

[Document name] Description

[Title of the Invention] FLUID OBJECT ANALYZING DEVICE

5 [Technical Field]

The present invention relates to a technique of detecting a fluid object, such as smoke and flame, from an image that a monitoring camera photographed.

10 [Background Art]

As a background art of this technical field, there is Japanese Patent Application Laid-Open No. H5 (1993)-46887 (Patent Literature 1). This patent application describes "a fire detecting device that roughly detects an outbreak
15 place of a fire by using a visible-light and infrared camera while moving its viewing angle up and down and right and left sequentially, and moves the detected place to a center of the viewing angle, whereby a detection accuracy is improved."

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[Citation List]

[Patent Literature]

[Patent Literature 1] Japanese Patent Application Laid-Open No. H5 (1993)-46887

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[Summary of Invention]

[Technical Problem]

With the above-mentioned technology, when a fire breaks out, outbreak of the fire can be detected by
5 detecting a region containing smoke. However, fluid objects such as smoke may spread to a place away from a fire outbreak place being the source. Therefore, the technology disclosed by Patent Literature 1 has a room for improvement in accuracy in specifying the fire source. An
10 object of the present invention is to provide a technology that makes it possible to analyze accurate information when performing analysis of fluid objects such as smoke.

[Solution to Problem]

15 In order to address the above-mentioned problem, the fluid analysis system according to the claimed invention includes a smoke detection part for detecting smoke from the inside of the image that a monitoring camera photographed, and a fire source specification part that
20 specifies the fire source by calculating a motion feature quantity of the smoke.

[Advantageous Effects of Invention]

According to one aspect of the present invention,
25 accuracy of specifying the fire source can be improved by

calculating the motion feature quantity of the smoke.

[Brief Description of Drawings]

Figure 1 is a diagram showing a configuration example
5 of a whole system according to a first embodiment.

Figure 2 is a diagram showing a hardware
configuration of a fluid object analyzing device.

Figure 3 is a diagram showing a hardware
configuration of a firefighting monitoring device.

10 Figure 4 is a diagram showing functional blocks of
the whole system.

Figure 5 is a diagram showing a sequence of the whole
system.

Figure 6 is a diagram showing a processing flow of
15 motion feature quantity extraction.

Figure 7 is a diagram showing an image of division
into blocks.

Figure 8 is a diagram showing a data structure of a
motion feature quantity.

20 Figure 9 is a diagram showing a fluid object region
extraction flow.

Figure 10 is a diagram showing a source calculation
flow.

Figure 11 is a diagram showing a smoke feature
25 quantity extraction flow.

Figure 12 is a display screen of a first embodiment.

Figure 13 is a sequence diagram of a state analysis management part according to a second embodiment.

Figure 14 is a data structure diagram of a state
5 analysis propriety determination rule according to the second embodiment.

Figure 15 is a diagram showing a flow of state analysis propriety determination according to the second embodiment.

10 Figure 16 is a diagram showing a sequence according to a third embodiment.

Figure 17 is a display screen of the third embodiment.

Figure 18 is a diagram showing a configuration example of a whole system according to a fourth embodiment.

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[Description of Embodiments]

Below, an example of a smoke detection system 1 to which an embodiment according to the present invention is applied is explained with reference to drawings.

20

First Embodiment

Figure 1 is a diagram showing a configuration example of a whole smoke detection system to which a first embodiment according to the present invention is applied.

25

The smoke detection system 1 includes a video input

device 2, and a fire monitoring system 3 that receives a video of the video input device 2 through a network comprised of a LAN (Local Area Network), a WAN (Wide Area Network), a VPN (Virtual Private Network), or the like, detects outbreak of a fire by detecting smoke, and notifies workers of it.

Incidentally, in this embodiment, the fire monitoring system 3 has a fluid object analyzing device 5 for detecting existence of a fire by analyzing the video and a firefighting monitoring device 6 capable of notifying the workers of a monitoring video and the detection result in the form of a screen or a voice. Hereinafter, a detailed configuration is explained using Figure 2, Figure 3, and Figure 4.

