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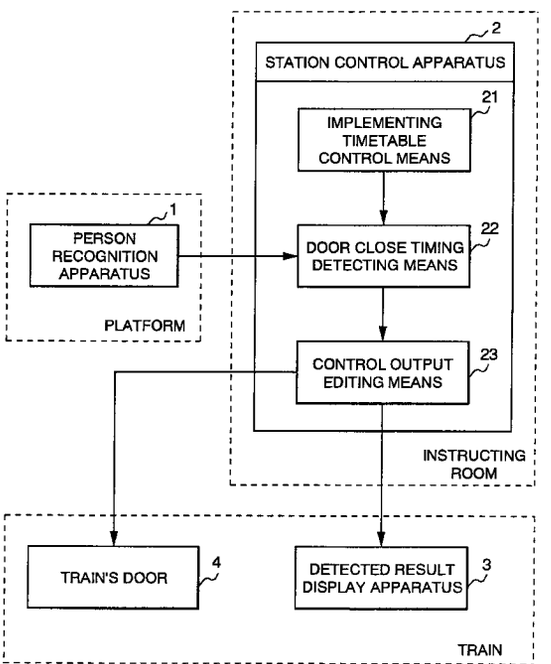
(54) Automatic open/close operation system for train door

(57) An automatic train door open/close system includes a person recognition apparatus 1 for recognising the presence of person near the train door 4, implementing timetable control means 21 for controlling the operation of the train based on a train timetable, means 22 for detecting a timing for closing the door based on the person recognition apparatus at the departure of the train, a control output editing means 23 for outputting open/close control signals to the train door by editing control information on the door close operation, and a detected result display apparatus 3 for indicating whether or not the timing for closing the door is detected. When a timing for closing the cannot be detected by any reason, such as crowded passengers or the like, this condition is informed to the train operator, and a manual door close operation is proposed after confirming the condition near the door. Safety of the passengers is thus ensured.

FIG. 1



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Description

Background of the Invention

The present invention relates to an automatic open/close operation system of train's door, and particularly, to an automatic open/close operation system of the train's door which is preferable for reducing burden of a motorman of one-man operating train.

Conventionally, a motorman of one-man operating train operated a system to close the train's door with confirming no-presence of passenger near the door, who was intending to get on or off the train, by watching a monitor, after such conditions were satisfied that departure time in the train timetable of the train staying at a platform has reached, and that a pre-determined time had been elapsed since said train arrived at the platform, as disclosed, for instance, in JP-A-8-58587 (1996).

Japanese laying-open patent pubulication Hei 4-15159 (JP-A-4-15159 (1992)) has proposed a system wherein a door closing operation of individual door is instructed after confirming completion of the passenger's getting on and off by an output signal from a getting on and off sensor provided near the door, with an assumption that the train has a conductor.

However, in accordance with the above first system, the motorman during operating the one-man train has to watch the monitor continuously for no-presence of the passenger near the door, who is intending to getting on or off the train, and to determine an adequate timing capable of closing the door. Therefore, the motorman has been burdened significantly.

In accordance with the above second system, notwithstanding the assumption that the train has a conductor, the primary door close operation must be performed by any of the motorman or the conductor even if the system is applied to either of the one-man operating train and a case when the train has the conductor. Therefore, decreasing the burden of the motorman and the conductor was limited.

Summary of the Invention

The object of the present invention is to provide an automatic open/close operation system of train's door, which is practically capable of decreasing the burden of the motorman by detecting automatically a timing capable of closing the train's door and performing automatically a closing operation of the train's door, especially, for one-man operating trains.

In order to achieve the above object, the present invention proposes an automatic open/close operation system of train's door comprising a person recognition apparatus for recognizing the presence of person, who is intending to get on or off from the train, near the train's door, implementing train timetable control means for controlling operation of the train based on the train timetable information, door close timing detecting means for detecting a timing capable of door close operation based on information from said person recognition apparatus at departure of the train, control output editing means for at least editing control information on the door close operation and outputting an open/close operation control signal to the train's door, and a detected result display apparatus for displaying whether the timing capable of the door close operation has been detected or not.

The implementing train timetable control means is a means for detecting conditions that a departure time in the implementing train timetable of the train staying at platform has reached, and that a pre-determined time has been elapsed since said train has arrived at the platform.

