

PASSENGER CONVEYOR SYSTEM

FIELD

Embodiments described herein relate generally to a passenger conveyor system.

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BACKGROUND

Some passenger conveyors (for example, escalators, moving walkways, etc.) are designed for outdoor installation. Generally, components used in such outdoor passenger conveyors are waterproofed; however, not all components are subjected to waterproofing. For example, drive chains, coupling chains (step chains), and handrail drive chains are not subjected to waterproofing. As a result, when it rains or snows, lubricating oil applied to these chains may flow away.

15 In passenger conveyors, diagnostic operations are in some cases conducted to assess the condition of various devices (components) that make up the conveyor. To obtain accurate diagnostic results during a diagnostic operation, it is important to replicate the conditions of previous diagnostic operations (for example, conducting the diagnostic operation with no passengers on the conveyor).

20 However, in the outdoor passenger conveyors described above, moisture may enter the truss due to rain or snow, causing the lubricating oil applied to the chains described above to flow away. As a result, diagnostic operation may be performed with insufficient lubricating oil, which differ from previous diagnostic operation conditions. In such cases, accurate diagnostic results cannot be obtained.

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SUMMARY

According to one embodiment, a passenger conveyor system diagnoses a state of an outdoor passenger

conveyor. The system includes a control device and a remote monitoring device. The control device controls operation of the outdoor passenger conveyor. The remote monitoring device periodically acquires from a meteorological data server, meteorological data including at least weather information indicating weather conditions in an area where the outdoor passenger conveyor is installed. The control device includes a storage unit, a weather condition determination unit and an information processing unit. The storage unit stores time information indicating startup time of the outdoor passenger conveyor, and the meteorological data acquired by the remote monitoring device from a previous startup time of the outdoor passenger conveyor until a current startup time. The weather condition determination unit, when the startup time indicated by the time information arrives, determines whether rainfall or snowfall occurred during a period from the previous startup time to the current startup time based on the weather information contained in the stored meteorological data. The information processing unit, when the weather condition determination unit determines that no rainfall or snowfall occurred, starts the outdoor passenger conveyor and operates it in a predetermined operation mode, and diagnoses the state of the outdoor passenger conveyor.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram schematically showing an example of a configuration of a passenger conveyor system according to an embodiment.

FIG. 2 is a block diagram showing an example of a functional configuration of some elements included in

the passenger conveyor system according to the same embodiment.

FIG. 3 is a flowchart showing an example of operation of the passenger conveyor system according to the same embodiment.

DETAILED DESCRIPTION

Embodiments will now be described with reference to the accompanying drawings.

The disclosure is merely an example, and the invention is not limited to the content described in the following embodiments. Modifications that can be easily conceived by those skilled in the art are naturally included in the scope of the disclosure. For clarity, the sizes, shapes, etc., of each part in the drawings may be changed from the actual implementation and represented schematically. In multiple drawings, corresponding elements may be assigned the same reference numbers, and detailed descriptions may be omitted.

Further, the following descriptions are directed to an example case where the passenger conveyor included in the passenger conveyor system is an "outdoor escalator".

FIG. 1 is a diagram schematically showing an example of a configuration of a passenger conveyor system according to this embodiment. The passenger conveyor system is a system which includes an outdoor escalator 10 and can diagnose the statuses of various devices constituting the escalator 10 (a system which can collect operational information of various devices constituting the escalator 10). As shown in FIG. 1, the escalator 10 is installed at an incline between, for example, an outdoor lower floor and an upper floor.

In the example shown in FIG. 1, the lower floor side is assumed to be the boarding side of the escalator 10, and the upper floor side is assumed to be the landing side of the escalator 10.

5 The escalator 10 shown in FIG. 1 is configured to transport passengers (users) who have boarded on tread steps (or just "steps") 11 by circulating the steps 11, which are coupled together without gaps, between a lower machine chamber 12 (boarding area) and an upper machine chamber 13 (landing area).
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 These tread steps 11 are coupled together by an endless coupling chain 14 and are placed within a truss 15 installed beneath the floor. Inside the truss 15, a lower sprocket 16 and an upper sprocket 17 are
15 disposed, between which the coupling chain 14 is wrapped therearound.

 In the example shown in FIG. 1, a drive unit 18, which includes a motor and a speed reducer, is coupled to the upper sprocket 17. The drive unit 18 rotates
20 the lower sprocket 16 and the upper sprocket 17, around which the coupling chain 14 is wound, and thus circulates these between the lower machine chamber 12 and the upper machine chamber 13 while guiding the multiple tread steps 11 along guide rails (not shown)
25 via the coupling chain 14. Note that in FIG. 1, the drive unit 18 is coupled to the upper sprocket 17, but the drive unit 18 may as well be coupled to the lower sprocket 16.

