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TITLE OF THE INVENTION

ELEVATOR SYSTEM

BACKGROUND OF THE INVENTION

5 The present invention relates to an elevator system in which information is transmitted and received between an elevator control unit and terminals in an elevator car and on each of floors.

 An elevator is operated under requests of a hall call
10 button placed at a landing entrance on each of floors and a car call button (also called as a destination button) placed inside an elevator car, and statuses of the hall call button on each of the floors and the car call button in the car are sequentially transmitted to an elevator control unit. Wire communication has
15 been generally used for the transmission.

 Use of a wireless system for information transmission between an elevator machine room and a car is proposed in Japanese Patent Application Laid-Open No.6-227766, Japanese Patent Application Laid-Open No.7-97152 and Japanese Patent
20 Application Laid-Open No.11-150505. Further, Japanese Patent Application Laid-Open No.3-46979 discloses a system that a control panel of an elevator machine room on a rooftop of a building and an indicator of a landing entrance on each floor are connected by a wireless communication line.

25 On the other hand, in the fields other than elevator system, there is a technology that using a plurality of specified small power wireless transmitting/receiving units or very-weak radio wave transmitting/receiving units, information is transmitted to a range of not directly transmitting by



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relaying the information between the units. Such technologies are disclosed in Japanese Patent Application Laid-Open No.5-292577, Japanese Patent Application Laid-Open No.6-348999, Japanese Patent Application Laid-Open No.9-66129 and Japanese
5 Patent Application Laid-Open No.9-205908.

The above-mentioned conventional technologies in the field of elevator have been not widely used because a wireless unit having a large output capacity needs to be used corresponding to the height of the building. Further, each of
10 the technologies is not sufficient to reduce number of elevator wires in the building.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an
15 elevator system which can certainly transmit and receive information between an elevator control unit and a car, a counterweight or a landing entrance on each floor even if wireless transmitting/receiving units having a comparatively narrow communicable range.

20 In a preferred embodiment of the present invention, wireless transmitting/receiving units of very weak radio wave are individually incorporated in an elevator control unit and a car terminal or floor terminals, the wireless transmitting unit of the terminal of the sending side transmits a very weak
25 radio wave including a final receiving side (final destination) and transmission information. One of the terminals located near the terminal of the sending side receiving the radio wave transmits a radio wave including the same information toward another of the terminals located within a communicable range.

After that, the above-described process is repeated to transmit the information to the final receiving side. In the communication with the terminal in the car, the terminals to be used as relay stations are selected based on car positional
5 information at the present time to perform relay transmission.

By the wireless transmission relaying information using the terminal within a communicable range, it is possible to communicate between a sending side and a receiving side which are too apart to directly communicate, and it is possible to
10 perform sending and receiving of information in an elevator system using wireless transmitting/receiving units having a relatively narrow communication range.

BRIEF DESCRIPTION OF THE DRAWINGS

15 FIG. 1 is a block diagram showing the construction of an embodiment of an elevator system in accordance with the present invention.

FIG. 2 is a block diagram showing the construction of a main terminal.

20 FIG. 3 is a view showing the data construction of transmission information.

FIG. 4 is a block diagram showing a transmission path of information having low priority.

FIG. 5 is a block diagram showing a transmission path of
25 information having high priority.

FIG. 6 is a flowchart showing the processing in a floor terminal.

FIG. 7 is a flowchart showing the transfer destination determining processing of relay transmission in each terminal.

FIG. 8 is a flowchart showing the processing in a car terminal.

FIG. 9 is a flowchart showing the processing in a main terminal.

5 FIG. 10 is a block diagram showing the construction of another embodiment of an elevator system in which a control unit is placed in the hoistway.

FIG. 11 is a diagram showing transmission paths for various priorities.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 is a block diagram showing the construction of an embodiment of an elevator system in accordance with the present invention. A rope 37 is wound around a pulley 36 arranged to
15 a ceiling of an elevator hoistway, and an elevator car 34 and a counterweight 33 are suspended on the rope so as to counter each other in weight. That is, one end of the rope 26 is fixed to a fixing portion 38 in the ceiling, and goes downward and passes through a pullet 25 arranged in the lower side of the car
20 34 to be turned upward, and then is wound around the pulley 36. further, the rope 37 goes downward and passes through a drive pulley 30 of the counterweight 33 to be turned upward, and then the other end is again fixed to a fixing position 39 in the ceiling.

25 The elevator is driven by a rotation force of a motor 35 mounted on the counterweight 33. That is, an electric power converter 31 is controlled by a control unit 32 to supply a variable-voltage variable-frequency alternating current electric power to the motor 34. The motor 35 drives to rotate

the driving pulley 30 corresponding the alternating current electric power, and drives the counterweight 33 and the elevator car 34 through the rope wound around the sheave.