The control output editing means is a means for editing information from said door close timing detecting means, and outputting a control signal of the open/close operation of the train's door based on said information.

In any cases, the control output editing means can be a means for outputting a signal to display impossibility to detect a door close timing and a proposal to close the door manually by the train's motorman to the detected result display apparatus, when the control output editing means can not detect a timing capable of closing the door even if the departure time of the train has been past and a pre-determined time has been elapsed since the train arrived at the platform, because of the presence of person near the train's door, who is intending to get on or off the train.

The control output editing means can output a signal to close the door by half to said train's door during detecting the timing capable of closing the door.

In accordance with the present invention, the person recognition apparatus is installed at the platform near the train's door, and outputs information on the presence of person near the train's door to the door close timing detecting means. The implementing train timetable control means detects information whether the departure time of the train in the implementing train timetable has reached and a predetermined time has been elapsed since the train has arrived at the platform, and outputs the information to the door close timing detecting means. The door close timing detecting means analyses the information on the presence of person near the train's door from the person recognition apparatus after receiving information on the capability of the train departure from the implementing train timetable control means. In a case when a timing of the absence of person is detected, the train's door is closed automatically. On the contrary, when a timing of the absence of person can not be detected even if the predetermined time has been elapsed, the train's door can be closed by half in order to warn of the closing door to passengers. When a predetermined re-try number is exceeded after repeating the warning several times, information on impossibility of automatic detection is

output to the detected result display apparatus. Therefore, only in the case, for example, when the passengers are crowded, a manual door closing operation is proposed to the motorman. Consequently, the burden of the motorman of one-man operating train can be decreased significantly with ensured safety of the passengers.

Brief description of the drawings

FIG. 1 is a block diagram indicating a system composition of an embodiment of the automatic open/close operation system of train's door relating to the present invention;

FIG. 2 is a flow chart indicating the steps of door close operation of an one-man operating train by the automatic open/close operation system of train's door indicated in FIG. 1;

FIG. 3 is an example of installing condition of the person recognition apparatus using for the automatic open/close operation system of train's door relating to the present invention;

FIG. 4 is a flow chart indicating the steps of door close operation, wherein a door half-close operation step for warning previously of closing the door to the passengers is added to the middle of the door close operation steps indicated in FIG. 2;

Detailed Explanation of the Preferred Embodiment

FIG. 1 is a block diagram indicating the composition of an embodiment of the automatic open/close operation system of train's door relating to the present invention. The automatic open/close operation system of train's door relating to the present invention is fundamentally composed of a person recognition apparatus 1, a station control apparatus 2, and a detected result display apparatus 3. The station control apparatus 2 comprises an implementing train timetable control means 21, a door close timing detecting means 22, and a control output editing means 23. The person recognition apparatus 1 is installed near the train's door, and detects the presence of person who is intending to get on or off the train by, for example, a pattern recognition. The station control apparatus 2 controls integrally information such as implementing train timetable, station facilities, and the like. The implementing train timetable control means 21 in the station control apparatus 2 detects whether the departure time in the implementing train timetable of the train at the platform has reached and a predetermined time has been elapsed since the train has arrived at the platform. The door close timing detecting means 22 detects a timing capable of closing operation of the door based on information from the person recognition apparatus 1 and the implementing train timetable control means 21. The control output editing means 23 outputs control signals based on the detected result of the door close timing detecting means 22. The detected result display apparatus 3 displays execution mode of the door close operation, that is, automatic mode/manual mode, and the like. The train's door 4 is operated to close automatically when the control output editing means 23 outputs a signal of automatic mode to the detected result display apparatus 3.

FIG. 2 is a flow chart indicating steps of door close operation in a one-man operating train by the automatic open/close operation system of train's door indicated in FIG. 1. When the train arrived at the platform, the scheduled departure time of the train is judged in the step 5. That is, whether the time has reached the scheduled departure time in the implementing timetable of the train at the platform or not is judged, and if the time has reached the scheduled departure time, the train staying time is counted in the step 6. Counting the train staying time is performed in order to ensure a minimum staying time of the train. After elapsing the minimum staying time of the train, presence of person, who is intending to get on or off the train, is judged based on output signals from the person recognition apparatus 1 in the step 7.