Figure 2 is a diagram showing a hardware configuration of the fluid object analyzing device 5. The fluid object analyzing device 5 is configured with a CPU (Central Processing Unit) 17, memory 10, an external storage device 11, a communication device 18, and a bus 16 for connecting these elements.

The CPU 17 is a unit for executing various operations. The CPU 17 performs various processing by executing a predetermined program loaded to the memory 10 from the external storage device 11.

The memory 10 stores a program that is executed by

the CPU 17 and data necessary for execution of the program.

The external storage device 11 is a nonvolatile storage for storing digital information, such as so-called a hard disk (Hard Disk Drive) and an SSD (Solid State Drive), flash memory, or the like. The external storage device 11 stores a fluid object analyzing program 12 plus a fluid region model 13, a smoke model 14, and a camera attribute table 15 that are default data.

The fluid object analyzing program 12 is developed in the memory 10 by the CPU 17. A result of the development will be described later using Figure 4. The fluid region model 13 is information showing a probability distribution for segmenting the fluid object and objects other than the fluid object. The smoke model 14 is information for extracting the feature quantity of an image for smoke existence determination using a video containing the smoke and a video not containing the smoke, inputting it into a support vector machine as teacher data, and building a determination model. The camera attribute table 15 stores information for calculating a distance from a center position of the monitoring video to a camera and the like according to values of a camera installation height, a viewing angle, and its lens.

The communication device 18 performs processing of receiving the video of the video input device 2 through a

network 4, processing of transmitting a control command to the video input device 2, and processing of transmitting the detection result to the firefighting monitoring device 6.

5 Figure 3 is a diagram showing a hardware configuration of the firefighting monitoring device 6. The firefighting monitoring device 6 is configured with a CPU (Central Processing Unit) 26, memory 20, an external storage device 21, a communication device 28, an output
10 device 27, and a bus 25 for connecting these elements. Regarding the memory 20, the CPU 26, and the external storage device 21, explanations of them overlap with the explanation of Figure 2, and therefore they are omitted.

 A firefighting monitoring program 22 is a program for
15 displaying the video of the video input device 2, a map of a periphery of a monitoring region, and an output result from a fire detecting device.

 Map data 23 is information showing map information of roads, buildings, forests, etc. in the monitoring region.
20 The firefighting monitoring program 22 transmits these pieces of information to the output device 27.

 Fire management data 24 is information that shows the kind of forest for each place, an estimated fire spreading speed in case of outbreak of a fire, etc.

25 Video data inputted from the video input device 2 is

accumulated in monitoring video data 29.

The communication device 28 receives the video of the video input device 2 through the network 4. Similarly, the communication device 28 receives the detection result of the fire detecting device 5.

The output device 27 displays the image of the video input device 2, a result of fire detection from the fluid object analyzing device 5, etc. For example, the output device 27 is assumed to be a video display unit, such as a CRT display, a liquid crystal display, and a projector. Incidentally, the output device 27 may have a configuration other than those of the video display units. For example, the output device 27 may be a device that generates sound, vibration, light, or the like for attracting the workers' attention.

Figure 4 is a functional block diagram of the smoke detection system 1. The video input device 2 consists of a video acquisition part 31 and a control command execution part 32. The video acquisition part 31 images the monitoring region using a CCD image sensor or a CMOS image sensor. The control command execution part 32 can alter an imaging range of the video acquisition part 31 by controlling values of an azimuth, a direction, and the lens of the video input device 2 according to a remote control command, such as PTZ (Pan-Tilt-Zoom), received via the

network 4.

Next, functional blocks of the fluid object analyzing device 5 are explained. The fluid object analyzing device 5 is configured with a video input part 41, a state analysis management part 45, a motion feature quantity calculation part 42, a fluid region extraction part 46, a source estimation part 47, a feature-quantity-for-smoke-determination extraction part 44, and a smoke determination part 48.