Operation of the elevator is controlled by an elevator control unit 32 managing the operation. The elevator control unit 32 is mounted on the counterweight 33, and controls the operation of the elevator under service requests by hall call buttons 141 to 14n arranged on the floors and a car call button 24 arranged in the car 34. Call information of the hall call buttons 141 to 14n and the car call button 24 is transmitted by wireless (radio wave) through wireless transmit/receive terminals 131 to 13n and 22. The transmitted call information is received by a main terminal 40 similarly mounting a wireless transmit/receive terminal 42, and the received call information is transferred to the control unit 32. The wireless transmitting/receiving unit used here is a wireless transmitting/receiving unit usable without any license or any permit. Such a wireless transmitting/receiving unit is, for example, a short distance wireless transmitting/receiving unit having a communicable range of 2.5 to 10 m, that is, using the very weak radio wave defined by the radio wave law, that is, ① a radio wave of which a frequency band is less than 322 MHz and an electric field intensity at a 3 m distant position is less than 500 $\mu\text{V/m}$, ② a radio wave of which a frequency band is within the range of 322 MHz to 10 GHz and an electric field intensity at a 3 m distant position is less than 35 $\mu\text{V/m}$, ③ a radio wave of which a frequency band is within the range of 10 GHz to 150 GHz and less than 3.5 (f $\mu\text{V/m}$) within a range of an electric field intensity at a 3 m distant position not

exceeding 500 $\mu\text{V/m}$, and ④ a radio wave of which a frequency band is within the range above 150 GHz and an electric field intensity at a 3 m distant position is less than 500 $\mu\text{V/m}$.

FIG. 2 is a block diagram showing the construction of the wireless transmitting/receiving unit 42. Although the construction of each of the wireless transmitting/receiving units 131 to 13n and 22 of the terminals is the same as that of the wireless transmitting/receiving unit 42, description will be made by taking the main terminal 40 mounted on the counterweight 33 as a typical example. The wireless transmitting/receiving unit 42 comprises both of a transmitter 421 and receiver 423, and transmitted data and received data are converted between serial/parallel data by an encoder 422 and a decoder 424, respectively, to communicate with a microcomputer 41. Switching between transmitting and receiving is performed by a control part 425, and the wireless transmitting/receiving unit 42 is normally in the receiving state and is switched to the transmitting state only when a transmitting request (transmit interruption: IRQ2) is received from the control unit 32. The microcomputer 41 accepts an interruption signal (IRQ1) informing of receiving a radio wave in addition to transmit/receive data from the wireless unit 42. The microcomputer 41 is triggered by the receive interruption signal (IRQ1) to perform appropriate processing (different from terminal to terminal) to be described later.

The main terminal 40 has control information in common with the control unit 32, and transmits and receives by wireless the following three kinds of information with the floor terminals 101 to 10n and the car terminal 20 through the wireless

unit 42 mounted on the main terminal 40.

A first kind of information is call information indicating a state of the hall call buttons 141 to 14n and the car call button 24 (which button is pushed), and a second kind of information is information commanding turning-on a lamp of each of the hall call buttons 141 to 14n or the car call button 24. A third kind of information is car position information displayed on indicators 151 to 15n and 23 individually arranged in the floors and the car for informing of a car position. The call information is information transmitted to the main terminal from the floor terminals 101 to 10n and the car terminal 20, and the other kinds of information are information transmitted from the main terminal 40 to the floor terminals 101 to 10n and the car terminal 20. These kinds of information are transmitted by relay transmission to be described later.

The construction of the floor terminal will be described below, taking the floor terminal 101 on the first floor shown in FIG. 1 as a typical example. The construction of the floor terminals 102 to 10n installed on the other floors is the same as that of the floor terminal 101 on the first floor.

The floor terminal 101 comprises a microcomputer 111, a wireless transmitting/receiving unit 131, a floor setting device 121 and a battery 171. Further, the floor terminal 101 is constructed so as to connect to a hall call button 141 and an indicator 151 and a solar battery panel 161. The microcomputer 111 can detect a state of the hall call button 141 through an I/O port, and can turn on the lamps of the hall call button 141 and the indicator 151. Therefore, when the hall call button 141 is pushed, the floor terminal 101 transmits the

information to the main terminal 40 through the wireless transmitting/receiving unit 131. The floor terminal 101 receives the lamp turning-on command information or the car position information transmitted from the main terminal 40, and
5 turns on the lamp of the hall call button 141 or the indicator 151 according to the information.

The floor setting device 121 is for setting a floor of setting the floor terminal 101 (a floor value), and is composed of a dual inline package (DIP) switch and so on. A set floor
10 value is input to the microcomputer 111, and is used when a destination (a final destination or a transfer destination) of radio wave is judged.

Light energy of hall light 181 is converted to electric energy using the solar battery panel 161 mounted the floor
15 terminal 101, and the electric energy is used as a drive electric power source of the floor terminal 101. The battery 171 is for storing the electric power. By doing so, the electric power cable can be eliminated, and accordingly installation work of the floor terminals can be reduced together with eliminating
20 of the information transmission cables.