FIG. 3 indicates an example of installing condition of the person recognition apparatus used in the automatic open/close operation system of train's door indicated in FIG. 1. The person recognition apparatus 1 is installed between the train's door 4 and the platform door 14, and outputs consecutively information on the presence of person, who is intending to get on or off the train, to the door close timing detecting means 22 indicated in FIG. 1. The present invention is effective in a railway station, wherein only the train's door 4 is usable and the platform door 14 does not exist.

In the step 7 in FIG. 2, when information that no presence of person, who is intending to get on or off the train, at all the doors of the train is informed from the person recognition apparatus 1, a door close timing is transmitted and displayed at the detected result display apparatus 3 in the step 8 after the above condition of no-presence of person is continued during a pre-determined time, and the door close operation is performed automatically in the step 9.

On the other hand, in a case when the information of no-presence of person is not transmitted, that is, a case when persons are getting on or off the train continuously, the re-try number is counted in the step 10, and go back to the step 7 until a pre-determined re-try number is reached. If the pre-determined re-try number is exceeded by any reason such as crowded passengers in the step 10, impossibility of automatic detection of door close timing is displayed at the detected result display apparatus 3 in the step 11, and the manual door operation is proposed to the motorman of the one-man operating train in the step 12.

FIG. 4 is a flow chart indicating the steps, wherein a door half-close operation for warning previously of the door close to the passengers is added to the middle of the door close operation steps indicated in FIG. 2. After repeating the re-try several times, the train's door 4 is

closed by half in order to give the passengers near the door a warning of the closing door in the step 13, and the presence of person is judged again in the step 7. In accordance with the door half-close operation 13, getting on or off the train of the passengers near the door can be suppressed or terminated, and the operation is effective as a means to generate a condition of no-presence of person who is intending to get on or off the train in the step 7. Also in this case, a pre-determined re-try number of the half-close operation is set, the re-try number is counted in the step 10, if the pre-determined re-try number is exceeded, impossibility of automatic detection of door close timing is displayed at the detected result display apparatus 3 in the step 11, and the manual door operation is proposed to the motorman of the one-man operating train in the step 12.

In accordance with the present invention, a timing capable of closing doors at departure of one-man operating train can be detected automatically, and a door close operation can be performed automatically. As a result, a burden of the motorman of the one-man operating train can be decreased significantly. In a case when the automatic door close operation is judged to be impossible because of crowded passengers, and the like, a manual door close operation after confirming the condition of the passenger's getting on or off the train is proposed to the motorman of the one-man operating train. Therefore, safety of the passengers can be ensured sufficiently even in the rush-hour of the passengers.

Claims

1. An automatic open/close operation system for train doors comprising:

   means for recognising the presence near the train door of a person intending to get on or off the train,
   timetable implementing means for controlling the operation of the train based on the timetable information,
   means for detecting the timing for closing the door based on information from said person recognising means at the departure of the train,
   means for editing control information on the door closing operation and outputting to the train door an open/close operation control signal, and
   display means for indicating whether or not the timing for closing the door has been detected.

2. The system of claim 1, wherein said timetable implementing means includes means for determining that the departure time scheduled by the timetable of the train staying at platform has been reached, and that a pre-determined period has elapsed since the train arrived at the platform.

3. The system of claim 1 or 2, wherein said control information editing means includes means for editing information from said door close timing detecting means, and for outputting a control signal of the open/close operation based on said information.

4. The system of any one of claims 1 to 3, wherein said control information editing means includes means for outputting a signal indicating the impossibility to detect a door close timing and outputting to said display means a proposal to close the door manually by the train operator, when said control information editing means cannot detect a timing for closing the door although the departure time of the train has been reached and a predetermined period has elapsed since the train arrived at the platform, due to the presence near the train door of a person intending to get on or off the train.

5. The system of any one of claims 1 to 4, wherein said control information editing means includes means for outputting to said train door a signal to close the door by half at the detection of the timing for closing the door.

