

"AN ELEVATOR CONTROL SYSTEM"

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The present invention relates to an elevator control system for moving up and down at least one cage among a plurality of floors in an elevator path of a building and, more particularly, relates to an elevator control system for controlling the running of the cage in accordance with the situation of waiting persons in landing places or passengers in the cage obtained by means of image pickup devices so that the running efficiency can be improved and that crime prevention and monitoring can be attained.

A large number of methods for improving the running efficiency of the elevator by using image information or for improving monitoring by using image information have been proposed in patent applications. Of those methods, that disclosed in JP-A-58-69671 is as follows. That is, the degree of crowdedness in a landing place (hereinafter called "hall") of an observatory floor is detected by using a camera and a crowdedness detector provided in the hall of the observatory floor, so that in accordance with the detected degree of crowdedness, an automatic voice guidance is made in the observatory floor or other floors and, at the same time, the elevator running pattern is changed.

1 Further, that disclosed in JP-A-61-192685 is
as follows. That is, a camera and a detector for
detecting an intruder into a monitoring area are
provided so that the camera and the monitor are actuated
5 to operate only when an intruder exists.

The aforementioned first prior art technique
has the following disadvantage. When the crowdedness
detector makes a judgment that the landing place is
crowded, the elevator running pattern and the voice
10 guidance are switched to a predetermined running pattern
and a predetermined voice guidance. When the judgment
is not true, not only the running efficiency is lowered
remarkably but unnecessary guidance is made in the floor
where no person exists.

15 The second prior art technique has the
following disadvantage. Because the detector for
detecting an intruder into the monitoring area must be
provided additionally and separately, not only there
arises a problem in construction labor and cost but
20 there arises another problem in that the monitor is
actuated to operate wastefully even against proper
intruders.

Therefore, an object of the present invention
25 is to provide an elevator control system improved in
elevator running efficiency.

Another object of the invention is to provide an elevator control system improved in running efficiency in group supervisory controlled elevators provided
5 with special call buttons.

A further object of the invention is to provide an elevator control system in which cage service in accordance with the situation of waiting persons in halls and passengers in cages is carried out.

10 A still further object of the invention is to provide an elevator control system improved in crime prevention and monitoring.

Another object of the invention is to provide an elevator control system in which the quantity of data
15 on data transmission line is small and, accordingly, failure of signal transmission is reduced to thereby make exact elevator control possible.

Accordingly the present invention may provide an elevator control system for moving at least one cage
20 up and down in at least one elevator path of a building by elevator control means, comprising:

a. image pickup means provided in either or both of the inside of the or each cage, and the landing place of each floor of said building where the or one of the
25 cages stops;

b. first image processing means for processing images picked up by said image pickup means and second image processing means having an image processing level not lower than the image processing level of

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said first image processing means;

c. said elevator control means including means for applying the result of image processing performed by
5 said first image processing means to the control of said at least one cage, and means for applying the result of image processing performed by said second image processing means to the control of said at least one cage when the image processing is carried out
10 based on the result of image processing performed by said first image processing means and the other information pertaining passengers and waiting persons.

Similarly the present invention may provide an elevator control system for moving at least one cage
15 up and down in at least one elevator path of a building by elevator control means, comprising:

a. image pickup means provided in either or both of the inside of the or each cage, and the landing place of each floor of said building where the or one of the
20 cages stops;

b. image processing means for processing images picked up by said image pickup means with first and second image processing levels different from each other, said second image processing level being higher
25 than said first image processing level;

c. said elevator control means including means for applying the result of image processing performed by using said first image processing level to the control of said at least one cage, and means for applying the

result of image processing performed by using said second image processing level to the control of said at least one cage when the image processing is carried out based on the result of image processing performed by using said first image processing level and other information pertaining passengers and waiting persons.

The present invention may further provide an elevator control system for moving at least one cage up and down in at least one elevator path of a building by elevator control means, comprising:

- a. image pickup means provided in the inside of the or each cage and in the landing place of each floor of said building where the or one of the cages stops;
- 15 b. image processing means for processing images picked up by said image pickup means with first and second image processing levels different from each other, said second image processing level being higher than said first image processing level;
- 20 c. said elevator control means including every-floor stop means which is arranged to confirm the fact that the number of passengers in a given cage becomes two on the basis of the image processing by using said second level in the case where it is expected that the
- 25 number of passengers in said given cage will become two on the basis of the image processing by using said first level so that said every-floor stop means controls said cage to stop at every floor from the

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point of time when the number of passengers in said given cage has become two to the point of time when said given cage reaches a floor designated by the
5 passengers in said given cage.

Another arrangement of the present invention may provide an elevator control system for moving at least one cage up and down in at least one elevator path of a building by elevator control means, comprising:

- 10 a. image pickup means provided in landing places of floors of said building where said at least one cage stops;
- b. a plurality of first image processing means provided corresponding to said image pickup means
15 provided in the landing places of said respective floors and for processing images picked up by said image pickup means;
- c. second image processing means provided commonly to said plurality of first image processing means and
20 for processing images picked up by said image pickup means;
- d. a transmission line for connecting each of said first image processing means to said second image processing means so as to transmit images processed by
25 each of said first image processing means and images picked up by each of said image pickup means to said second image processing means;
- e. said elevator control means including means for applying the result of image processing performed by

each of said first image processing means to the control of said at least one cage, and means for applying the result of image processing performed by
5 said second image processing means to the control of said at least one cage when the image processing is carried out based on the result of image processing performed by said first image processing means and other information pertaining to passengers and waiting
10 persons.

Alternatively the present invention may provide an elevator control system for moving at least one cage up and down in at least one elevator path by elevator control means, comprising:

- 15 a. image pickup means provided in the inside of the or each cage and in landing places of each floor where the or one of the cages stops;
- b. a plurality of first image processing means for processing images picked up by said image pickup
20 means;
- c. second image processing means for processing images picked up by said image pickup means at a higher level than that of said first image processing means;
- 25 d. a first transmission line for connecting each of said first image processing means to said second image processing means;
- e. indicator control means for causing indicators provided in said landing places to indicate

information, such as running conditions of said at least one cage and waiting persons in said landing places;

- 5 f. image display means for displaying the situation of waiting persons in the respective landing places and passengers in said at least one cage by means of images obtained by said image pickup means;
- g. said elevator control means including means for
10 applying the result of image processing performed by said first image processing means to the control of said at least one cage, and means for applying the result of image processing performed by said second image processing means to the control of said at least
15 one cage when the image processing is carried out based on the result of image processing performed by said first image processing means and other information pertaining to passengers and waiting persons;
- 20 h. a second transmission line for connecting said elevator control means, said second image processing means, said indicator control means and said image display means to each other.

On the other hand, the present invention may
25 provide an elevator control system for moving at least one cage up and down in at least one elevator path of a building by elevator control means, comprising:

a. image pickup means provided in the inside of said at least one cage;

- b. first and second image processing means for processing images picked up by said image pickup means, said second image processing means having an
5 image processing level higher than that of said first image processing means;
- c. load weight detecting means provided under respective bottoms of said at least one cage;
- d. said elevator control means including means for
10 applying the result of image processing performed by said first image processing means to the control of said at least one cage when the result of image processing performed by said first image processing means substantially agrees with the result of
15 detection performed by said load weight detecting means, and means for applying the result of image processing performed by said second image processing means to the control of said at least one cage when the result of image processing performed by said first
20 image processing means disagrees with the result of detection performed by said load weight detecting means.

The elevator control means may be single-elevator control means or may be group supervisory control
25 means for general control of a plurality of elevators.

The words "image processing level" of the first and second image processing means accuracy in image processing. The first and second image processing means may be functionally united in one body or the

second image processing means and the elevator control means may be functionally united in one body or the second image processing means and the elevator control
5 means may be functionally united in one body.

In the case where lowering of running efficiency may be caused by the running control of the respective cage based on the result of image processing by the first image processing means, the situation of the
10 landing place or cage can be exactly recognized by using the result of image processing by the second image processing means and, at the same time, running control can be made based on the result of image processing by the second image processing means. The
15 lowering of running efficiency can be estimated based on the result of image processing by the first image processing means and other information pertaining to passengers in cages

1 and waiting persons in landing places of floors.