It may be possible that electric power is supplied to the battery 171 from an energy storing unit installed in the car 34 or the counterweight 33 when the car 34 and accordingly the counterweight 33 is stopped, and this electric power is used
25 as the driving electric power source of the floor terminal 101 not using the solar battery panel 161. In this case, since the solar battery panel 161 is unnecessary, there is an advantage to avoid the appearance of the hall from being spoiled. Therein, the energy supply to the energy storing unit mounted on the car

34 or the counterweight 33 is not particularly specified, but it is assumed that the energy storing unit is supplied with electric power from a contact or non-contact power supply unit installed on an appropriate floor.

5 Next, the car terminal 20 will be described below. The car terminal 20 also comprises a microcomputer 21 and a wireless transmitting/receiving unit 22, and an indicator 23 and the car call button 24 are connected to the car terminal 20. The car terminal 20 detects information of the car call button 24, and
10 transmits radio wave to the main terminal 40 through the wireless transmitting/receiving unit 22. The car terminal 20 also receives lamp turning-on command information or car position information transmitted from the main terminal 40, and perform turning on the lamp of the car call button 24 or the
15 indicator 23.

 In addition to the three kinds of terminals described above, a mobile terminal 50 connected to a wireless transmitting/receiving unit 51 is added to the information transmission network composed of the terminals as a terminal.
20 In detail, the mobile terminal is formed by a personal computer or the like. Using the mobile terminal 50, it is possible to access the control unit 32 through the each of the terminal and the main terminal 40 similarly to the each of the terminal, and to have the control information and general information
25 (service information in common with the control unit 32. By doing so, a person in charge of maintenance can be perform maintenance work without going to the machine room. In the case where the mobile terminal 50 is added to the information transmission network as one terminal, it is preferable that an

identification code is given to the mobile terminal 50 and the main terminal 40 in advance, and the mobile terminal is permitted to be integrated into the information transmission network only when the identification code agrees with each other.

5 A position where the mobile terminal 50 exists (on a floor or in the car) is input to the mobile terminal 50 as a position code in order to specify a position of the mobile terminal 50, and is transmitted and set together with the identification code to the main terminal 40 (the control unit 32). The transmission
10 of radio wave to the mobile terminal 50 is sent to a terminal (the floor terminal or the car terminal) which is set to the mobile terminal.

The relay transmission using the wireless communication (short distance wireless) will be described below.

15 The relay transmission makes it possible to communicate between wireless stations (sending side and receiving side) using the short distance wireless even if the distance between the wireless stations is distant above the communicable range. That is, by relaying the other wireless stations within the
20 communicable range seeing from the sending side, it makes possible to communicate with a wireless station outside the communicable range. The present embodiment employs the short distance wireless having a communicable range of nearly 2-floor distance (for example, from the first floor to the third floor).
25 By employing the relay transmission method, the short distance wireless transmitting/receiving units of a small capacity can be used even if the communicable range is as narrow as a 2-floor range.

FIG. 3 shows the data construction of a

transmitting/receiving signal. In order to efficiently perform the relay transmission, the radio wave is sent in a form of adding the final destination 302 to be the final receiving side and the transfer destination 301 to be the relay station in addition to the data 304 to be transmitted. In the terminal assigned as the relay station, the transfer destination 301 is changed to a name of a terminal to be the next relay station. The priority 303 is an additional information to specify a priority of the data to be transmitted, and is set a priority (high/low level) for each information to be transmitted. That is, ① the priority of call information from the floor terminals and the car terminal to the main terminal is set to the high level, and ② the priority of the car position information and the lamp turning-on command information from the main terminal to the floor terminals and the car terminal is set to the low level. By switching of the relay transmission path to be described below using the priority 303, information to be hurried is given priority in transmission to make the transmission speedy. The priority levels may be classified into three or more levels. In the transfer destination, the transmitted data 304 may be added to the information from the initial sending station if the transfer destination has any information to be transmitted to the same final destination.

FIG. 4 shows a transmission path (a low speed transmission path) of information having the low priority, and the relay station (transfer destination) is assumed to be a floor terminal on the adjacent floor. The communicable range of the wireless transmitting/receiving units is larger than 2.5 m which is the minimum floor pitch of the building such as an apartment house.

The figure shows an example of transmission of the car position information, and the control unit 32 having the car position information supplies information to the car terminal 29 and all the floor terminals 101 to 106 through the wireless transmitting/receiving unit 42. The main terminal 40 transmits radio wave by taking the car position information as the transmitted data, and by setting the car terminal 20 and the floor terminals on the uppermost floor and the lowermost floor (on the sixth floor and on the first floor in the figure) as the final destinations, and further setting the floor terminal (the floor terminal 105 on the fifth floor in the figure) adjacent to the position of the counterweight 33 (the main terminal 40) as the transfer destination. The floor terminal 105 on the fifth floor receiving the radio wave sets the floor terminals 106, 104 on the sixth floor and on the fourth floor as the transfer destinations by judging from the final destinations and transmits radio wave to the floor terminals 106, 104. After that, the information is transferred by setting the adjacent floor terminals to the transfer destination, the floor terminal 102 on the second floor transfers the information to the floor terminal 101 on the first floor, and at the same time also transfer the information to the car terminal 20.