The video input part 41 decodes coded image data that was received via the communication device 18, and converts it into an image in the unit of frames.

The state analysis management part 45 determines propriety of smoke detection using an inputted video. When it is determined that smoke detection is possible, existence of smoke is determined. When smoke is detected, the state analysis management part 45 notifies the firefighting monitoring device 6 of it via the communication device 18. The motion feature quantity calculation part 42 extracts feature quantities about a motion of the inputted video. The fluid region extraction part 46 extracts a region of non-fixed form objects with mobility having fluidity, such as smoke, while excluding fixed form objects existing in the video, such as a vehicle. The source estimation part 47 estimates coordinates of the

source of fluid objects, such as smoke, using the motion feature quantities and data of the attribute data table 15 of the camera. The feature-quantity-for-smoke-determination extraction part 44 extracts the feature quantity for recognizing whether the fluid object is smoke. The smoke determination part 48 determines whether the fluid object is smoke using feature quantities for smoke determination that the feature-quantity-for-smoke-determination extraction part 44 extracted.

Next, functional blocks of the firefighting monitoring device 6 are explained. The firefighting monitoring device 6 is configured with a video input part 50, a firefighting plan generation part 51, and a display generation part 52. The video input part 50 has the same function as that of the video input part 41. The firefighting plan generation part 51 generates information that contributes to firefighting activities and an evacuation behavior according to a fixed rule when smoke is detected. The display generation part 52 generates data for displaying the video received from the video input part 50 and information that the firefighting plan generation part 51 generated on the screen.

Figure 5 is a diagram showing a whole processing sequence of the smoke detection system 1.

First, a compressed video that was acquired via the

communication device 18 is converted into an image of each frame by a pretreatment step S1, and is transmitted to the state analysis management part 45. Next, the state analysis management part 45 transmits the image of the current frame to the fluid region extraction part 46, and makes a request to extract the fluid region. The fluid region extraction part 46 requires the motion feature quantity calculation part 42 to calculate a motion feature quantity, and a motion feature quantity calculation step S2 is executed. Details of the flow of calculating the motion feature quantity will be described later with reference to Figure 6.

The motion feature quantity calculation part 42 transmits the calculated motion feature quantity to the fluid region extraction part 46 after completing the motion feature quantity calculation step S2. The fluid region extraction part 46 calculates a region where the fluid object exists in a fluid region calculation step S3. Details of the calculation method will be described later with reference to Figure 9.

After completing the fluid region calculation step S3, the fluid region extraction part 46 requires a source calculation part 47 to calculate a source of the fluid object, and a source calculation step S4 is executed. Its details will be described later with reference to Figure 10.

The source calculation part 47 transmits position information of the source calculated in the step S4 to the fluid region extraction part 46. The fluid region extraction part 46 transmits a range of the calculated
5 fluid region and the information of the source to the state analysis management part 45. The state analysis management part 45 calculates whether it is a timing of smoke detection using the received information. Speaking of the timing of smoke detection as one example, a timing when an
10 area of a fluid object region is larger than or equal to 20 pixels $\times$ 20 pixels on the screen is considered to be possible for smoke detection.

Incidentally, when the calculated result of a step S5 means being possible to determine the existence of smoke,
15 the state analysis management part 45 instructs determination of smoke existence to the smoke determination part 48. When the smoke determination part 48 receives the instruction, it requires the feature-quantity-for-smoke-determination extraction part 44 to extract the smoke
20 determination feature quantities that is to be used for smoke determination. Details of a feature-quantity-for-smoke-determination extraction step S6-1 will be described later with reference to Figure 11.

Motions of non-fluid objects, such as a bird and a
25 vehicle in motion, are removed by the fluid region

calculation step S3, which produces an effect of avoiding erroneous detection by these. Only when the smoke detection is possible, a smoke existence determination step S6 is executed in the current video.