FIG. 1

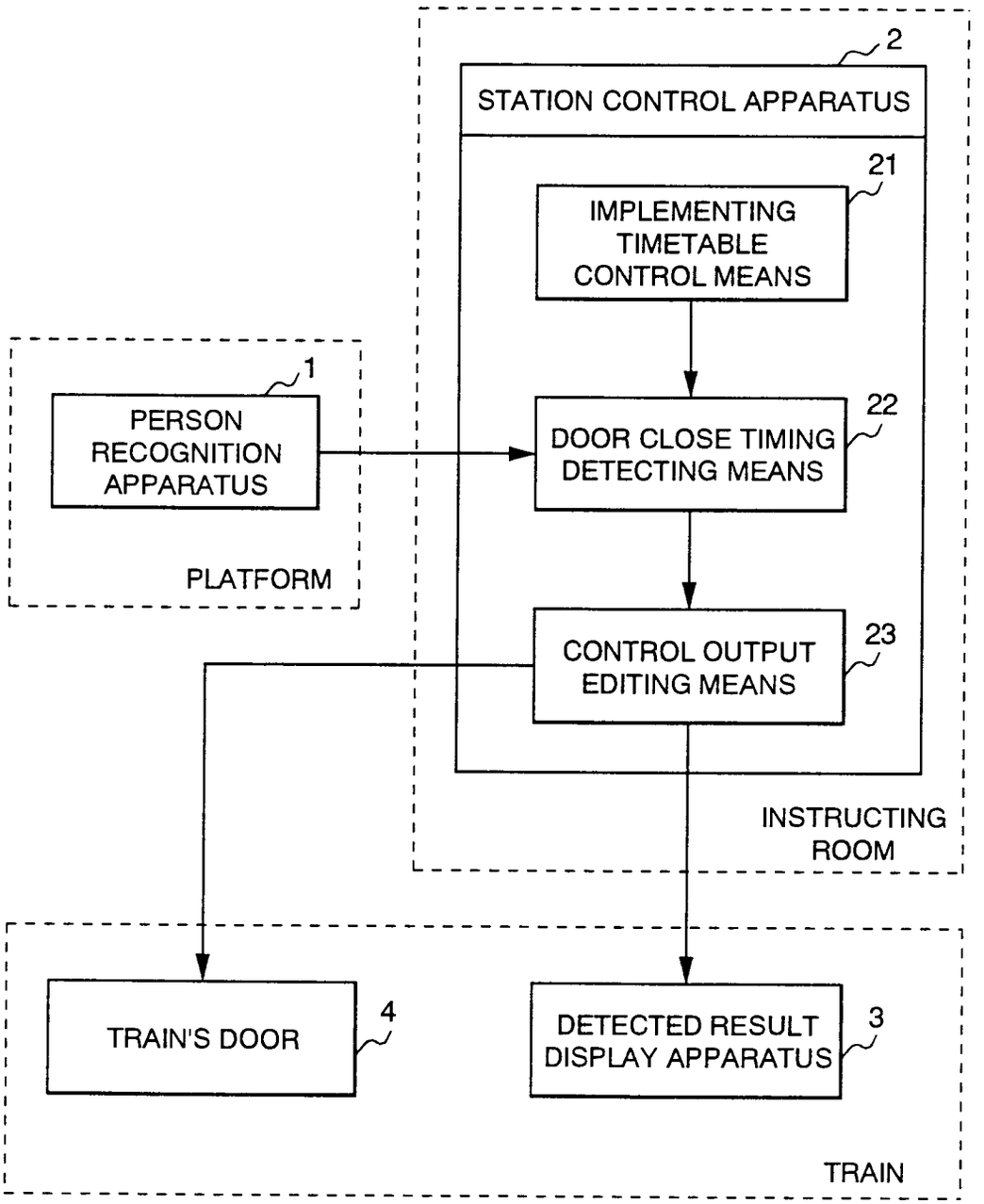

2
STATION CONTROL APPARATUS
21
IMPLEMENTING TIMETABLE CONTROL MEANS
1
PERSON RECOGNITION APPARATUS
22
DOOR CLOSE TIMING DETECTING MEANS
PLATFORM
23
CONTROL OUTPUT EDITING MEANS
INSTRUCTING ROOM
TRAIN'S DOOR
4
DETECTED RESULT DISPLAY APPARATUS
3
TRAIN