As described above, when the final destination is the car terminal 20 or the main terminal 40, the floor terminal understands a position of the car 34 or the counterweight 33 from the car position information to determine a transfer destination adjacent to these mobile object.

FIG. 5 shows a high speed transmission path of information having high priority. In a case of a high level priority, a

terminal on a not-adjacent floor (one floor is skipped over in the present embodiment) is set to the relay station. The point due to the difference in the priority is different only in setting the transfer destination, and the transfer itself is the same as in the low speed transmission path. The figure shows an example of transmission of information on the hall call button (the priority: high level), and the final destination is the main terminal 40, and the relay station is set the floor terminal by skipping one floor. Since the transfer destination is always set by understanding positions of the car terminal 34 and the counterweight 33 similarly to the above, in the floor terminal 103 on the third floor, the transfer destination is set not to the floor terminal 101 on the first floor but to the floor terminal 102 on the second floor, and the information is transferred from the floor terminal 102 on the second floor to the car terminal 20.

When the sending side and the receiving side exist within the directly communicable range, the radio wave communication is performed between the sending side and the receiving side not though any relay station. For example, in a case where the car terminal 20 and the main terminal 40 are close to each other, or in a case where a floor terminal and the main terminal are close to each other, radio wave exchange is performed between the terminals close to each other.

FIG. 6 shows the processing in the microcomputer in the floor terminal, and the processing is common in the floor terminals on all the floors. Description will be made below, taking the floor terminal 101 on the first floor as a typical example. Two kinds of interruption signals are input to the

microcomputer 111 in the floor terminal 101 from the hall call button 141 and the wireless transmitting/receiving unit 131. One is an interruption signal (IRQ1) generated by pushing the hall call button 141, and the other is an interruption signal
5 (IRQ2) generated when the wireless transmitting/receiving unit 131 receives radio wave. The microcomputer 111 executes the following processing to the two interruption signals.

Initially, in Step 601, the kind of the input interruption signal is judged. If the judged result is that the input
10 interruption signal is the hall call button interruption signal (IRQ1), the processing proceeds to Step 602. If the judged result is that the input interruption signal is the signal receive interruption signal (IRQ2), the processing proceeds to Step 605 to execute processing.

15 The case of the hall call button interruption signal (IRQ1) will be firstly described. In Step 602, it is detected which button among the hall call buttons 141 is pushed. This information directly becomes transmission data having the high level priority (hall call button information). Then, in Steps
20 603, 604, a final destination and a transfer destination are set. The final destination is the main terminal 40, but the transfer destination is determined in transfer destination setting processing to be described later because it is necessary to take the position of the main terminal 40 into consideration.
25 After completion of setting the final destination and the transfer destination, the processing is completed by sending radio wave from the wireless transmitting/receiving unit 131.

The case of the signal receive interruption signal (IRQ2) will be described below. In Steps 605 and 606, the destinations

(the final destination, the transfer destination) of the received radio wave is checked. The checking of the destinations is performed by comparing with a floor value set in a floor setting device 121 to judge whether or not the destinations
5 accord with the floor value. In Step 605, it is judged whether or not transfer of the received information is necessary (transfer of the received information is necessary when the transfer destination accords with the floor value). For example, if the transfer destination does not accord with the floor value,
10 it is judged that the received radio wave has no relation, and the processing is completed. On the other hand, if the transfer destination accords with the floor value, the processing proceeds to Step 606, it is judged whether or not the final destination accords with the floor value. If the final
15 destination does not accord with the floor value, transfer processing of the received radio wave is performed in Step 607 and the following steps. In Step 607, it is judged whether or not the received radio wave is car position information. If the received radio wave is car position information, the lamp of
20 the indicator 151 is turned on through an I/O port of the microcomputer 111 using the information under transferring (Step 608). Then, transfer processing of the received radio wave is performed in Step 609. In the transfer processing in Step 609, since the transfer destination needs to be determined
25 depending on the final destination and the priority of the transferred information, the transfer destination is determined in transfer destination setting processing (to be described later) and then radio wave is transmitted from the wireless transmitting/receiving unit 131.

If the final destination accords with the floor value, the processing proceeds to Step 610 to analyze the contents of the transferred information and execute the corresponding processing. If the transferred information is lamp turning-on
5 information, the lamp of the hall call button 141 is turned on in Step 611. If the transferred information is car position information, the lamp of the indicator 151 is turned on in Step 612. If it is judged in the processed contents of Step 610 that the information is other than the above-mentioned kinds of
10 information, it is judged that the transmitted radio wave is information to the mobile terminal 50 described above and the floor terminal directly ends the processing.