Accordingly, the necessity of answering unjust calls can be eliminated. In addition, in the case where the number of passengers in a cage becomes two, crimes
5 can be prevented by stopping the elevator at every floor or by stopping the elevator at the nearest floor.

The present invention will now be described in greater detail by way of examples with reference to the accompanying drawings, -wherein:-

Fig. 1 is a diagram showing the whole configuration of the elevator group supervisory control
10 system according to the present invention;

Fig. 2 is a diagram showing an image processing subsidiary system in the elevator group supervisory control system depicted in Fig. 1;

Fig. 3 is a diagram showing the detailed
15 configuration of the image input portion depicted in Fig. 2;

Fig. 4 is a diagram showing the detailed configuration of the image processing portion depicted in Fig. 2;

20 Fig. 5 is a diagram showing the detailed configuration of the transmission processing portion depicted in Fig. 2;

Fig. 6 is a diagram showing the situation in which an image pickup device and an image processor are
25 set in each hall;

Fig. 7 is a diagram showing an example of an image of passengers in a cage picked up by an image

1 pickup device;

Figs. 8 through 10 are diagrams for explaining an image processing method used in the image processor;

Fig. 11 is a diagram showing a format in data
5 transmission between the image generalizer and the respective image processor;

Fig. 12 is a diagram showing a memory map in the DPRAM of the transmission processing portion in the image generalizer;

10 Fig. 13 is a diagram for explaining a method for transmission of image information data into a storage area in the memory map depicted in Fig. 12;

Fig. 14 is a diagram showing a format in transmission of image information data into a storage
15 area in the memory map depicted in Fig. 12;

Fig. 15 is a flow chart showing the operation of the group supervisory controller depicted in Fig. 1;

Fig. 16 is a flow chart showing the operation of the image generalizer depicted in Fig. 1;

20 Fig. 17 is a flow chart showing the operation of each image processor;

Fig. 18 is a diagram showing an example of the condition in which image pickup devices and LED indicators are set in an n-th floor;

25 Fig. 19 is a diagram showing an example of the image pickup condition in the image pickup devices depicted in Fig. 18;

Fig. 20 is a diagram showing the whole

1 configuration of the elevator control system as another
embodiment in which special call buttons are provided in
each hall;

Fig. 21 is a flow chart showing the operation
5 of the group supervisory controller depicted in Fig. 20;

Fig. 22 is a diagram showing an example of
connection between a plurality of image pickup devices
and one image processor in one floor;

Fig. 23 is a diagram showing an example of the
10 configuration of the image processor depicted in Fig.
22;

Fig. 24 is a diagram showing another
embodiment related to the monitor in the elevator
control system depicted in Fig. 1;

15 Fig. 25 is a diagram showing another embodi-
ment related to the setting of the image processors in
the elevator control system depicted in Fig. 1;

Fig. 26 is a diagram showing the relationship
between one cage, the image generalizer and the group
20 supervisory controller in another embodiment of the
invention;

Fig. 27 is a flow chart showing the operation
of the group supervisory controller in the embodiment
depicted in Fig. 26; and

25 Fig. 28 is a flow chart showing the operation
of the image generalizer in the case where the image
processors in the elevator control system depicted in
Fig. 1 are adjusted or checked.

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An embodiment of the present invention will be described hereunder with reference to Fig. 1.

Fig. 1 shows an example of an elevator group-supervisory control system in which four elevators are generally controlled.

A group supervisory controller 1, elevator controllers 2-1 to 2-4 for controlling the four elevators respectively, indicator controllers 3-1 to 3-4, an image generalizer (second image processing means) 4 and a monitor 6 are multidropwise connected to a serial transmission line 20. Standard input-output equipment such as call buttons 8-1 to 8-4 installed in halls is connected to serial transmission lines 21-1 to 21-4 which serve as output lines of the respective elevator controllers 2-1 to 2-4. Operation panels 10-1 to 10-4 in respective cages 9-1 to 9-4 are connected to serial transmission lines 22-1 to 22-4 which serve as other output lines of the respective elevator controllers 2-1 to 2-4.

LED indicators 13-1 to 13-8 provided in the n-th and m-th floors of a building are connected, corresponding to the respective elevator controllers 2-1 to 2-4, to transmission lines which serve as output lines of indicator controllers 3-1 to 3-4.

Image processors (first image processing means) 12-5 to 12-12 for processing output image signals of image pickup devices 11-5 to 11-12 installed in hall

1 ceilings of the n-th and m-th floors and provided
corresponding to the respective elevators are connected
to serial transmission lines 24-1 to 24-4 which serve as
output lines of the image generalizer 4, while the image
5 processors are classified into groups corresponding to
the respective elevator controllers 2-1 to 2-4. Other
image processors 12-1 to 12-4 for processing output
image signals of image pickup devices 11-1 to 11-4
installed in the respective cages are connected to a
10 serial transmission line 24-5 which serves as another
output line of the image generalizer 4. Further, a
personal computer (hereinafter abbreviated as "PC") 5 is
connected to a general communication circuit (RS-232C)
24-6.

15 A monitor television set (image display means)
7 for displaying image data of the image pickup devices
11-1 to 11-12 is connected to the monitor 6 connected to
the transmission line 20.

In the following, the configuration and
20 operation of an image processing subsidiary system in
the elevator group supervisory system are described with
reference to Fig. 2.

The configuration and operation of the image
processors 12-1 to 12-2 are described in detail with
25 reference to the image processor 12-5.

The image processor 12-5 comprises an image
input portion 12-5-1, an image processing portion 12-5-
2, and transmission processing portion 12-5-3. The

1 image input portion 12-5-1 serves to convert the output
image signal (analog quantity) of the image pickup
device 11-5 into digital quantity. The image processing
portion 12-5-2 serves to detect the situation of waiting
5 persons remaining in the hall, judging from the digital
quantity, as will be described more in detail. The
transmission processing portion 12-5-3 serves to
transmit the information of waiting persons found as
described above, to the image generalizer 4 according to
10 a predetermined format.

The configurations of the image input portion
12-5-1, the image processing portion 12-5-2 and the
transmission processing portion 12-5-3 are shown in
Figs. 3, 4 and 5, respectively.

15 As shown in Fig. 3, the image input portion
12-5-1 has an A/D converter circuit 32 for converting an
analog image signal 47 into a digital signal, a display
memory 38 for temporally storing an original image in
the form of a digital signal, and a D/A converter
20 circuit 34 through which a monitor television set 42 can
be connected for the purpose of adjusting the image
processor individually.

In Figs. 3 and 4, reference numeral 52
designates a data bus through which the digital signal
25 of the original image is transmitted between the image
processing portion 12-5-2 depicted in Fig. 4 and the
transmission processing portion 12-5-3 depicted in
Fig. 5.

1 As shown in Fig. 4, the image processing
portion 12-5-2 serves as a center portion of the image
processor 12-5. The image processing portion 12-5-2 has
a work memory 67 for storing background and original
5 images, a digital signal processor (DSP) 69 for
performing image processing, a micro-processing unit
(MPU) 60 for performing original image storage and
original image processing, a read-only memory (ROM) 62
for storing a processing program in advance, and a
10 random-access memory (RAM) for temporally storing data
processed by the MPU 60. The MPU 60 serves to find the
number of waiting persons and perform image recognition,
such as for example a judgment as to whether a wheel-
chair is used or not. The image processing portion 12-
15 5-2 is connected to the PC 5 through an asynchronous
communication IC (ACIA) 61.

As shown in Fig. 5, the transmission proces-
sing portion 12-5-3 has a single-chip microcomputer
(SMC) 90, a dual-port RAM (DPRAM) 91, a transmission
20 interface circuit 92, and a pulse transformer 93.

In the following, a practical method for
detecting waiting persons in an elevator hall using the
apparatus configured as described above is described.

Fig. 6 shows the situation in which the
25 apparatus is set.