5 The feature quantity calculated in the step S6-1 is transmitted to the smoke determination part 48, and in a step S6-2, it is possible to initialize a support vector machine for smoke determination and to determine the existence of smoke with the acquired feature quantities for
10 smoke determination using the smoke model of the external storage device 11. Incidentally, the above-mentioned smoke determination method is one example, and another feature quantity extracted from the fluid object may be used.

 The determination result by the smoke determination
15 part 48 is transmitted to the state analysis management part 45. When smoke is detected, the state analysis management part 45 notifies the firefighting monitoring device 6 of fire information that includes position information of the fluid object, a moving speed of the
20 fluid object, the position information of the source, and a fact that the fluid object is the smoke with the communication device 18.

 When the firefighting monitoring device 6 receives the fire information transmitted from the fire detecting
25 device 5 using the communication device 28, the display

generation part 52 assigns the monitoring video received from the video input part 50 as a warning screen by adding information of the fire to the monitoring video and presents the fire information using the output device 27.

5 Figure 6 is a diagram showing a processing flow of motion feature quantity extraction.

 The inputted image is divided into multiple blocks in the motion feature quantity calculation step S2 (S11). A shape and a size of the block are changeable according to
10 detection accuracy and detection speed of the fluid object. The image of division into blocks will be described later with reference to Figure 7.

 After completing the block division step S11, a motion feature quantity extraction operation S12 is carried
15 out for every block. Below, details of S12 are described.

 Calculates a trajectory of motion of a feature point existing in the block (S13). The feature point is a point that is easy to track, for example, an intersection of two edges. An optical flow of the image is obtained using the
20 feature points of the image and using a method, such as a gradient method, as a technique of calculating the motion of the feature points over multiple frames.

 Next, in order to reduce the number of the trajectories each having a small motion and noise
25 trajectories, a step S14 of filtering a trajectory that is

comprised of points and is longer than or equal to a predetermined length and a trajectory whose migration distance is extremely large, therefore having a high possibility of being a noise, is carried out for calculated
5 trajectories of all the feature points.

Next, a step S15 of calculating an area of a region in which a motion is found using the position information of the feature points is carried out. In the step S15, an area of a zone where the feature points with a motion exist
10 is obtained. In doing this, regarding the area of the region with a motion, a ratio of an area of the existing block is designated as the feature quantity. As a technique of finding a region in which multiple points are distributed, there is a method of obtaining a circumscribed
15 circle, a circumscribed rectangle, or α Shape of all the points.

Next, a step S16 of calculating a degree of dispersion of directions of trajectories is carried out. In the step S16, the moving direction of each trajectory is
20 calculated and a ratio of the number of trajectories that are in agreement with the average moving direction of the trajectories to the total number of trajectories is outputted.

Next, a step S17 of calculating a linearity of the
25 trajectory is carried out. In the step S17, the linearity

is calculated for every trajectory. That is, in other words, it can also be said that a bend condition of a curved line is calculated.

Processing of the step S12 is performed for all the
5 blocks, and the calculated results of S15, S16, and S17 are specified as motion feature quantities.

Figure 7 is a diagram showing an image of block division.

In Figure 7, an inputted image is divided into 3×3
10 blocks of the same size. The inputted image includes an image region 64 whose area is large such as smoke, a block 62 containing a bird whose size is small, and a block 65 containing a vehicle in motion. A region 63 in which all the blocks are constructed becomes a target region of fluid
15 object region detection. When there is a request to assign a part of the image to be a detection target, it becomes applicable by making the region 63 smaller than the screen.

Figure 8 is a diagram showing a data structure of the motion feature quantity. Specifically, Figure 8 shows one
20 example of having calculated a motion feature quantity for an image of a certain frame. A motion feature quantity 70 contains three feature quantities for every block. A block ID 70-1 shows a number of the block. A ratio 70-2 of the area, a degree of dispersion 70-3 in a trajectory direction,
25 and a linearity 70-4 of the trajectory are calculated

results of S15, S16, and S17, respectively.