In the case of communication from the main terminal 40 to the mobile terminal 50, since the radio wave is transmitted
15 to a terminal (here, the floor terminal) of the set position code (a floor or the car placing the mobile terminal 50 is specified), the floor terminal completes the processing neglecting the transmitted information.

FIG. 7 is a flowchart showing the transfer destination
20 setting processing. Initially, the car position information is acquired in Step 701 in order to understand the position of the car terminal 20 (including the main terminal 40). In Step 702, the final destination is judged. If the final destination is the car terminal, the processing proceeds to Step 703. If the
25 final destination is the main terminal, the processing proceeds to Step 713. If the final destination is a specified floor terminal, the processing proceeds to Step 715.

Initially, the case where the final destination is the car terminal will be described. In Step 703, it is judged (from

the floor value set by the floor setting device 121) where the car 34 having the car terminal 20 installed is located with respect to the floor terminals (including the main terminal 40). Therein, the judged results are expressed as three kinds of on
5 an upper level/on the same floor level/on a lower level. For example, if the car terminal 20 is on the same level, the radio wave is sent to the car terminal 20 (Step 715) without setting any transfer destination (Step 704) because the car terminal 20 is in a distance which the radio wave can directly reach.
10 If the car terminal 20 is on an upper floor level, the processing proceeds to Step 705 to check the priority of the information in order to determine a transfer destination. If the priority is low, the transfer destination is set to the floor terminal on the +1 floor (Step 706). On the other hand, if the priority
15 is high, the transfer destination is set to the floor terminal on the +2 floor (Step 708). Then, the radio wave is transmitted in Step 715. Therein, the transfer destination may exceed the final destination when the transfer destination is set by the +2 floor. Therefore, a floor difference with respect to the
20 final destination is checked in Step 707, and the floor terminal on the +2 floor is set only when the floor difference is above two floors. On the other hand, if the car terminal 20 is on a lower floor level, the processing proceeds to Step 709 to similarly check the priority of the transmitted information.
25 However, different from the above, if the priority is low, the transfer destination is set to the floor terminal on the -1 floor in Step 710. If the priority is high, the transfer destination is set to the floor terminal on the -2 floor in Step 712. Then, the radio wave is transmitted (Step 715). In this case, the floor

difference is similarly checked in Step 711 to determine an appropriate transfer destination.

Further, in Step 702, if the final destination is the main terminal, a position of the main terminal is estimated in Step 713. The main terminal 40 placed in the counterweight 33 is moved upward and downward similarly to the car 34. Therefore, the position of the counterweight 33 (the main terminal 40) is estimated from the car position information to determine a terminal on the adjacent floor. In Step 714, it is judged where the position of the main terminal 40 is located with respect to the floor terminals (including the car terminal 20). The judged results are expressed as three kinds of on an upper level/on the same floor level/on a lower level. The setting of the transfer destination after that is similar to the above.

In Step 702, if the final destination is the floor terminal on a specified floor, the processing proceeds to Step 715 to judge (only the vertical direction) where the floor terminal on the specified floor is located with respect to the floor terminals (including the car terminal 20). The setting of the transfer destination after that is similar to the above. The floor terminal on the specified floor includes the mobile terminal 50.

FIG. 8 is a flowchart showing the processing in the microcomputer 21 in the car terminal 20. Two kinds of interruption signals are input to the microcomputer 21 in the car terminal 20 from the car call button 24 and the wireless transmitting/receiving unit 22. One is an interruption signal (IRQ1) generated by pushing the car call button 24, and the other is an interruption signal (IRQ2) generated when the wireless

transmitting/receiving unit 22 receives radio wave. The microcomputer 21 executes the following processing to the two interruption signals.

In Step 801, the kind of the input interruption signal is judged. If the judged result is that the input interruption signal is the destination button interruption signal (IRQ1), the processing proceeds to Step 802. If the judged result is the input interruption signal is the signal receive interruption signal (IRQ2), the processing proceeds to Step 805 to execute processing.

The case of the destination button interruption signal (IRQ1) will be firstly described. In Step 802, it is detected which button among the car call buttons 24 is pushed. This information directly becomes transmission data having the high level priority (car call button information). Then, in Steps 803, 804, a final destination and a transfer destination are set. The final destination is the main terminal 40, and the transfer destination is determined in the above-mentioned transfer destination setting processing by taking the position of the main terminal 40 into consideration. After completion of setting the final destination and the transfer destination, radio wave is sent from the wireless transmitting/receiving unit 22.

The case of the signal receive interruption signal (IRQ2) will be described below. In Steps 805 and 806, the destinations (the final destination, the transfer destination) of the received radio wave is checked. In the present embodiment, the transfer processing in the relay transmission is not performed in the car terminal 20, which is different from the floor

terminal described above. Therefore, if the destination is not accord with the car terminal, the processing is directly completed. In this case, the judgment step of "TRANSFER DESTINATION?" in Step 805 can be eliminated. However, supposing
5 that the car terminal erroneously receives (picks up) a signal unnecessary to receive of "radio wave of which the transfer destination is the other terminal and the final destination is the car terminal itself", the judgment step in Step 805 in the present embodiment has the role of excluding such a pick-up
10 radio wave.