The image pickup device 11-5 is installed in
the ceiling of the elevator hall of the n-th floor. The
image processor 12-5 is installed in an elevator path

1 where the cage 9-1 moves. The image processor 12-5 is
connected through a picture signal cable. The output of
the image processor 12-5 is connected to a transmission
line 24-1 laid in the elevator path, so that information
5 is transmitted to the image generalizer 4 through the
transmission line 24-1.

A method for detecting waiting persons 101 to
103 in the hall in the aforementioned setting situation
will be described hereunder.

10 Fig. 7 shows an example of a picture picked up
the image pickup device 11-5. In Fig. 7, one scene 104
is formed by arranging a number, N, of unit picture
elements 105 in the horizontal direction and a number,
M, of unit picture elements 105 in the vertical
15 direction. The numbers N and M vary according to the
image pickup device. In this embodiment, the resolution
power in the image input portion 12-5-1 of the image
processor 12-5 is assumed to be 256 x 240. In short,
the numbers N and M are assumed to be 256 and 240,
20 respectively. In the drawing, background, head and
clothing colors are assumed to be gray, black and white,
respectively.

As shown in Fig. 8, in suitable timing, the
MPU 60 judges that there is no waiting person on the
25 bases of the image taken in the display memory 38 and
the running state of the elevator. The image as a
background image is stored in the page 0, 67-1, of the
work memory 67. Then, a next image, as an original

1 image, is taken in after the passage of a predetermined
time and stored in the page 1, 67-2, of the work memory
67. Then, the MPU 60 makes the DSP 69 carry out image
processing according to the aforementioned procedure, so
5 that images thus obtained are stored in the pages 2 and
3, 67-3 and 67-4, of the work memory 67, successively
and periodically.

The images stored in the respective pages 67-2
to 67-4 of the work memory 67 are overwritten periodi-
10 cally and successively to be updated to newest images.

Fig. 9 shows the content of the processing in
the DSP 69. When the background image stored in the
page 0, 67-1, and the original image stored in the page
1, 67-2, are expressed respectively by $g(x, y)$ and
15 $f(x, y)$, the DSP 69 calculates the absolute value $h(x, y)$
of the difference therebetween by the following
formula to store the value in the page 2, 67-3, of the
work memory 67.

$$h(x, y) = |f(x, y) - g(x, y)|$$

20 As a result, background and body colors become
black and gray, respectively. Then, the image is
compared with a suitable threshold B and transformed to
a binary image $i(x, y)$ represented by the following
formula. The binary image is stored into the page 3,
25 67-4 of the work memory 67. As a result, background and
body colors becomes black and white, respectively.

$$i(x, y) = \begin{cases} 255 : h(x, y) \geq B \dots \text{white} \\ 0 : h(x, y) < B \dots \text{black} \end{cases}$$

1 In the formula, x represents an integer in a range of from 0 to N (255), and y represents an integer in a range of from 0 to M (239).

The MPU 60 classifies the situation of waiting
 5 persons into 4 groups as shown in Fig. 10 based on the result. In short, the MPU 60 calculates an area (number of picture elements) occupied by the body color based on the binary image stored in the page 3, 67-4, of the work memory 67 and calculates occupied area rate P by
 10 dividing the area by the number of total picture elements, as shown in the following expression.

$$P = \frac{\sum_{K=1}^n S_K}{N \times M}$$

Assuming now that the areas corresponding to the waiting persons 101, 102 and 103 are replaced by S_1 , S_2 and S_3 , respectively, then n in the expression takes
 15 the value of 3.

The occupied area rate P is within a range represented by the relation $0 \leq P \leq 1$. In this embodiment, the range is classified into four groups, namely, a group from 0 to P_1 , a group from P_1 to P_2 , a
 20 group from P_2 to P_3 , and a group from P_3 to 1. In

1 short, the MPU 60 roughly recognizes the situation of
waiting persons classified into four groups, namely, 0
"no waiting person", S "a small number of waiting
persons", M "a medium number of waiting persons", and L
5 "a large number of waiting persons". The detection
accuracy is about $\pm 30\%$ calculated in the number of
persons. Accordingly, processing speed can be improved
sufficiently to perfect the processing in the time
required by the group supervisory controller 1.

10 The situation of waiting persons is detected
in each of the cages 9-1 to 9-4 in the same manner as
described above.

In the following, the configuration and
operation of the image generalizer for generalizing
15 information obtained in the image processors 12-1 to 12-
12 as described above is described with reference to
Fig. 2.

As shown in Fig. 2, the image generalizer 4
comprises an image processing portion 4-1, a plurality
20 of transmission processing portions 4-2 to 4-7, and an
image output portion 4-8. The configuration of these
portions 4-1 to 4-8 is the same as that of the portions
of the image processor 4-8. Accordingly, the original
image transmitted to the image generalizer 4 is
25 processed in the image processing portion 4-1 so that
the number of waiting persons or the existence of a
wheelchair user can be judged from image recognition.
The image processing accuracy in the image generalizer 4

1 is not less than that of the image processors 12-1 to
12-12. In the case where accurate image processing is
required, the detection accuracy can be improved to
about $\pm 5\%$ calculated in the number of persons. The
5 configuration of the portions is the same as in Figs. 3
to 5. Detailed description of the configuration of the
portions will be omitted. The configuration of the
image output portion 4-8 is the same as that of the
image input portion 12-5-1 of the image processor 12-5,
10 except that the image output portion 4-8 does not use
the image take-in function.

In the following, the operation of the
elevator control system according to the present
invention is described.

15 The elevator control system has two operation
modes. The first mode is related to elevator control,
and the second mode is related to adjustment and
checking of the image processor provided separately from
the image generalizer.

20 In the following, the first mode is described
with reference to Fig. 11.

As shown in Fig. 11, the transmission
processing portions 4-3 to 4-7 of the image generalizer
4 serve as master stations which periodically collect
25 information pertaining to waiting persons or passengers
(information pertaining to waiting persons is
information pertaining to the situation of waiting
persons in halls, and information pertaining to

1 passengers is information pertaining to passengers in
cages) from the image processors 12-1 to 12-12 serving
as terminal stations. In short, one transmission period
is separated into a period 110 for transmitting
5 information pertaining to waiting persons and passengers
and a room period (in which image information is
transmitted if necessary) 111. The period 110 for
transmitting information pertaining to waiting persons
and passengers is further separated into a period in
10 which a command 110-2 and a block check code 110-3 are
transmitted from the image generalizer 4 as a master
station to an image processor as a terminal station
designated by a terminal station address 110-1, and a
period in which waiting person or passenger information
15 (hereinafter called "processed data") 110-5 and a block
check code 110-6 are received in the master station from
the designated image processor corresponding to the
terminal station address 110-4 and the command. The
transmission period is repeated by the number of
20 terminal stations connected to the transmission lines so
that processed data are collected.

The contents of the command in conjunction
with an example of processing in the respective terminal
station are shown in Table 1.

Table 1

Command No.	Contents	Procedure in Terminal Station	
		Contents	Transmission
1	Taking-in of background image	Background image is taken in judging whether a person exists or not.	Absent
2	Taking-in of original image	Original image is taken in to find the situation of waiting persons and passengers.	Absent
3	Processed data request	The situation of waiting persons and passengers is transmitted.	Present
4	Image data request	Image data in designated page is transmitted.	Present
5	Tuning	Predetermined tuning is carried out.	Absent

1 In general, the image generalizer 4 carries
out processing designated by command No. 3 in Table 1,
so that collected processed data are stored in the
DPRAMs of the transmission processing portions 4-3 to 4-
5 7, respectively. The MPU of the image processing
portion 4-1 serves to store the data in the DPRAM of the
transmission processing portion 4-2 after arrangement of
the data. As a result, the data processed by the image
processors 12-1 to 12-12 are successively stored in
10 storage areas 120 to 131 as shown in a memory map of
Fig. 12.

