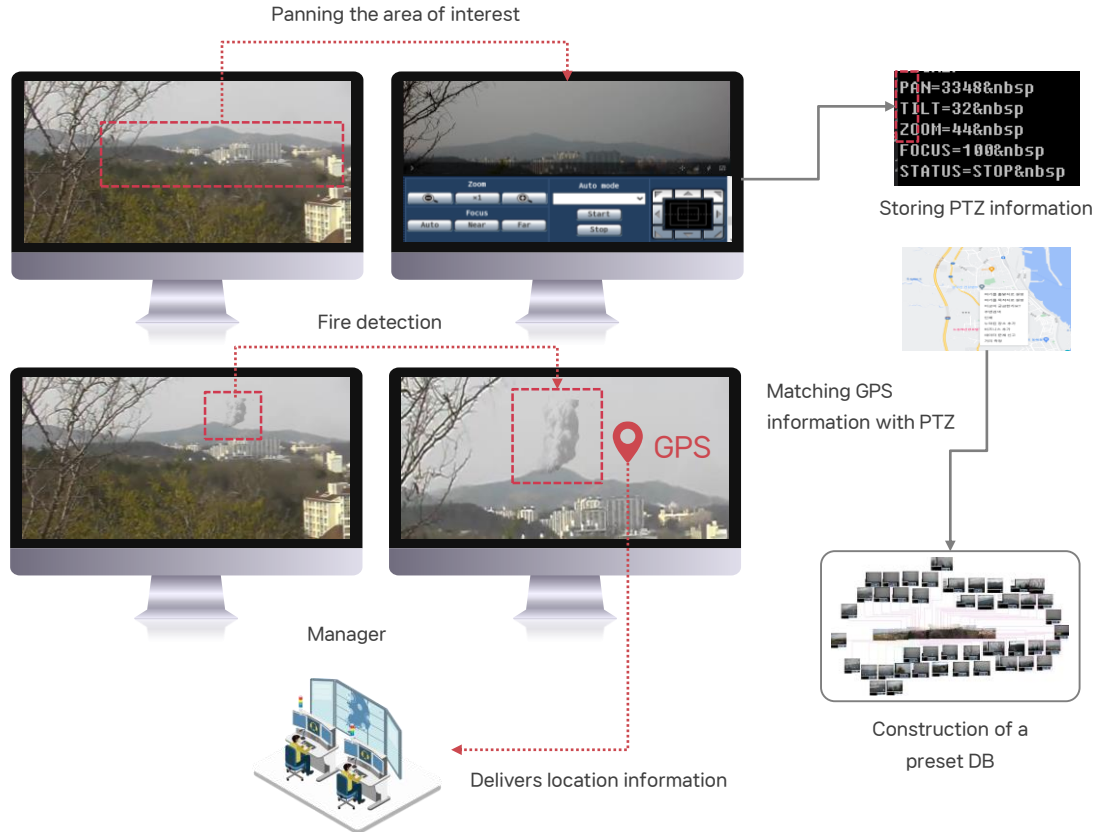
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# Core Technologies

Location estimation technology using presets

## Detailed Functions

- ✓ Fire Detection
- ✓ Checking of **detected PTZ state** of the CCTV
- ✓ Search **presets and GPS** in the **database** with PTZ information
- ✓ Outputs **estimated location of fire origin (GPS)**





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## 06. Major Functions

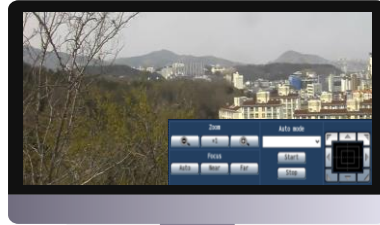
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# Major Functions



Real-time  
smoke/wildfire  
monitoring  
function



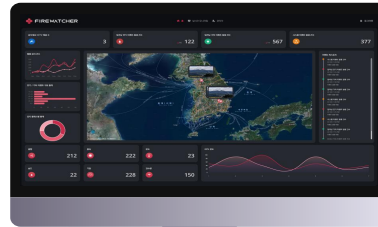
Smoke detection  
location  
estimation  
function