If the transfer destination and the final destination accord with the car terminal, the processing proceeds to Step 807 to analyze the contents of the transferred information and execute the corresponding processing. If the transferred
15 information is lamp turning-on information, the lamp of the car call button 24 is turned on in Step 808. If the transferred information is car position information, the lamp of the indicator 23 is turned on in Step 809. If it is judged in the processed contents of Step 807 that the information is other
20 than the above-mentioned kinds of information, it is judged that the transmitted radio wave is information to the mobile terminal 50 described above. In this case, the mobile terminal is in the car 34, and the radio wave is transmitted to the car terminal as the final destination. Therefore, the car terminal 20
25 directly ends the processing by neglecting the information.

FIG. 9 is a flowchart showing the processing in the main terminal 40. Two kinds of interruption signals are input to the microcomputer 41 in the main terminal 40 from the control unit 32 and the wireless transmitting/receiving unit 42. One is an

interruption signal (IRQ1) in regard to a request of transmitting radio wave from the control unit 32, and the other is an interruption signal (IRQ2) generated when the wireless transmitting/receiving unit 42 receives radio wave. The
5 microcomputer 41 executes the following processing with the two interruption signals as the trigger.

In Step 901, the kind of the input interruption signal is judged. If the judged result is that the input interruption signal is the transmission request interruption signal (IRQ1),
10 the processing proceeds to Step 902. If the judged result is that the input interruption signal is the signal receive interruption signal (IRQ2), the processing proceeds to Step 910 to execute processing. Initially, the case of the transmission request interruption (IRQ1) will be described. In Step 903, the
15 contents of the transmitted signal is judged. If the transmitted information is car position information, the processing proceeds to Step 903. If the transmitted information is lamp turning-on information, the processing proceeds to Step 906. The case of the car position information will be described. The
20 car position information is set to the transmitted data in Step 903, and then the final destination is set in Step 904. The car position information needs to be sent to the floor terminals on all the floors and the car terminal, and the final destinations are set to the car terminal 20 and the floor
25 terminals on the uppermost floor and on the lowermost floor, and then is transmitted to the three final destinations in Step 905. The transfer destinations at transmitting the car position information are determined through the transfer destination setting processing described above.

Description will be made below on the case where it is judged in Step 902 that the transmitted information is lamp turning-on information. The lamp turning-on information is set to the transmitted information in Step 906, and then the final destination is set in Step 907. The final destination is the car terminal 20 or a floor terminal on a specified floor of which the lamp is to be turned on. After that, the transfer destination is determined in Step 905, and the radio wave is transmitted. If it is judged that the information is other than the above-mentioned kinds of information, it is judged that the transmitted radio wave is information to the mobile terminal 50 described above and the processing proceeds to Step 908. In Step 908, the information is set to the transmitted data (the priority: low level) and the final destination is set in Step 909. Since the communication to the mobile terminal 50 is transmitted the radio wave to a floor or the car placing the mobile terminal 50, the final destination is set based on the set position code (the place where the mobile terminal 50 exists is specified). Then, in Step 905, the transfer destination is determined and the radio wave is transmitted.

The case of the signal receive interruption signal (IRQ2) will be described below. In Steps 910 and 911, the destinations (the final destination, the transfer destination) of the received radio wave is checked. In the present embodiment, the transfer processing in the relay transmission is not performed in the main terminal 40. Therefore, if the destination is not accord with the main terminal, the processing is directly completed. If the transfer destination and the final destination accord with the main terminal, the processing

proceeds to Step 912 to analyze the contents of the transferred information and execute the corresponding processing. For example, if the received information is car call (destination) button information or information on hall call button, the data
5 is transferred to the control unit 32 in Step 913. If it is judged in Step 912 that the information is information from an external unit, the identification code included in the information is checked in Step 914. Since the mobile terminal 50 and the control unit 32 have the same identification code in advance, the
10 information is transferred to the control unit 32 only when the identification codes agree with each other. If the identification codes do not agree with each other, it is judged that the information is a radio wave from a unit other than the present elevator system, the processing is completed.

15 In the above description, each of the terminals mounted on the car and the counterweight does not have the transfer function to the other terminals, that is, the relay station function. However, if the terminals mounted on the car and the counterweight during moving are used as the relay stations, this
20 can be performed by make the completely same processing as that described in the other floor terminals under judgment of the existing position of the car and the counterweight at present.