The storage area 132 serves as a work area in
the case where the image data (image information)
obtained in the room period 111 depicted in Fig. 11 is
15 transmitted. As shown in Fig. 13, the image data is
transmitted according to the transmission format
depicted in Fig. 14 after one scene 104 is divided into
240 (M) blocks each of which has 256 bytes (N). In
short, the image data is transmitted as follows. An
20 address 111-1 of a terminal station requesting the image
data, a command 111-2 for requesting the image data, a
page number 111-3 requested, a block number 111-4
requested, and a block check number 111-5 are
transmitted from the master station to the terminal
25 station. Then, an address 111-6 of the terminal station
serving as an answer, a transmission page number 111-7,
a transmission block number 111-8, one-block image data
111-9 (256 bytes), and a block check code 111-10 are

1 transmitted from the terminal station to the master station. The aforementioned transmission procedure is repeated till transmission of all blocks (240 blocks) is completed.

5 The group supervisory controller 1 receives the processed data through the transmission processing portion 4-2 and the transmission line 20 and performs running pattern control such as assignment of the number of elevators in accordance with the situation of waiting
10 persons. If necessary, the group supervisory controller 1 issues an image request instruction to the image generalizer 4 based on the result of image processing by each image processor and other information pertaining to passengers, for example, in the case where information
15 of the presence of waiting persons is given with no occurrence of pushing of hall call buttons 8-1 to 8-4 or in the case where one of special call buttons is pushed. The image generalizer 4 carries out the procedure designated by command No. 4 in Table 1 corresponding to
20 the instruction, to thereby obtain the image data from the designated image processor. Then, the image processor 4 carries out detailed processing and then transmits the result of the detailed processing.

The group supervisory controller 1 issues a
25 monitoring instruction based on the data transmitted from the image generalizer 4, so that the monitor 6 displays a designated image on the television set 7 in response to the monitoring instruction.

1 This series of procedure is described with
reference to the flow charts of Figs. 15 to 17 which
show an example of crime prevention elevator running
control.

5 When a judgment in Step 140, in Fig. 15 proves
that there is no person or a few persons on the basis of
circumstances, such as running situations of the
respective elevators, hall call button information, cage
call button information and measurements performed by
10 the respective intra-cage load weight detector, (that
is, other information pertaining to passengers), the
group supervisory controller 1 issues both a background
take-in instruction and a terminal station address of a
take-in-enabled image processor to the image generalizer
15 4 in Step 141. When there is no take-in-enabled image
processor in Step 140, the Step 141 is bypassed. In
Step 142, ordinary elevator running control is carried
out. In Step 143, processed data of all the image
processors 12-1 to 12-12 collected in the image
20 generalizer 4 are received. When a judgment in Step 144
proves that at least one data of "S" exists in the
processed data, an image data request command and a
terminal station address of the image processor
generating the data "S" are issued to the image
25 generalizer 4 in Step 145.

 The Step 145 corresponds to the means for
finding the result of image processing by the second
image processing means based on the result of image

- 1 processing by the first image processing means and other
information pertaining to passengers.

Assuming now that the image processor
generating the data "S" is an image processor 12-5 for
5 processing an image in the vicinity of the No. 1
elevator in the hall of the n-th floor, then the image
generalizer 4 receives a background image data and an
original image data of the image processor 12-5 and
another image processor 12-1 provided to process the
10 output image signal of the image pickup device 11-1
installed in the No. 1 elevator and calculates the
number of persons by detailed processing. The result of
the processing is used for cage control. In short, in
the case where the result of the processing shows that
15 the sum of the number of passengers and the number of
waiting persons is two, the group supervisory controller
1 judges from Step 146 that monitoring is required for
prevention of crimes and the group supervisory
controller 1 issues a monitoring instruction to the
20 image generalizer 4 and the monitor 6 in Step 147. As a
result, the monitor 6 starts its operation. When one or
two waiting persons get on the elevator so that the
number of passengers in the elevator changes to two, a
running pattern control instruction to stop the elevator
25 at every floor is issued in Step 148. Thereafter, the
situation of the procedure is returned so that the
series of procedure is repeated. When the number of
passengers is not one, the running pattern is returned

1 to the original pattern. As described above, a novel
point of the present invention is in that the group
supervisory controller 1 re-confirms the situation of
waiting persons and passengers and uses the result of
5 the reconfirmation for cage control.

Then, the image generalizer 4 receives an
instruction from the group supervisory controller 1 in
Step 150 and judges in Step 151 whether the instruction
is a monitoring instruction or not. When the instruc-
10 tion is a monitoring instruction, command No. 4, that
is, an image data request command is issued to an image
processor designated by the group supervisory controller
1 in Step 152. The image data received is transmitted
to the monitor 6 in Step 153, so that the image is
15 displayed on the monitor television set 7. Then,
command No. 2, that is, an image take-in command is
issued to all the image processors 12-1 to 12-12 to
carry out processing for the next original image. The
results are collected and arranged in Step 155. The
20 result of Step 155 is stored in the transmission
processing portion 4-2 which carries out transmission
processing with respect to the group supervisory
controller 1. Thereafter, the situation of the
procedure is returned to the head step of the series of
25 procedure.

On the other hand, when the judgment in Step
151 proves that the instruction is not a monitoring
instruction, a judgment in Step 157 is made as to

1 whether the instruction is a background image take-in
instruction or not. When the instruction is a
background image take-in instruction, command No. 1,
that is, a background image take-in command is issued to
5 the image processor designated by the group supervisory
controller 1 in Step 158. Then, the situation of the
procedure is returned to the head step. When the
judgment in Step 157 proves that the instruction is not
a background image take-in instruction, a judgment in
10 Step 159 is made as to whether the instruction is an
image data request instruction or not. When the
judgment proves that the instruction is an image data
request instruction, command No. 4 is issued to the
image processor designated by the group supervisory
15 controller in Step 161 so that both a background image
and an original image are received. These images are
processed in detail in Step 161. In Step 156, the
results are stored in suitable positions in the
processed data storage areas 120 to 131 of the DPRAM
20 in the transmission processing portion 4-2 as shown in
Fig. 12.

The original image transmitted to the image
generalizer 4 based on the image data request
instruction may be an original image stored in the
25 display memory 38 of the respective image processors as
a base of the instruction or may be a newest original
image taken in just before the instruction.

1 Finally, the processing by the image
processors 12-1 to 12-12 is described.

 The command from the image generalizer 4 is
first judged in Step 170. When the command is command
5 No. 1, background image take-in processing is carried
out in Step 171. When the command is not command No. 1,
the Step 171 is bypassed. In the case where the Step
171 has not been executed, the situation of the
procedure is returned to the head step as shown in the
10 broken line. Then, a judgment in Step 172 is made as to
whether the command is command No. 5 or not. When the
command is command No. 5, a designated tuning procedure
is carried out in Step 173. Thereafter, the situation
of the procedure is returned to the head step. When the
15 command is not command No. 5, a judgment in Step 174 is
made as to whether the command is command No. 4 or not.
When the command is command No. 4, an image data in a
designated page is transmitted to the image generalizer
4 and then the situation of the procedure is returned to
20 the head step. When the command is not command No. 4, a
judgment in Step 176 is made as to whether the command
is command No. 2 or not. When the command is command
No. 2, the procedure of detecting the situation of
waiting persons and passengers is carried out in Step
25 177 and then the situation of the procedure is returned
to the head step. When the command is not command No.
2, a judgment in Step 178 is made as to whether the
command is command No. 3 or not. When the command is

- 1 command No. 3, the processed data is transmitted to the
image generalizer 4 in Step 179 and then the situation
of the procedure is returned to the head step. When the
command is not command No. 3, the situation of the
5 procedure is returned to the head step without executing
any procedure.

According to the aforementioned example of the
first mode, the group supervisory controller 1 issues a
monitoring instruction or a crime-prevention running
10 control instruction to stop the elevator at every floor
based on the accurate image re-recognition of the image
generalizer 4 through the step of transmitting stored
original images from the image processors 12-1 to 12-12
to the image generalizer 4. Accordingly, criminal act
15 can be prevented so that the system can be improved in
crime prevention and, consequently, secure running
service to passengers can be carried out.