Incidentally, a value stored here may use a part of the three feature quantities mentioned above or may adopt a feature quantity showing a feature of a motion of another
5 image.

Figure 9 is a diagram showing a fluid region extraction flow of fluid object. In the fluid region calculation step S3, first, the fluid region model 13 stored in the external storage device 11 is loaded to the
10 memory 10 (S21).

Next, processing of reading the feature quantity of the fluid object in the unit of blocks (S22) is performed.

Next, on the read feature quantity, determination whether the block concerned is the fluid object is
15 performed using the fluid region model (S23).

After completing the determination, it is checked whether there is an unprocessed block (S24).

Here, when an unprocessed block exists, a processing target is moved to the next block and the process proceeds
20 to a loop of processing of S22 (S26).

Then, when there is no unprocessed block, pieces of region information of the blocks in which all the fluid objects exist are merged to make the fluid object region, and the position information of the fluid object and total
25 area information are outputted (S25).

Figure 10 is a diagram showing a source calculation flow.

In the source calculation step S4, the camera attribute table 15 stored in the external storage device 11
5 is loaded to the memory 10 (S41).

Next, information of current azimuth, direction, etc. of the camera is read (S42).

Next, a distance from the camera to the smoke and a height H of the smoke are calculated using the camera
10 attribute table 15 and information showing a current state of the camera (S43).

Next, an average lateral moving speed V_x and an average climbing speed V_y of the fluid object are calculated using the distance to the smoke calculated in
15 the step S43 (step S44). Next, a horizontal distance between the source and the fluid object region is calculated using a formula of $d = H / V_y \times V_x$ (step S45). Here, a place of the source is assumed to be located in a counter direction to a direction of lateral motion of smoke.

20 Figure 11 is a diagram showing the feature quantity extraction of smoke.

In the feature-quantity-for-smoke-determination extraction step S6-1, the position information of the fluid object is read first (step S31).

25 Next, trajectory information of a motion region

calculated in the step S14 is read (step S32).

Next, in order to avoid influences of objects other than that in the fluid object region, only the trajectory information of the fluid object region is filtered and
5 extracted in a trajectory information re-filtering step (step S33).

Next, a HOG (Histogram of Oriented Gradients) in the periphery of the feature point at an end of the extracted trajectory is calculated (step S34).

10 Finally, a sequence of the migration distance of the extracted trajectory in the XY directions for every frame is extracted (step S35). Then, the HOG feature quantity that was extracted and the trajectory feature quantity are assigned as the feature quantities for smoke determination
15 of the video.

Figure 12 is one example of the warning screen that the firefighting monitoring device displays. On a warning screen 81, in addition to the video of the field and a message that the smoke is discovered being displayed,
20 information of the lateral moving speed and climbing speed of smoke, an arrow head 82 of an estimated fire outbreak point, and a route 83 between the estimated fire outbreak point and the smoke are displayed.

Incidentally, when the firefighting monitoring device
25 cooperates with a weather information provision system or a

firefighter position sharing system in addition to the above-mentioned information, information of air temperature of the spot, a fastest arrival time, etc. may be displayed on the screen.

5 As described above, according to the first embodiment, when smoke is detected by video analysis even when forest, buildings, etc. hide a fire outbreak point, it is possible to shorten a time until when giving the workers a firefighting instruction by presenting the fire outbreak
10 point appropriately, and it is possible to contribute to pro-active measures of the fire.

Second Embodiment

Figure 13 is a sequence diagram of the state analysis
15 management part 45 in connection with a smoke detection system to which a second embodiment according to the present invention is applied. In the second embodiment, since its basic processing is fundamentally the same as the processing sequence of Figure 5 in the first embodiment,
20 only different portions are described in the below.