FIG. 2

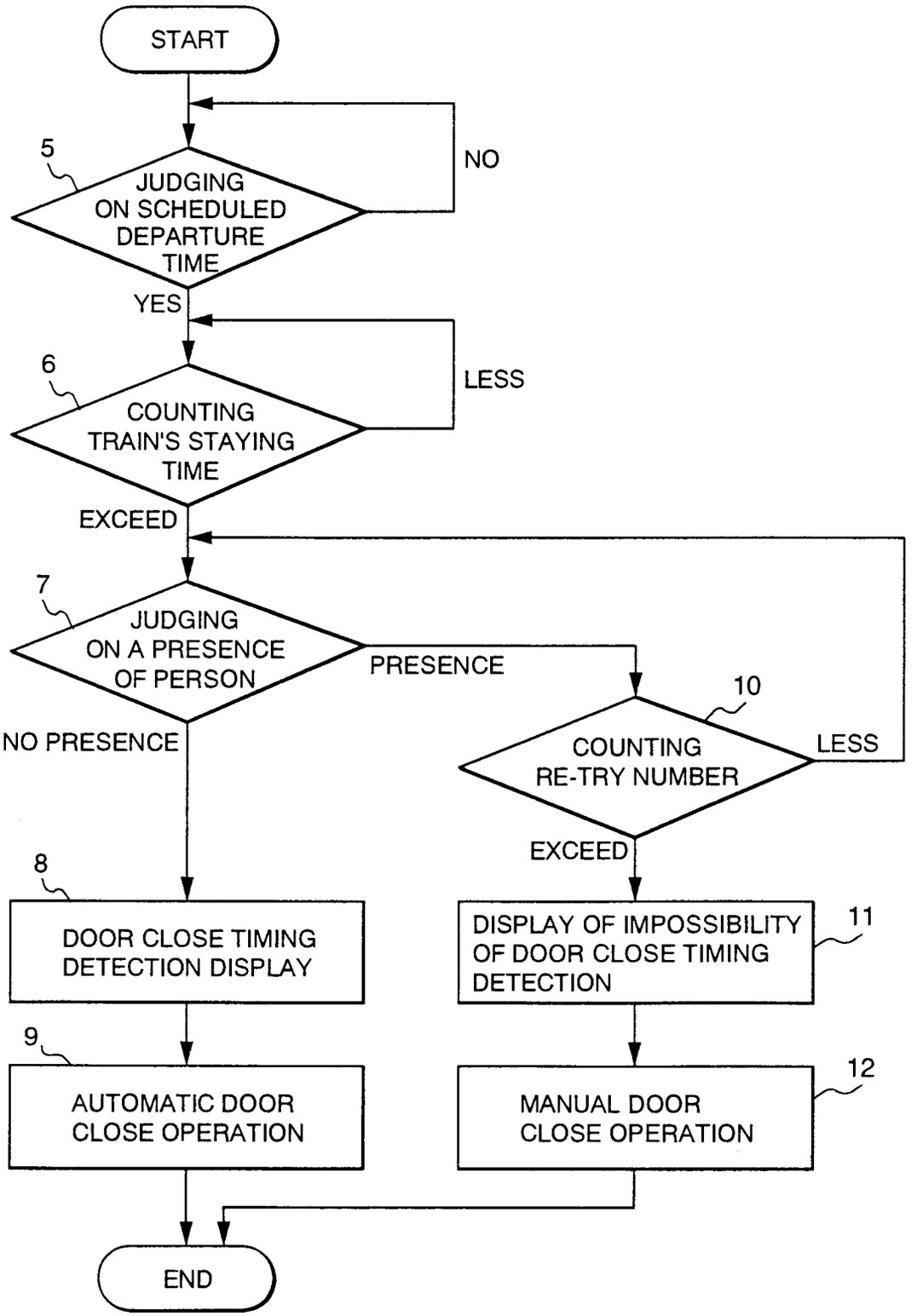

START
5
JUDGING ON SCHEDULED DEPARTURE TIME
NO
YES
6
COUNTING TRAIN'S STAYING TIME
LESS
EXCEED
7
JUDGING ON A PRESENCE OF PERSON
PRESENCE
10
COUNTING RE-TRY NUMBER
LESS
NO PRESENCE
EXCEED
8
DOOR CLOSE TIMING DETECTION DISPLAY
DISPLAY OF IMPOSSIBILITY OF DOOR CLOSE TIMING DETECTION
11
9
AUTOMATIC DOOR CLOSE OPERATION
MANUAL DOOR CLOSE OPERATION
12
END