Even in the case where information that
waiting persons exist is given with no pushing of hall
20 call buttons 8-1 to 8-4, exact processing can be carried
out by the image generalizer 4. In short, the initial
input information that waiting persons exist can be
neglected when an exact decision is made by the image
generalizer 4 that there is no waiting persons.
25 Accordingly, wasteful time caused by the stopping
of the elevator at unnecessary floors can be eliminated
to thereby attain improvement in running efficiency.

1 The image re-recognition may be carried out
regardless of the judgment of the group supervisory
controller and through the step of obtaining original
data from the image processors 12-1 to 12-12 at the
5 point of time when the image generalize 4 detects the
fact that there are a small number of waiting persons or
passengers.

 According to the aforementioned method, a
burden imposed on software processing in the group
10 supervisory controller 1 can be lightened.

 In the elevator group supervisory control
system as shown in Fig. 1, an image information
subsidiary system as shown in Fig. 2 and an indication
subsidiary system comprising indicator controllers 3-1
15 to 3-4 and LED indicators 13-1 to 13-8 are provided in
parallel to each other. The group supervisory
controller 1 performs controlling to feed information to
the LED indicators 13-1 to 13-8 timely based on exact
information obtained from the image information
20 subsidiary system.

 Fig. 18 shows an example of the setting of the
LED indicators 13-1 to 13-4 at the n-th floor. Table 2
shows an example of the relationship between the output
timing of information and the indication pattern of
25 indication contents.

Table 2

Timing	Place	Display Contents
Upon detection of person	Corresponding indicator	"Welcome." "Push call button, please."
Upon assignment of elevator	All indicators	"Wait in front of No. $\bigcirc$ elevator." "Wait for $\bigcirc$ seconds."
Crowded at m-th floor	Indicator in front of elevator with waiting person	"Crowded at m-th floor. Wait for a bit, please." "Crowded at m-th floor. Use an escalator (moving staircase)."
Upon change of elevator allocation	ditto	"Assignment is changed to No. $\bigcirc$ elevator." "Move in front of No. $\bigcirc$ elevator."
Arrival of elevator	Indicator in front of arriving elevator	"Here are persons getting off. Clear the way."

1 In short, as shown in Fig. 18, the image pickup devices
11-5 to 11-8 are provided in suitable positions of the
hall ceiling where images in the vicinity of the
entrances of the elevators can be picked up. The output
5 lines of the image pickup devices are connected to the
image processors 12-5 to 12-8 installed in the elevator
paths. The output lines of the image processors 12-5 to
12-8 are connected to the image generalizer 4 installed
in a machine chamber through serial transmission lines
10 24-1 to 24-4 installed in the elevator paths. On the
other hand, the LED indicators 13-1 to 13-4 are provided
in places which can be seen easily and located in the
vicinity of the entrances of the elevators as shown in
the drawing. Information to be indicated is transmitted
15 from the indicator controllers 3-1 to 3-4 to the LED
indicators through the transmission lines 23-1 to 23-4
installed in the elevator paths. Information obtained
by hall buttons 8-1 to 8-3 provided in the hall is
transmitted to the respective elevator controllers 2-1
20 and 2-3 through the transmission lines 21-1 and 21-3
installed in the elevator paths.

The group supervisory controller 1 makes the
LED indicators 13-1 to 13-4 perform indication of
necessary information in various kinds of timings as
25 shown in Table 2. By using image information in
combination, the LED indicators can be used efficiently
and, accordingly, improvement in service for users can
be attained.

1 To lighten the burden on software processing
in the group supervisory controller 1, the function
thereof may be separated so that the indicator
controllers 3-1 to 3-4 can carry out indication
5 information as shown in Table 2 through taking-in of
information pertaining to the running of the elevator
cages 9-1 to 9-4 and information pertaining to the
situation of waiting persons.

 There may be provided a time zone in which
10 pictorial patterns from the indicators 13-1 to 13-8 are
displayed in the form of animation, in the case where
the fact that at least one child is contained in the
waiting persons is estimated based on the character-
istics, such as size, length, width, and the like, of
15 the person seen from the ceiling. By using the afore-
mentioned method, the child can have an interest in the
indicators to thereby prevent the child from making a
noise in the hall, thereby attaining maintenance of
order on waiting persons in the hall.

20 Though not shown in Table 2, the group
supervisory controller 1 may assign a current service
cage and another additional cage and, at the same time,
may issue an instruction to the indicator controllers 3-
1 to 3-4 to make the indicators indicate information
25 pertaining to the elevator running condition in the case
where the image generalizer 4 detects such a large
number of waiting persons that left-off persons will
occur. Accordingly, waiting persons seeing the

1 indicators 13-1 to 13-8 can wait without anxiety so that
passengers can get on and off smoothly. Furthermore,
the operations of continuously pushing door-opening
5 buttons for elongating a door-opening period or the
operations of opening and closing the elevator door by
passengers or waiting persons can be reduced, so that
each of the cages can start smoothly to the next floor.
Consequently, elevator running efficiency can be
improved.

10 In the aforementioned configuration, the image
pickup areas (broken lines) 200 of the image pickup
devices 11-5 to 11-8 may be established to be overlapped
with each other as shown in Fig. 19 to form processing
areas (dot-and-dash lines) 201, so that waiting persons
15 can be detected without omission.

Monitor television sets may be provided in the
cages or halls so that image data can be displayed
directly. As shown in Fig. 19, image data in the
processing areas 201 of the image pickup devices 11-5 to
20 11-8 may be transmitted to the monitor 6 and displayed
dividing one screen on a monitor television set. In
this case, the whole image of the hall can be observed
at a glance.

Image pickup devices and image processors may
25 be provided corresponding to the elevators and other
image processors may be provided in the hall side so
that the output results thereof are transmitted
serially. In this case, not only signal cables between

- 1 the halls and the machine chamber can be saved but
ordinary data quantity can be saved greatly.

Both information pertaining to the number of
waiting persons calculated from the images and informa-
5 tion pertaining to the direction of the running of the
cages may be used to grasp the traffic flow in the
corresponding floor exactly, and, accordingly, to
improve the traffic flow learning function thereof.

Because the image pickup areas of the image
10 pickup devices are overlapped with each other, the image
pickup devices can compensate for each other to some
degree in the case where one of the image pickup devices
is broken down. Accordingly, there arises an effect in
that reliability on the system can be improved. Because
15 the situation of the hall divided by the plurality of
image pickup devices can be displayed as if it was
picked up by one image pickup device, there arises an
effect in that monitoring efficiency can be improved.

Because the plurality of image processors take
20 in images simultaneously according to the instruction
given from the image generalizer 4, there is no mistake
that one and the same person may be detected by a
plurality of image processors. Accordingly, there
arises an effect in that detecting accuracy in the image
25 processors can be improved.

Because background images necessary for
processing are taken into the image processors 12-1 to
12-12 according to the instruction issued by the group

1 supervisory controller 1 after judgment of the optimum
condition, there arises an effect in that detecting
accuracy in the image processors can be improved.

Because signal transmission lines in the image
5 information system are separated from signal lines used
in the information indication system, there arises an
effect in that stable and speedy image transmission can
be carried out with no influence of the change of the
data quantity on the information indication system.

10 Fig. 20 shows another embodiment of the
invention related to the first mode.

This embodiment shown in Fig. 20 shows an
elevator group supervisory control system having special
call buttons 8-5, such as call buttons for disabled per-
15 sons such as wheelchair users, port-type call buttons,
code-type call buttons, or the like, other than the call
buttons 8-1 to 8-4 provided in the respective floors in
the aforementioned embodiment as shown in Fig. 1.

In general, call buttons for physically
20 handicapped or disabled persons other than ordinary call
buttons 8-1 to 8-4 are often provided in the elevator
system in order to call a cage having a special interior
suitable for physically handicapped or disabled persons
in haste or control the opening and shutting of a door
25 for the purpose of maintaining safety of physically
handicapped or disabled persons. Or port-type call
buttons are often provided to improve running efficiency
through knowing the destination floor requested by uses

1 in advance. Or code-type call buttons are often
provided to limit users in the running pattern of the
elevator. However, the special call buttons are often
abused or misused by persons not related thereto to
5 bring about a lowering of running efficiency.