FIG. 10 shows another embodiment of an elevator system in which the drive pulley 30 and the motor 35 for rotating the
25 drive pulley are installed in a pit of the hoistway. An electric power converter 31 for supplying electric power to the motor 35 and a control unit 32 for covering control of the electric power converter 31 and control of the elevator are also installed in the wall of the hoistway near the pit. Therein,

the main terminal 40 is placed in the wall of the hoistway integrated with or separately from the control unit 32. The main terminal 40 comprises the microcomputer 41 and the wireless transmitting/receiving unit 42, and performs the control and
5 the processing in the completely same manner as those in the above-mentioned embodiment. The counterweight 33 may mount the relay station terminal. In an elevator in which the drive pulley 30, the motor 35, the electric power converter 31 and the control unit 32 are arranged in a machine room outside the hoistway on
10 the rooftop of the building, the main terminal 40 may be placed in the machine room or the ceiling portion of the hoistway if the main terminal 40 has the antenna directing toward the inside of the hoistway.

The floor terminals are not limited to installing
15 corresponding to individual floors, but one terminal may be installed for 20 to 3 floors to cover transmitting and receiving of information for the several floors. Further, communication between the floor terminals and the main terminal may be performed using a LAN which has been used. One or more relay-only
20 transmitting/receiving units may be arranged in the hoistway between the elevator control unit fixed or movable and the car.

FIG. 11 shows another embodiment in which transmission path is changed depending on the priority. In this embodiment, the priority is classified into three levels (low/middle/high).
25 Firstly, the case of transmission path in the low level priority will be described. The terminal on the first floor initially sends radio waves A, B having the same information to the floor terminals on the second floor and the third floor capable of receiving the radio waves. The terminal on the second floor

sends receiving the radio wave A the radio wave C having the same information to the terminal on the fourth floor skipping one floor. On the other hand, the terminal on the third floor receiving the radio wave B sends the radio wave D having the same information to the terminal on the fourth floor. Therein, in the terminal on the fourth floor receiving the radio waves C and D through the different two paths, the received data contents of the radio waves C and D are compared to check whether or not there is any error. The above is set as one cycle, and after that, the information is transmitted by repeating the cycle.

In the case of transmission path in the middle level priority, the terminal on the first floor initially sends radio waves A, B to the floor terminals on the second floor and the third floor. Then, the terminal on the second floor sends receiving the radio wave A the radio wave C having the same information to the terminal on the third floor. Therein, in the terminal on the third floor receiving the radio waves B and C transmitted through the two paths, the received data contents are compared to check whether or not there is any error. The above is set as one cycle, and after that, the information is transmitted by repeating the cycle. Similarly, in the case of transmission path in the high level priority, the received data contents are compared with the cycle as shown in the figure. The difference among the three transmission paths is in frequency of the checking work of the received data contents. By performing the switching of the transmission path depending on the priority, the reliability of the information transmission can be improved.

In addition to the embodiments of the present invention described in the section of What is claimed is, there are the following embodiments.

11. The elevator system according to any one of claims 1 and
5 2, wherein transmitting/receiving of a signal is performed between two terminals distant from each other by being relayed through the wireless transmitting/receiving unit of a terminal on the adjacent floor.

12. The elevator system according to any one of claims 1 and
10 2, wherein transmitting/receiving of a signal is performed between two terminals distant from each other by being relayed through the wireless transmitting/receiving unit of a terminal on the next adjacent floor.

13. The elevator system according to any one of claims 1 and
15 2, wherein transmitting/receiving of a first signal is performed between two terminals distant from each other by being relayed through the wireless transmitting/receiving unit of a terminal on the adjacent floor, and transmitting/receiving of a second signal is performed between two terminals distant from
20 each other by being relayed through the wireless transmitting/receiving unit of a terminal on the next adjacent floor.

14. The elevator system according to the embodiment 13 described above, wherein the terminal comprises a means for
25 comparing the information received from the wireless transmitting/receiving unit of the terminal on the adjacent floor with the information received from the wireless transmitting/receiving unit of the terminal on the floor skipping by one floor.

15. The elevator system according to any one of claims 1 to 7, wherein the terminal comprises a solar battery panel and a battery.

16. The elevator system according to claim 4, wherein the counterweight mounts the control unit to which the hall call button signal and the car call button signal are input.

17. The elevator system according to any one of claims 1 to 10 and the embodiment items 11 to 16, wherein the wireless transmitting/receiving unit has the transmission capacity of a communicable distance within a range longer than 2.5 m and shorter than 10 m.

The elevator system according to any one of claims 1 to 10 and the embodiment items 11 to 16, wherein the wireless transmitting/receiving unit transmits radio wave a radio wave of which a frequency band is less than 322 MHz and an electric field intensity at a 3 m distant position is less than $500 \mu\text{V/m}$, of which a frequency band is within the range of 322 MHz to 10 GHz and an electric field intensity at a 3 m distant position is less than $35 \mu\text{V/m}$, of which a frequency band is within the range of 10 GHz to 150 GHz and less than $3.5 (f \mu\text{V/m})$ within a range of an electric field intensity at a 3 m distant position not exceeding $500 \mu\text{V/m}$, and of which a frequency band is within the range above 150 GHz and an electric field intensity at a 3 m distant position is less than $500 \mu\text{V/m}$.