 Further, on the upper portion of the truss 15, a pair of skirt guards (not shown) are installed along
30 the direction of movement of the tread steps 11, so as to oppose the respective side surfaces of each tread step 11. On the upper portions of the pair of skirt

guards, handrail stands 19 are provided to stand upright. In other words, the handrail stands 19 are set to stand on the respective sides of the tread steps 11. Around each of the handrail stands 19, a belt-shaped handgrip 20 is attached. The handgrip 20 is a grip for passengers riding on the steps 11 to hold onto, and rotates around in sync with the movement of the steps 11, for example, by the driving force from the drive unit 18 transmitted thereto.

The boarding and landing areas (boarding area and landing area) of the escalator 10 are located at the upper portion of the lower machine chamber 12 and the upper machine chamber 13, and the boarding/landing plates 22 and 23 are removably installed at these areas. The boarding/landing plates 22 and 23 correspond to the ceilings of the lower machine chamber 12 and the upper machine chamber 13. Passengers pass over the boarding/landing plate 22 when boarding the escalator 10 (steps 11) and pass over the landing plate 23 when landing from the escalator 10 (steps 11).

In the upper machine chamber 13, a control device 21 is installed in addition to the drive unit 18. The control device 21 controls the operation of various devices installed on the escalator 10 (for example, the operation of the drive unit 18) to control the operation of the escalator 10.

Furthermore, the upper machine chamber 13 is further equipped with an automatic oil supply device 24. The automatic oil supply device 24 is a device which can automatically supply lubricating oil or the like, and this device supplies lubricating oil to the coupling chain 14 via an oil suction pipe 25. Note that the automatic oil supply device 24 and the oil

suction pipe 25 may as well be installed in the lower machine chamber 12.

5 The detection device 26 is an infrared beam sensor including, for example, a beam emitter 26a and a beam receiver 26b, and the emitter 26a and the receiver 26b are installed near the boarding area so as to oppose each other. For example, the emitter 26a is installed on the deck cover near the boarding area, with the infrared beam irradiation port facing toward the
10 landing area side (toward the receiver 26b side), whereas the receiver 26b is installed on the deck cover near the landing area, with the infrared beam receiving surface facing toward the boarding area side (toward the emitter 26a side).

15 In the vicinity of the control device 21, a remote monitoring device 27 is installed and coupled to the control device 21 via a wired connection. Further, the remote monitoring device 27 is connected to a monitoring center (not shown) for communication.
20 Furthermore, the remote monitoring device 27 is connected to a metrological data server (not shown) for communication.

The remote monitoring device 27 transmits information indicating the status of various devices
25 constituting the escalator 10 (as will be described in detail later, diagnostic result information) and information indicating the operating status of the escalator 10, which can be obtained from the control device 21, to the monitoring center. Moreover, the
30 remote monitoring device 27 receives various instructions (for example, diagnostic instructions) from the monitoring center and outputs the received instructions to the control device 21.

Furthermore, the remote monitoring device 27 periodically acquires metrological data from the metrological data server and outputs the acquired metrological data to the control device 21. In this
5 embodiment, it is assumed that the remote monitoring device 27 acquires metrological data from the metrological data server every hour, but the time interval at which the remote monitoring device 27 acquires metrological data from the metrological data
10 server may be set to any value.

The metrological data contains at least weather information indicating the weather conditions in the area where the escalator 10 is installed. Note that the metrological data may further contain information
15 indicating the temperature, humidity, precipitation, snowfall, solar radiation, wind direction, and wind speed in the area where the escalator 10 is installed, in addition to the weather information described above.

FIG. 2 is a block diagram showing an example of the functional configuration of some elements included
20 in the passenger conveyor system according to this embodiment. As shown in FIG. 2, the control device 21 is connected to both the detection device 26 and the remote monitoring device 27.

25 As shown in FIG. 2, the remote monitoring device 27 comprises a communication unit 27a, a control unit 27b, and a storage unit 27c. The communication unit 27a is a communication interface for communicating with the control device 21, the monitoring center, and the
30 metrological data server. The control unit 27b controls the operation of the remote monitoring device 27. The storage unit 27c stores metrological data periodically obtained from the metrological data server

via the communication unit 27a. Note that the storage unit 27c also stores metrological data obtained from the metrological data server between the previous startup time of the escalator 10 and the current startup time.

As shown in FIG. 2, the control device 21 includes a storage unit 21a, a user presence/absence determination unit 21b, a weather condition determination unit 21c, an information processing unit 21d, and an operation control unit 21e.

The storage unit 21a stores startup time information indicating the startup time (start of operation) of the escalator 10. Note that the storage unit 21a may further store shutdown time information indicating the shutdown time (end of operation) of the escalator 10. Further, the storage unit 21a may store operation schedule information containing the startup time information and the shutdown time information.

Moreover, the storage unit 21a stores, in addition to the time-related information described above, metrological data acquired by the remote monitoring device 27, more specifically, metrological data acquired by the remote monitoring device 27 during the period from the previous start time of the escalator 10 to the current start time.