In this embodiment, the operation of the
special buttons is checked in the image information
system to thereby prevent the lowering of running
efficiency.

10 In Fig. 20, items equivalent to those in Fig.
1 are referenced correspondingly and description about
them is omitted here.

In the following, the operation of the
elevator system in this embodiment is described with
15 reference to a flow chart shown in Fig. 21 in which
items equivalent to those in Fig. 15 are referenced
correspondingly and description about them is omitted
here.

In Fig. 21, a series of procedure designated
20 by Step 210 to 213 is carried out before the situation
of the procedure is returned to the head step after all
steps in the series of procedure in the group super-
visory controller 1 in Fig. 15 are finished. In Step
210, a judgment is made as to whether the special call
25 button 8-5 is pushed or not. When the special call
button is not pushed, the situation of the procedure is
returned to the head step as in the conventional case.
When the special call button is pushed, the image

1 generalizer 4 obtains image data from a corresponding
 image processor and makes detailed image processing in
 Step 211. When a judgment in Step 213 proves that the
 calling is normal, the aforementioned special running of
 5 the elevator is carried out. When a judgment in Step
 213 proves that the calling is abnormal, the Step 123 is
 bypassed.

Table 3 shows special call buttons and proces-
 sing by the image generalizer 4. For example, when a
 10 call button for disabled persons is pushed, a judgment
 is made as to whether a wheelchair exists in the image.
 The wheelchair detection can be made easily based on the
 characteristic variables, such as area, form, round
 length, and the like, of a matter seen from the ceiling.
 15 On the other hand, when a port-type call button is
 pushed, the number of callings and the number of persons
 existing in one scene are compared with each other.
 When a code-type call button is pushed, the character-
 istics of a person registered in advance and the
 20 characteristics of the person detected from an image are
 compared with each other.

TABLE 3

Special call button	Contents of image processing
Call button for disabled persons	Checking wheelchair
Port-type call button	Comparing the number of calls and the number of persons
Code-type call button	Checking users

1 According to this embodiment, the normality of
the special calling can be judged in the group super-
visory controller 1 based on the image recognition of
original images in the image generalizer 4. According-
5 ly, lowering of running efficiency caused by reduction
of the number of cages controlled by the group super-
visory controller can be prevented, though the reduction
of the number of cages is caused by priority of special-
call running service to ordinary-call running service.

10 Fig. 22 shows another embodiment related to
the arrangement of image pickup devices and image
processors. In this embodiment, the output signals of
image pickup devices provided in one and the same floor
are collected into one place so that the output signals
15 are transmitted through one transmission processing
portion and one serial transmission line. In short, as
shown in Fig. 22, the output signals of image pickup
devices 11-5 to 11-8 are connected to an image processor
220 in an elevator path by ceiling wiring as shown in
20 the broken line, so that processed data and image data
are transmitted to the image generalizer 4 through a
serial transmission line 24-1.

The configuration of the image processor 220
in Fig. 22 is shown in Fig. 23.

25 The output signals of the image pickup devices
11-5 to 11-8 are respectively connected to image
processors 12-5a to 12-8a each of which comprises an
image input portion and an image processing portion.

1 The same image processing as that in the first embodiment is carried out. As a result, the signals are transmitted to one transmission processing portion 221 through a common bus 222, arranged in the transmission
5 processing portion and then transmitted to the image generalizer 4 through the transmission line 24-1.

Although the drawing shows the situation of an n-th floor, it is to be understood that the same structure can be applied to an m-th floor and that data can be
10 transmitted through one serial transmission line.

Accordingly, the number of transmission processing portions 4-3 to 4-6 provided in the hall side of the image generalizer 4 shown in Fig. 2 can be reduced to one.

15 According to this embodiment, not only the number of serial transmission lines can be reduced to one but the number of transmission processing portions in the image processors 12-5a to 12-8a and the image generalizer 4 can be reduced. Accordingly, there arises
20 an effect in that improvement in construction work and reduction of system size can be attained.

Fig. 24 shows another embodiment related to the monitor.

In this embodiment, an exclusive-use serial
25 transmission line 24-7 for connecting between the image generalizer 4 and the monitor 6 is provided. In short, processed data and image data transmitted from the image processors 12-1 to 12-12 are arranged in the image

1 generalizer 4, so that the processed data necessary for
elevator control are fed to the transmission line 20 and
the image data necessary for monitoring are fed to the
serial transmission line 24-7. It is therefore not
5 necessary that image data as a multiplex signal are
transmitted to the transmission line 20 at the time of
monitoring. Accordingly, there is no reduction of
efficiency in transmission of information pertaining to
elevator control.

10 According to this embodiment, as described
above, there is no reduction of efficiency in trans-
mission of information pertaining to elevator control.
Furthermore, the misoperation of the elevator caused by
multiplex transmission of image data can be prevented.

15 Fig. 25 shows another embodiment related to
the setting of the image processors.

 In this embodiment, all of the image
processors 12-1 to 12-12 are provided in the machine
chamber.

20 This embodiment can be applied to a relatively
low building.

 In short, in the case where the image
processors 12-1 to 12-12 are provided in the hall-side
elevator paths as in the embodiment shown in Fig. 1,
25 setting or checking work contains on-cage dangerous
work. According to this embodiment, all of the image
processors 12-1 to 12-12 are provided in the machine
chamber and connected to one serial transmission line

1 24-1. Accordingly, the same image processing as in the
embodiment shown in Fig. 1 can be made. Furthermore,
safety at the time of the setting and checking of the
elevator can be improved. In addition, the tuning of
5 every image processor can be made easily.

Another embodiment of the present invention
will be described hereunder with reference to Figs. 26
and 27.

In general, a differential-transformer-type
10 load weight detector for detecting load weight is
provided under the floor of every elevator cage. The
elevator controller performs control of the elevator
carrying a full load of passengers by using the output
of the load weight detector. When, for example, the
15 elevator carries such a full load of passengers that no
person can get on the elevator, the elevator controller
is designed to control the elevator to pass the cage
without stopping at a floor designated by hall-call.
The accuracy in the output of the load weight detector
20 is considered to be $\pm 10\%$ as a value calculated in the
number of persons.

In the previous embodiment, disagreement
between the situation of pushing of the call button and
the result of image processing by each image processor
25 is used as a trigger for starting the detailed image
processing by the image generalizer. In this embodi-
ment, disagreement between the result of detection by
the load weight detector and the result of image

1 processing by the image processor for the cage is used
as a trigger for starting the detailed image processing.
In short, the result of detection by the load weight
detector is used as other information pertaining to
5 passengers.

In the following, the configuration of this
embodiment is described with reference to Fig. 26.

Fig. 26 shows a typical example of the load
weight detector provided in the No. 1 elevator.

10 The load weight detector 30 is provided under
the floor of a cage 9-1. The output of the load weight
detector 30 is transmitted to the individual elevator
controller 2-1. After arranging elevator information
such as intra-cage load weight and the like, the
15 controller 2-1 transmits the arranged information to the
group supervisory controller 1 through the transmission
line 20. On the other hand, an image in the cage 9-1
picked up by the image pickup device 11-1 is processed
by the image processor 12-1, so that the degree of
20 crowdedness in the cage is transmitted to the image
generalizer 4. The image generalizer 4 arranges the
thus obtained information with information obtained from
other image processors and transmits the arranged
information to the group supervisory controller 1
25 through the transmission line 20. The group supervisory
controller 1 makes a comparison between the intra-cage
load weight (obtained by the load weight detector 30)
obtained from the individual elevator controller 2-1 and

- 1 the degree of intra-cage crowdedness (obtained by the
image processor 12-1) obtained from the image gener-
alizer. On the basis of the comparison, the group
supervisory controller 1 performs elevator optimum
5 assignment control in a flow chart shown in Fig. 27.

In the following, the flow of procedure is described with reference to Fig. 27.

- In Steps 300 and 301, information pertaining to intra-cage load weight and information pertaining to
10 crowdedness are collected from the individual elevator controllers 2-1 to 2-4 and the image generalizer 4 in the manner as described above. Then, a judgment in Step 302 is made as to whether the intra-cage load weight detected by the load weight detector 30 is more than a
15 predetermined value or not.