The state analysis propriety calculation step S5 is processing of calculating the propriety of smoke detection using a state analysis propriety rule. A data structure of the state analysis propriety rule will be described later
25 with reference to Figure 14.

When the state analysis is possible, the state analysis management part 45 determines the existence of smoke at Step 6. When the state analysis is impossible, it is checked whether there is a camera operation instruction presently. When there is the control command, the operation instruction is transmitted to the video input device 2 through the communication device 18 (step S8).

The control command execution part 32 of the video input device 2 interprets the received control command, and alters parameters of a direction of the input device 2, an angle of dip, the lens, etc. (S9). By carrying out the control command, a video that the video acquisition part of the input device 2 acquired can be adjusted.

Figure 14 is a diagram showing the data structure of the state analysis propriety rule. A state analysis propriety rule 90 is comprised of multiple rules. That is, the rule is comprised of a condition ID 90-1, a condition detail 90-2, and a camera operation instruction 90-3. The condition ID 90-1 shows a turn of each rule. The condition detail 90-2 shows contents of conditions of the rule concerned. The camera operation instruction 90-3 shows a control command to move the video input device when the rule concerned is not established.

For example, after a rule 91 and a rule 92 were carried out, when an estimated source of the fluid object

exists in a place other than the monitoring region, a control will be done so as to move the video input device 2 in a direction of the source.

Figure 15 is a diagram showing an analysis propriety calculation flow of the state analysis propriety
5 calculation step S5 that uses the state analysis propriety rule 90. In the state analysis propriety calculation step S5 of Figure 13, propriety of execution of the smoke determination step S6 is calculated using position
10 information of the fluid object region and information of the estimated source of the fluid object.

Next, the first rule of the state analysis propriety rule 90 is loaded (S51).

Next, it is checked whether the rule concerned is
15 established using the input information, and when the rule is established, it is checked whether the next rule exists (S53).

Next, it is checked whether the next rule exists (S54), and when the next rule exists, the process proceeds
20 to a step for reading the next rule (S52).

The step S53 is repeatedly carried out using the read rule, and after the last rule is executed, analysis of smoke (S55) becomes possible.

When the rule in the step S53 is not established, it
25 is checked whether there is the camera operation

instruction 90-3 (S56).

When there is the camera operation instruction, the instruction and a purport that the state analysis is impossible are outputted (S57).

5 When there is no camera operation instruction, an instruction that the state analysis is impossible is outputted simply (S58).

Third Embodiment

10 Figure 16 is a sequence diagram of the firefighting plan generation part 51 in connection with a smoke detection system to which a third embodiment according to the present invention is applied. In the third embodiment, since a processing flow of the fluid object analyzing
15 device 5 is the same as those of the first embodiment and the second embodiment, it is omitted. In the following, only processing of the firefighting plan generation part 51 is described.

First, when the firefighting plan generation part 51
20 receives the attribute information of an outbreak site, a speed of the fire, etc., the firefighting plan generation part 51 loads burning attributes in the periphery of the fire source etc. from the fire management data 24 stored in the external storage device 21 (step S61).

25 Next, a speed of the fire spreading and a fire spread

region are calculated using attributes of the fire, the burning attributes in the periphery of the source, etc. (step S62).

Next, the map data 23 stored in the external storage
5 device 21 is loaded (step S63).

Next, specifying an evacuation region and searching for an evacuation route are performed using information of a residential area in the map information and fire spread region information of the fire calculated in the step S62
10 (step S64).

Next, a fastest route is generated using the fire spread region information and using map information for heading to a fire outbreak place (step S65).

Next, from the above-mentioned generated information,
15 screen data for display is generated by the image generation part 52 (step S66).

Finally, the screen data for display is transmitted to the output device 27, which enables the screen data for display to be presented to the workers (step S67).