According to the present invention, it is possible is to provide an elevator system in which information such as an elevator call button signal can be transmitted between the elevator control unit and the car or each of floors using

wireless transmitting/receiving units having a comparatively narrow communicable range, and which can save the elevator information transmission cables and the installing work.

What is Claimed is;

1. An elevator system in which a car travels upward and downward among a plurality of floors, which comprises:

an elevator control unit; and

5 terminals each having a wireless transmitting/receiving unit, said terminals being correspondently provided for each of said floors, wherein

transmitting/receiving of signals between two of said terminals distant from each other is performed by relaying the
10 signals through the wireless transmitting/receiving unit of the other of said terminals.

2. An elevator system in which a car travels upward and downward among a plurality of floors, which comprises

terminals each having a wireless transmitting/receiving
15 unit, said terminals being correspondently provided for each of said floors and for said car and/or for a counterweight, wherein

transmitting/receiving of signals between two of said terminals distant from each other is performed by relaying the
20 signals through the wireless transmitting/receiving unit of the other of said terminals.

3. An elevator system in which a car travels upward and downward among a plurality of floors, which comprises

terminals each having a wireless transmitting/receiving
25 unit, said terminals being correspondently provided for said car and for a counterweight and for each of said floors, wherein

transmitting/receiving of signals between said terminals of said car and said counterweight is performed by relaying the signals through the wireless transmitting/receiving unit of

said terminal on said floor.

4. An elevator system in which a car travels upward and downward among a plurality of floors, which comprises

terminals each having a wireless transmitting/receiving unit, said terminals being individually provided for said car and for a counterweight and for a hoistway, wherein

transmitting/receiving of signals between two of said terminals is performed by relaying the signals through the wireless transmitting/receiving unit of the other of said terminals.

5. An elevator system in which a car travels upward and downward among a plurality of floors, which comprises:

terminals each having a wireless transmitting/receiving unit, said terminals being provided one for said plurality of floors, one for said car and/or one for a counterweight; and

a transmission network for transmitting information between said terminals proximate enough to be capable of transmitting/receiving signals.

6. An elevator system in which a car travels upward and downward among a plurality of floors, which comprises

terminals each having a wireless transmitting/receiving unit, said terminals being correspondently provided one for each group of said one to several floors, one for said car and one for an elevator control unit in a hoistway, wherein

transmitting/sending of signals between said terminals is performed directly and/or by relaying the signals through the other of said terminals.

7. An elevator system in which a car travels upward and downward among a plurality of floors, which comprises:

terminals each having a wireless transmitting/receiving unit, said terminals being correspondently provided one for each group of said one to several floors, one for said car and/or one for a counterweight; and

5 a mobile terminal which is capable of wirelessly transmitting/receiving signals to/from said terminal within an appropriate distance.

8. An elevator system comprising a hole call button arranged in each floor; a car call button arranged in a car; and a control
10 unit for moving the elevator car among a plurality of floors corresponding to operation of the call buttons, which comprises:

 wireless transmitting units each for transmitting a signal of said hall call button from a landing entrance side
15 into an elevator hoistway;

 a wireless transmitting unit for transmitting a signal of said car call button from the car into said hoistway; and

 a wireless receiving unit for receiving the signal from each of said transmitting units and transmitting the signal to
20 said control unit directly or by relaying the signal through another transmitting/receiving unit, said wireless receiving unit being arranged inside said hoistway.

9. An elevator system comprising a hole call button arranged in each floor; a car call button arranged in a car; and a control
25 unit for moving the elevator car among a plurality of floors corresponding to operation of the call buttons, which comprises:

 wireless transmitting/receiving units each for transmitting a signal of said hall call button from a landing

entrance side into an elevator hoistway;

a wireless transmitting/receiving unit for transmitting a signal of said car call button from the car into said hoistway; and

5 a wireless transmitting/receiving unit for receiving the signal from each of said transmitting units and transmitting the signal to said control unit and for transmitting a lamp turning-on command signal to a response lamp of each of said call buttons from said control unit into said hoistway, said
10 wireless transmitting/receiving unit being arranged inside said hoistway.

10. An elevator system comprising a hole call button arranged in each floor; a car call button arranged in a car; and a control unit for moving the elevator car among a plurality of floors
15 corresponding to operation of the call buttons, which comprises:

a wireless transmitting unit for transmitting a signal of said car call button from the car into said hoistway;

a wireless transmitting/receiving unit for relaying and
20 re-transmitting the car call signal from said transmitting unit, said wireless transmitting/receiving unit being arranged inside said hoistway; and

a wireless receiving unit for receiving the car call signal from said wireless transmitting unit of the car or from
25 said wireless transmitting/receiving unit in said hoistway and for transmitting the car call signal to said control unit, said wireless receiving unit being arranged inside said hoistway.