FIG. 3

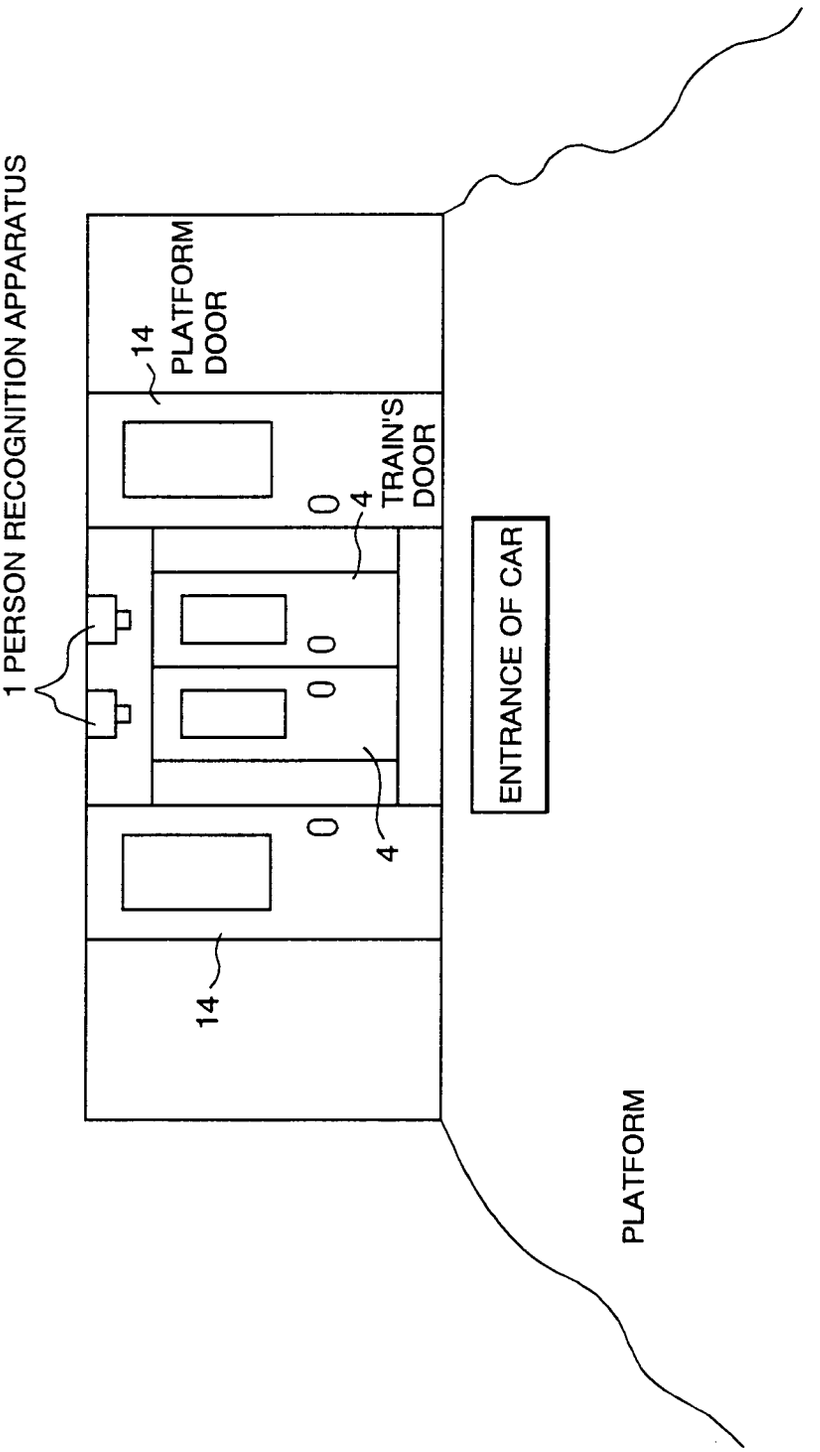
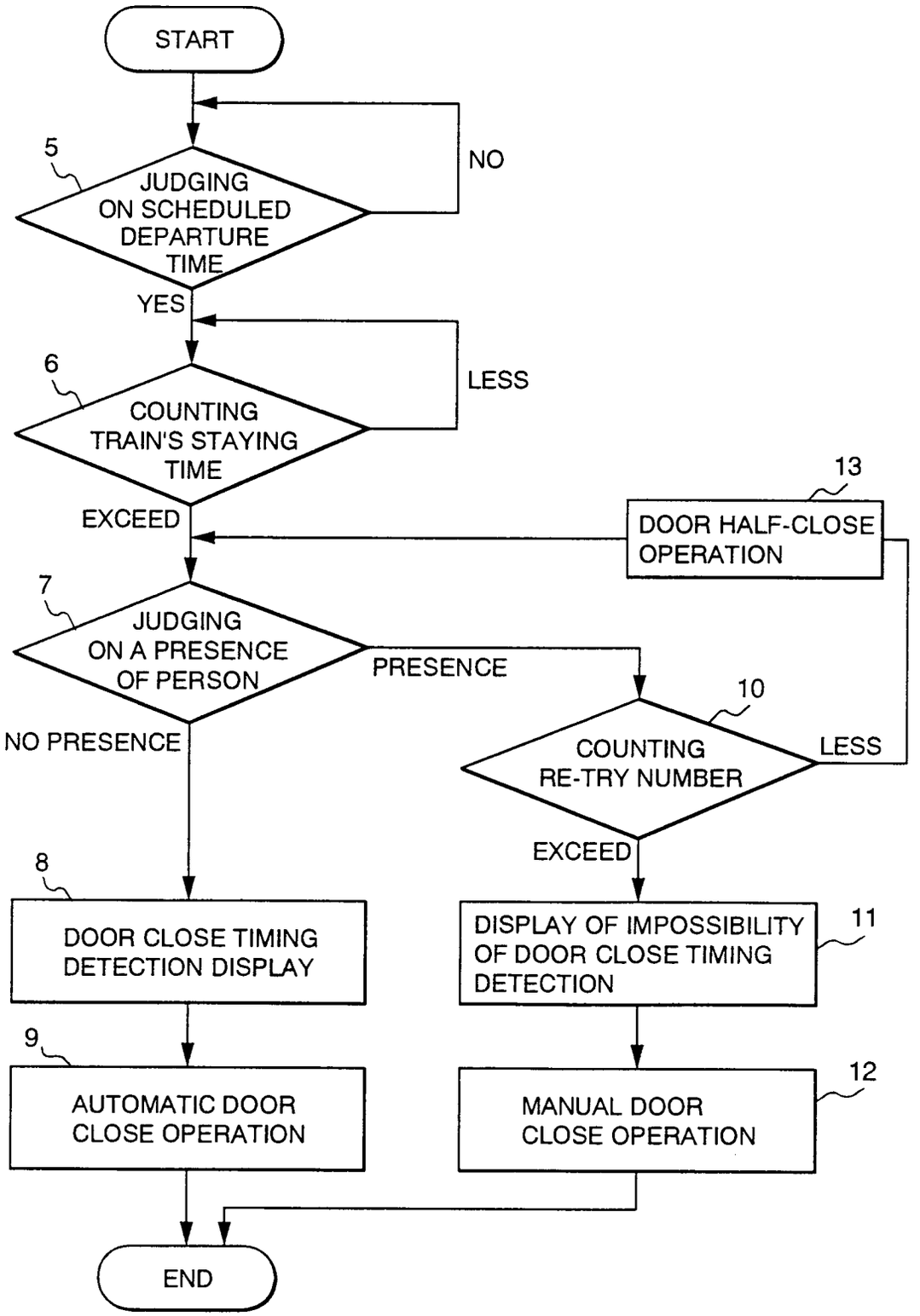

1 PERSON RECOGNITION APPARATUS
14
PLATFORM DOOR
TRAIN'S DOOR
4
4
14
ENTRANCE OF CAR
PLATFORM

FIG. 4


START
5
JUDGING ON SCHEDULED DEPARTURE TIME
NO
YES
6
COUNTING TRAIN'S STAYING TIME
LESS
EXCEED
13
DOOR HALF-CLOSE OPERATION
7
JUDGING ON A PRESENCE OF PERSON
PRESENCE
NO PRESENCE
10
COUNTING RE-TRY NUMBER
LESS
EXCEED
8
DOOR CLOSE TIMING DETECTION DISPLAY
11
DISPLAY OF IMPOSSIBILITY OF DOOR CLOSE TIMING DETECTION
9
AUTOMATIC DOOR CLOSE OPERATION
12
MANUAL DOOR CLOSE OPERATION
END