20 Figure 17 is a screen of firefighting plan guidance in the third embodiment. In addition to a fire outbreak point 104 being displayed on the map, a course 105 of the fire and a high-risk evacuation region 100 on the course are displayed. Moreover, an arrow head 102 indicating an
25 evacuation direction along which a movement to a safe place

from the evacuation region is attained and an optimal route
103 along which a motion to the fire outbreak point is
attained are displayed on the firefighting plan guidance
screen.

5 As described above, according to the third embodiment,
when a fire is detected, it becomes possible for the
firefighting monitoring device to improve efficiency of a
firefighting work by automatically performing works of
evacuation region specification, evacuation route
10 generation, firefighting route specification, etc. using a
source of a fire, the attributes of the fire, etc. that
were obtained from the fire detecting device.

Fourth Embodiment

15 Figure 18 is a diagram showing a configuration
example of a smoke detection system to which a fourth
embodiment according to the present invention is applied.
A smoke detection system 1-a can detect outbreak of a fire
by both the video input device 2 and the fire detecting
20 device 5 receiving the video of the video input device 2
through the network 4 and detecting smoke. Moreover, the
firefighting monitoring device 6 can check the monitoring
video of the video input device 2 and the detection result
of the fire detecting device 5 through a network 4-a
25 including a WAN (Wide Area Network), a VPN (Virtual Private

Network), or the like.

The fourth embodiment has an effect of making it possible to build the firefighting monitoring device at a low cost. Moreover, it becomes possible for firefighting
5 monitoring devices located at multiple places to check the monitoring video and receive an alarm via the same fire detecting device.

Incidentally, the present invention is not limited to the above-mentioned examples, and includes various
10 modifications. For example, the above-mentioned examples were explained in order to explain the present invention in detail intelligibly, and an embodiment is not necessarily limited to one that has all the explained configurations. Moreover, a part of a configuration of a certain example
15 can be replaced with a configuration of another example, and a configuration of another example can be added to a configuration of a certain example. Moreover, about a part of the configuration of each example, it is possible to carry out addition, deletion, or substitution of another
20 configuration.

Moreover, in each embodiment described so far, the number of the video input device 2 may be multiple sets. Moreover, there may be multiple fire detecting devices 5 and multiple fluid object detecting devices 6, respectively,
25 and these devices may respond to multiple video input

devices 2 while being in corporation with each other.

Moreover, a form where functions of the above-mentioned video input device 2 and fire detecting device 5 are incorporated in the same hardware may be adopted.

5 Moreover, a part or the whole of each configuration, function, processing part, etc. mentioned above may be realized with hardware, for example, by designing it as an integrated circuit or by other means. Moreover, a technical element of the above-mentioned embodiment may be
10 applied independently, or may be applied after it is divided into multiple parts, such as a program component and a hardware component.

Reference Signs List

15 2 ... Video input device,
5 5 ... Fluid object detecting device, and
6 6 ... Firefighting monitoring device.

CLAIMS

1. A fluid object analyzing device, comprising:
image input means for inputting a video photographed
5 by a camera;
feature quantity extraction means for extracting a
motion feature quantity from the inputted video;
a fluid object analyzing device for extracting a
region where a fluid object exists based on the extracted
10 motion feature quantity;
fire source estimating means for estimating a fire
source from the extracted region concerned; and
output means for outputting information showing the
estimated fire source in a display part.

15

2. The fluid object analyzing device according to claim
1,

wherein the fire source estimating means calculates a
distance between the fluid object and the camera concerned
20 based on information showing attributes of the camera, and
estimates the fire source.

3. The fluid object analyzing device according to claim
2,

25 wherein when the estimated fire source exists outside

a camera monitoring region, the camera is controlled based on a predetermined rule.

4. The fluid object analyzing device according to claim

5 3,

wherein the control is a control of altering an imaging range based on operation commands to alter rotation and an angle of dip.

10 5. The fluid object analyzing device according to any one of claim 1 to claim 4,

wherein the output means outputs information that shows a fire spread region centered on the fire source, a recommended evacuation region, and a route for heading to
15 the fire source in the display part.