Distinguishing  
Non-fire smoke  
phenomena  
function





Real-time  
monitoring &  
alert function



Management  
function





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## 07. Detailed Functions

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# Detailed Functions

01 – Real-time Smoke/Wildfire Monitoring function

## Detailed Functions

- ✓ Early discovery of wildfires using a deep learning model focused on smoke detection
- ✓ Smoke color distinguishing exercises (black/white/gray) for improved detection accuracy
- ✓ Minimization of false smoke detections through segmented analysis
- ✓ Korean environment-based dataset of 299,000 images and 3,000 hours of video



## Expected Outcomes

- ▶ Prevention of major disasters through early detection and extinguishing of wildfires
- ▶ Obtaining a highly accurate wildfire detection model using Korean datasets



Real-time smoke detection

# Detailed Functions

02 – Smoke Detection Location Estimation function

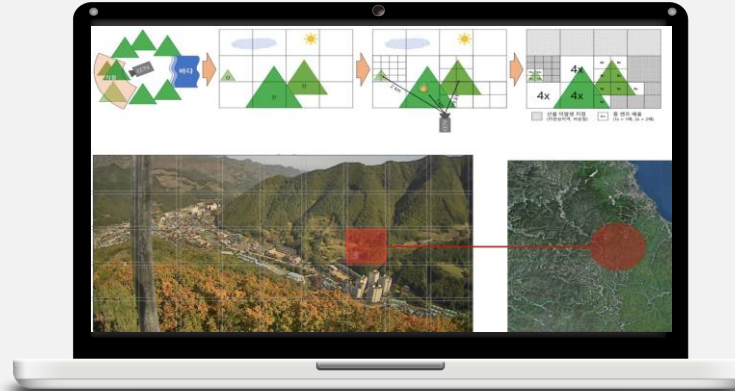
## Detailed Functions

- ✓ When an event is detected, **the GIS-based location of the fire origin is estimated** by mapping CCTV video pixel information and actual distance data.
- ✓ Can be linked to the control API of the existing CCTV and VMS environment, where available.



## Expected Outcomes

- ▶ When a wildfire breaks out, **the accuracy and efficiency of wildfire suppression** is improved **by accurately estimating the origin of the wildfire.**



Estimation process  
for wildfire outbreak  
location

# Detailed Functions

03 – Distinguishing Non-fire Smoke Phenomena function

## Detailed Functions

- ✓ Detected smoke situations and phenomena that could be recognized as smoke are sub-categorized into different classes.  
(clouds, fog, glare, etc.)
- ✓ Smoke can be distinguished according to different weather conditions.  
(sunny, rainy, foggy, etc.)



## Expected Outcomes

- ▶ The success rate of wildfire detection has increased due to the ability to distinguish and detect smoke in different environments.



In a rainy environment, fog/clouds are distinguished



In a foggy environment, fog/smoke are distinguished



In a foggy environment, fog/clouds are distinguished



In a sunny environment, clouds/smoke are distinguished

# Detailed Functions

04 – Real-time Monitoring and Alert function

## Detailed Functions

- ✔ Multi-channel CCTV monitoring screen output in real time
- ✔ When smoke is detected, the situation is displayed on the corresponding screen magnification or pop-up window.
- ✔ Smoke detection situation is provided in text via SMS alerts.



## Expected Outcomes

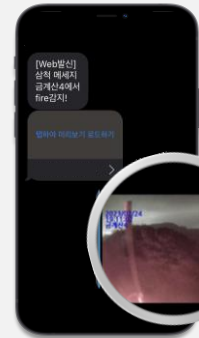
- ▶ The real-time monitoring function allows systematic observation of the area being monitored.
- ▶ Instant response to a wildfire outbreak is possible with screen magnification, pop-up windows and SMS alerts.