- When the result of the judgment is true (Y), a judgment in Step 303 is made as to whether the degree of intra-cage crowdedness is not less than "M". In short, the output of the load weight detector 30 and the
20 result of image processing by the image processor 12-1 are compared with each other in Steps 302 and 303 in the case where the number of passengers is large. When, for example, the judgment in Step 303 proves that the degree of crowdedness is not less than "M", the result of the
25 judgment in Step 303 agrees with the result of the judgment in Step 302. Accordingly, the group supervisory controller 1 performs elevator control such as additional assignment, passing of the elevator because

1 of the elevator carrying a full load of passengers, and
the like, in Step 304 without performing detailed image
processing by the image generalizer 4. When, for
example, the judgment in Step 303 proves that the degree
5 of crowdedness is not more than "S", the result of the
judgment in Step 303 disagrees with the result of the
judgment in Step 302. Accordingly, the group super-
visory controller 1 issues an instruction to the image
generalizer 4 to perform detailed image processing in
10 Step 305. In Step 306, a judgment is made as to whether
the number of passengers is less than a predetermined
value or not. When the result of the judgment is true
(Y), the group supervisory controller makes a decision
that load weight is considerably heavy but some
15 passengers can get on still. When the result of the
judgment in Step 306 is false (N), the aforementioned
Step 304 is carried out.

On the other hand, when the result of the
judgment in Step 302 is false (N), or in other words,
20 when the intra-cage load weight is not less than a
predetermined value, a judgment in Step 307 is made as
to whether the intra-cage load weight corresponds to two
persons or not. When the result of the judgment in Step
307 is true (Y), an image expressing the inside of the
25 cage is processed in detail by the image generalizer 4
in Step 308. From the result of Step 308, a judgment in
Step 309 is made as to whether the number of passengers
is two or not. When the result of the judgment is true

1 (Y), the image of the cage picked up by the image pickup
device 11-1 is transmitted to the monitor as shown in
Fig. 1 in Step 310 and then the running pattern is
switched to crime-prevention running to stop the cage at
5 every floor in Step 311. When any one of the results of
the judgments in Steps 307 and 309 is false (N),
ordinary running control is continued.

According to this embodiment, wasteful stop-
ping of not-acceptable cages and passing of acceptable
10 cages can be eliminated, thereby attain improvement in
running efficiency. In addition, the elevator control
system can be improved in crime prevention.

In the following, adjustment and checking of
image processors in the second mode are described.

15 At the time of the starting of the system or
at the time of the periodical checking of the system, it
is necessary to carry out the adjusting operation for
setting (or updating) various parameters or determining
processing areas in all of the image processors 12-1 to
20 12-12 or the operation for checking the running condi-
tion. This mode is provided for the aforementioned
case. This mode is started by connecting the PC 5 to
the general communication circuit 24-6 of the image
generalizer 4 and a monitor television set 7a to the
25 image output portion 4-8 as shown in Fig. 2.

When a command as shown in Table 4 is issued
from the PC 5 in Fig. 2, the MPU in the image processing
portion 4-1 logically cuts off the transmission

50.

- 1 processing portion 4-2 in interrupt handling and carries out tuning between the plurality of image processors 12-1 to 12-12.

Table 4

Command	Sub-command	Parameter	Contents of Processing
A	1	AD, ℓ	Read-out ℓ bytes from address AD.
	2		Write-in ℓ bytes from address AD.
B	-	X_1, Y_1 X_2, Y_2	Regard an area formed by diagonal points (X_1, Y_1) and (X_2, Y_2) as a processing area.
C	1	P	Take-in background image and store the image in page P.
	2		Take-in original image and store the image in page P.
	3		Extract differential image and store the image in page P.
	4	P_1, P_2	Convert the image in page P_1 into a binary image and store the binary image in page P_2 .
	5	P	Find the rate occupied by "white" from the binary image in page P.
D	6	-	Transmit processed data.
	1	P	Receive the image in page P.
	2		Transmit the image in page P.
E	-	-	Terminate the tuning procedure.

1 In the following, this procedure is described
with reference to a flow chart shown in Fig. 28.

Fig. 28 shows interrupt handling with respect
to the general communication circuit 24 of the image
5 generalizer 4.

In Step 180, judgment is made as to whether a
data from the general communication circuit 24-6 is
contained in the normal tuning commands A to E or not.
When the data is normal, judgment in Step 181 is made as
10 to whether the tuning command is "E" or not.

When the tuning command is not "E", the
transmission processing portion 4-2 is logically cut off
in Step 182 and at the same time the fact is reported to
the group supervisory controller 1. This can be made
15 easily by writing specific information in the processed
data storage areas 120 to 131 of the DPRAM in the
transmission processing portion 4-2 as shown in Fig. 12.
Then, a sub-command and a parameter are received from
the PC 5 in Step 183. Command No. 5 is issued to all of
20 the image processors 12-1 to 12-12 in Step 184. Then,
the tuning command, sub-command and parameter are issued
in Step 185. In Step 186, processing corresponding to
the tuning command is carried out. The aforementioned
series of procedure is repeated. When the command from
25 the PC 5 is estimated in Step 181 to be a tuning command
"E", the image generalizer 4 issues the tuning command
"E" to all of the image processors 12-1 to 12-12 in Step
187 to thereby report the finishing of the tuning

1 procedure. Thereafter, the image generalizer logically
connects the transmission processing portion 4-2 in Step
188. In Step 189, the interrupt handling is finished.
When the result of the judgment in Step 180 proves that
5 the tuning command obtained from the PC is not normal,
judgment in Step 190 is made as to whether the tuning
procedure has been executed once or more. When the
result of the judgment proves that the tuning procedure
has been executed, the aforementioned steps 187 and 188
10 are carried out and then the interrupt handling is
finished in Step 189.

When the tuning procedure has been not
executed, the steps 187 and 188 are bypassed so that the
interrupt handling is finished in Step 189. On the
15 other hand, when the command is estimated from Step 172
in Fig. 17 to be command No. 5, the respective image
processor carries out processing corresponding to Step
186 in Fig. 28 till the tuning command "E" is issued in
Step 176 in Fig. 17.

20 In the aforementioned processing, a menu of
tuning commands, a processing command input message and
transmission/reception data are displayed on a display
unit of the PC 5. Transmission/reception image data are
displayed on the television set 7a. A building manager
25 can judge by comparison between the data on the PC 5 and
the original image data on the monitor television set 7a
whether the image processor 12-5 operates normally or
not.

1 According to the second mode, the tuning of
the image processor 12-5 can be made efficiently by
using the original image stored in the image processor
12-5.

5 Having described the first and second modes in
the case where the image generalizer 4 uses the ordinal
image stored in the work memory 67, the invention is
applicable to the case where image signals obtained by
the image pickup devices 11-1 to 11-12 are directly
10 transmitted to the image generalizer 4 to thereby
perform image processing based on the images. This
reason is that, when there is a sufficient time differ-
ence between the image processing by the image gener-
alizer 4 and the image processing by each of the image
15 processors 12-1 to 12-12, the change of the image is
little.

CLAIMS

1. An elevator control system for moving at least one cage up and down in at least one elevator path of a building by elevator control means, comprising:
 - 5 a. image pickup means provided in either or both of the inside of the or each cage, and the landing place of each floor of said building where the or one of the cages stops;
 - b. first image processing means for processing
10 images picked up by said image pickup means and second image processing means having an image processing level not lower than the image processing level of said first image processing means;
 - c. said elevator control means including means for
15 applying the result of image processing performed by said first image processing means to the control of said at least one cage, and means for applying the result of image processing performed by said second
20 image processing means to the control of said at least one cage when the image processing is carried out based on the result of image processing performed by said first image processing means and other information pertaining passengers and waiting persons.
2. An elevator control system according to claim 1,
25 in which said first and second image processing means are arranged to calculate the number of passengers in the or each cage and the number of waiting persons in each of said landing places, based on image



processing.