Real-time Monitoring



Smoke detection alert



SMS alert

# Detailed Functions

05 – Management function

## Detailed Functions



- 1 CCTV channel and event information
- 2 Event statistics data
- 3 Shows public environmental data (for wildfire spread prediction)
- 4 System server operation information (CPU temperature)
- 5 Event history
- 6 Shows GIS-based camera location information



## Dashboard







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## 08. Operational Specifications & System Overview

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# Operational Specifications and System Overview

## Operational Specifications

### ✓ S/W Specifications

#### Server

- OS : Ubuntu 20.04 LTS
- DB : MongoDB v3.6.3

#### Client

- OS : Windows 10 Pro 64 bit
- Browser: Chrome 102.0 or above

### ✓ H/W Specifications

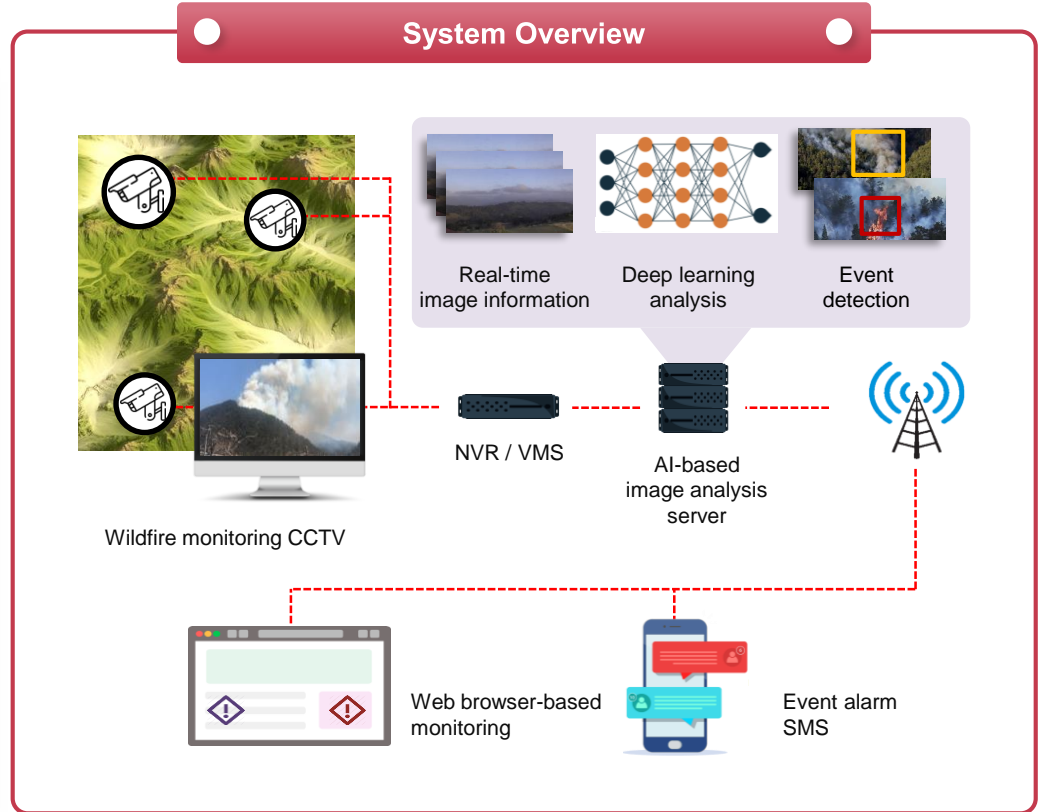
#### Server

- CPU: Intel(R) Xeon(R) Gold 6334 CPU@ 3.60 GHz or above
- GPU: Nvidia A10 (GPU memory 24 GB) or above
- RAM: 64 GB DDR4 2933 Mhz or above
- Installation Capacity: Minimum 20 GB is required
- NIC: 10/100/1,000 Mbps 1 port or above

#### Client

- CPU: Intel(R) Core(TM) i7-4702MQ CPU 2.20 GHz or above
- RAM: 8 GB or above
- HDD: 500 GB or above

## System Overview



# Building a Smarter Future With AI Technologies



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