3. An elevator control system according to claim 2,
in which the number of passengers and the number of
waiting persons are calculated as to a group of adults
5 and a group of children respectively.
4. An elevator control system according to claim 1,
in which said first image processing means performs
image processing while classifying each of the number
of passengers and the number of waiting persons into
10 at least four groups, namely, "no person", "a small
number of persons", "a medium number of persons", and
"a large number of persons".
5. An elevator control system according to claim 1,
in which the image processing to be performed by said
15 second image processing means is designated either by
said second image processing means per se or by said
elevator control means.
6. An elevator control system according to claim 5,
in which a call button is provided in each landing
20 place, and in which either said elevator control means
or said second image processing means includes means
for making said second image processing means perform
image processing when the number of pushings on said
call button is larger than the number of waiting
25 persons in the corresponding landing place detected by
said first image processing means.
7. An elevator control system according to claim 5,
in which a call button is provided in each landing



- place, and in which either said elevator control means or said second image processing means includes means for making said second image processing means perform image processing when some waiting person is detected
5 in each landing place by said first image processing mean with no pushing of the corresponding call button.
8. An elevator control system according to claim 5, in which a special call button is provided in either or both of each landing place and the inside of the or
10 each cage, and in which selected one of said elevator control means and said second image processing means includes means for making said second image processing means perform image processing when said special call button is pushed.
- 15 9. An elevator control system according to claim 8, in which said special call button serves as a call button for a disabled person, and in which said first and second image processing means provide images for judgment as to whether said disabled person uses a
20 wheelchair or not.
10. An elevator control system according to claim 1, in which said elevator control means further includes individual elevator control means provided corresponding to the respective cages in order to
25 drive a plurality of cages, and a group supervisory means for performing general control on said respective individual elevator control means, and in which said group supervisory means includes means for



making said second image processing means perform image processing.

11. An elevator control system according to claim 10, in which when said second image processing means
5 detects a sufficiently large number of waiting persons in a landing place of a floor to be unable to fit in a single cage, said group supervisory means serves to apportion another cage to a corresponding landing place of the same floor.
- 10 12. An elevator control system according to claim 1, in which indicator control means for controlling the contents of indicators provided in respective landing places are connected to said elevator control means, and in which said indicator control means give
15 instructions to said indicators to indicate based on information pertaining to running patterns of said at least one cage and waiting persons in the respective landing places.
13. An elevator control system according to claim 12,
20 in which said indicator control means serve to make said indicators indicate information pertaining to the running patterns of the respective at least one cage.
14. An elevator control system according to claim 13, in which said indicator control means serve to make
25 said indicators indicate pictorial patterns when said image processing means detect the presence of at least one child.
15. An elevator control system according to claim 1,



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in which a plurality of image pickup means are connected to said first image processing means.

16. An elevator control system for moving at least one cage up and down in at least one elevator path of a building by elevator control means, comprising:
- 5 a. image pickup means provided in either or both of the inside of the or each cage, and the landing place of each floor of said building where the or one of the cages stops;
- 10 b. image processing means for processing images picked up by said image pickup means with first and second image processing levels different from each other, said second image processing level being higher than said first image processing level;
- 15 c. said elevator control means including means for applying the result of image processing performed by using said first image processing level to the control of said at least one cage, and means for applying the result of image processing performed by using said
- 20 second image processing level to the control of said at least one cage when the image processing carried out based on the result of image processing performed by using said first image processing level and other information pertaining passengers and waiting persons.
- 25 17. An elevator control system for moving at least one cage up and down in at least one elevator path of a building by elevator control means, comprising:
- a. image pickup means provided in the inside of the



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or each cage and the landing place of each floor of said building where the or one of the cages stops;

b. image processing means for processing images picked up by said image pickup means with first and
5 second image processing levels different from each other, said second image processing level being higher than said first image processing level;

c. said elevator control means including every-floor stop means which is arranged to confirm the fact that
10 the number of passengers in a given cage becomes two on the basis of the image processing by using said second level in the case where it is expected that the number of passengers in said given cage will become two on the basis of the image processing by using said
15 first level so that said every-floor stop means controls said cage to stop at every floor from the point of time when the number of passengers in said given cage reaches a floor designated by the passengers in said given cage.

20 18. An elevator control system for moving at least one cage up and down in at least one elevator path of a building by elevator control means, comprising:

a. image pickup means provided in landing places of floors of said building where said at least one cage
25 stops;

b. a plurality of first image processing means provided corresponding to said image pickup means provided in the landing places of said respective



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floors and for processing images picked up by said image pickup means;

c. second image processing means provided commonly to said plurality of first image processing means and
5 for processing images picked up by said image pickup means;

d. a transmission line for connecting each of said first image processing means to said second image processing means so as to transmit images processed by
10 each of said first image processing means and images picked up by each of said image pickup means to said second image processing means;

e. said elevator control means including means for applying the result of image processing performed by
15 each of said first image processing means to the control of said at least one cage, and means for applying the result of image processing performed by said second image processing means to the control of said at least one cage when the image processing is
20 carried out based on the result of image processing performed by said first image processing means and other information pertaining to passengers and waiting persons.

19. An elevator control system according to claim 18,
25 in which said plurality of first image processing means are connected to said second image processing means through a common transmission line, and in which said second image processing means is connected to



said elevator control means through another transmission line.

20. An elevator control system according to claim 18, in which an image display means is connected to said
5 second image processing means so that images obtained by each of said image pickup means are transmitted from said second image processing means to said image display means so as to be displayed by the image display means.

10 21. An elevator control system according to claim 18, in which each of said first image processing means includes means for storing an image processed by said first image processing means per se as an original image to be processed by said second image processing
15 means.

22. An elevator control system for moving at least one cage up and down in at least one elevator path by elevator control means, comprising:

a. image pickup means provided in the inside of the
20 or each cage and in landing places of each floor where the or one of the cages stops;

b. a plurality of first image processing means for processing images picked up by said image pickup means;

25 c. second image processing means for processing images picked up by said image pickup means at a higher level than that of said first image processing means;



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d. a first transmission line for connecting each of said first image processing means to said second image processing means;

e. indicator control means for causing indicators
5 provided in said landing places to indicate information, such as running conditions of said at least one cage and waiting persons in said landing places;

f. image display means for displaying the situation
10 of waiting persons in the respective landing places and passengers in said at least one cage by means of images obtained by said image pickup means;

g. said elevator control means including means for applying the result of image processing performed by
15 said first image processing means to the control of said at least one cage, and means for applying the result of image processing performed by said second image processing means to the control of said at least one cage when the image processing carried out based
20 on the result of image processing performed by said first image processing means and other information pertaining to passengers and waiting persons;

h. a second transmission line for connecting said elevator control means, said second image processing
25 means, said indicator control means and said image display means to each other.

23. An elevator control system for moving at least one cage up and down in at least one elevator path of



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a building by elevator control means, comprising:

- a. image pickup means provided in the inside of said at least one cage;
- b. first and second image processing means for
5 processing images picked up by said image pickup means, said second image processing means having an image processing level higher than that of said first image processing means;
- c. load weight detecting means provided under
10 respective bottoms of said at least one cage;
- d. said elevator control means including means for applying the result of image processing performed by said first image processing means to the control of
15 said at least one cage when the result of image processing performed by said first image processing means substantially agrees with the result of detection performed by said load weight detecting means, and means for applying the result of image processing performed by said second image processing
20 means to the control of said at least one cage when the result of image processing performed by said first image processing means disagrees with the result of detection performed by said load weight detecting means.

25 24. An elevator control system according to claim 23, in which said load weight detecting means is made higher than said first image processing means in accuracy calculated in the number of persons, and in



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which said second image processing means is made higher than said load weight detecting means in accuracy calculated in the number of persons.

25. An elevator control system according to claim 23,
5 in which the comparison between the result of image processing performed by said first image processing means and the result of detection performed by said load weight detecting means is carried out when the intra-cage load weight is estimated to be less than
10 that corresponding to medium crowdedness.

26. An elevator control system constructed substantially as herein described with reference to and as illustrated in the accompanying drawings.