The user presence/absence determination unit 21b continuously (repeatedly) determines whether or not there is a user on the escalator 10 based on detection results obtained from the detection device 26 after the start time of the escalator 10 indicated by the start time information stored in the storage unit 21a. Here, as an example, it is assumed that the detection device 26 switches its power from off to on when the escalator

10 starts, and to begin irradiating an infrared beam
from the emitter 26a toward the receiver 26b. But the
operation is not limited to the type of this example.
For example, the detection device 26 may as well be
5 configured to emit an infrared beam from the beam
emitter 26a toward the beam receiver 26b at all times.
Furthermore, the detection device 26 may as well be
configured to switch the power from on to off after the
series of processing steps, which will be described
10 below with reference to FIG. 3, are completed.

The weather condition determination unit 21c
determines whether it rained or snowed between the
previous start time and the current start time based on
weather information contained in the metrological data
15 stored in the storage unit 21a when the result of the
determination performed by the user presence/absence
determination unit 21b at the start time indicates that
there are no users on the escalator 10.

If the weather condition determination unit 21c
20 finds metrological data containing weather information
indicating rain or snow in the metrological data stored
in the storage unit 21a, it determines that rainfall or
snowfall occurred between the previous startup time and
the current startup time. On the other hand, if the
25 weather condition determination unit 21c finds no
metrological data containing weather information
indicating rain or snow in the metrological data stored
in the storage unit 21a (for example, if there is only
metrological data containing weather information
30 indicating clear or cloudy weather), it determines that
no rainfall or snowfall occurred between the previous
startup time and the current startup time.

The information processing unit 21d, if the

determination result by the weather condition determination unit 21c indicates that rainfall or snowfall occurred between the previous startup time and the current startup time, does not perform the
5 diagnostic check described below for each operation mode. More specifically, the information processing unit 21d does not perform diagnostic check in each operation mode after starting the escalator 10, but outputs an instruction to the operation control unit
10 21e to set the operation mode of the escalator 10 to the normal operation mode. When the operation control unit 21e receives an instruction from the information processing unit 21d to set the operation mode of the escalator 10 to the normal operation mode, it controls
15 the operation of the drive unit 18 to operate the escalator 10 in the normal operation mode. Note that the normal operation mode is an operation mode to operate the escalator 10 at a movement speed of, for example, 30 m/min.

20 On the other hand, when the determination result by the weather condition determination unit 21c indicates that no rainfall or snowfall occurred between the previous startup time and the current startup time, the information processing unit 21d outputs an
25 instruction to the operation control unit 21e to start the escalator 10 and set the operation mode of the escalator 10 to a low-speed operation mode (a predetermined operation mode). When the operation control unit 21e receives an instruction from the
30 information processing unit 21d to set the operation mode of the escalator 10 to the low-speed operation mode, it controls the operation of the drive unit 18 to operate the escalator 10 to drive at low speed. Note

that the low-speed operation mode is an operation mode to operate the escalator 10 at a movement speed of, for example, 10 m/min.

5 When the information processing unit 21d finds that there are no users on the escalator 10 based on the result of the determination performed by the user presence/absence determination unit 21b when low-speed operation begins, it performs diagnostic checks on various devices constituting the escalator 10 while the
10 escalator 10 is being operated in the low-speed operation mode.

 Further, if the determination result obtained by the information processing unit 21d when the diagnostic check performed by the low-speed operation mode is
15 completed indicates that there are no users on the escalator 10, the information processing unit 21d outputs an instruction to the operation control unit 21e to switch the operation mode of the escalator 10 from the low-speed operation mode to the energy-saving
20 operation mode (another operation mode). When the operation control unit 21e receives an instruction from the information processing unit 21d to switch the operation mode of the escalator 10 from the low-speed operation mode to the energy-saving operation mode, it
25 controls the operation of the drive unit 18 to operate the escalator 10 in the energy-saving operation mode. Note that the energy-saving operation mode is an operation mode in which the escalator 10 is operated at a movement speed of, for example, 20 m/min.

30 If the determination result obtained by the user presence/absence determination unit 21b when the energy-saving operation begins indicates that there are no users on the escalator 10, the information

processing unit 21d performs diagnostic check on the various devices constituting the escalator 10 while the escalator 10 is being operated in the energy-saving operation mode.

5 Further, if the determination result obtained by the user presence/absence determination unit 21b when the diagnostic check in the energy-saving operation mode is completed indicates that there are no users on the escalator 10, the information processing unit 21d
10 outputs an instruction to the operation control unit 21e to switch the operation mode of the escalator 10 from the energy-saving operation mode to the normal operation mode. When the operation control unit 21e receives an instruction from the information processing
15 unit 21d to switch the operation mode of the escalator 10 from the energy-saving operation mode to the normal operation mode, it controls the operation of the drive unit 18 to operate the escalator 10 in the normal operation mode.

20 If the determination result obtained by the user presence/absence determination unit 21b when the normal operation begins indicates that there are no users on the escalator 10, the information processing unit 21d performs diagnostic checks on the various devices
25 constituting the escalator 10 while the escalator 10 is being operated in the normal operation mode.

 The diagnostic result information indicating the results of diagnostic check performed in each of the low-speed operation mode, energy-saving operation mode,
30 and normal operation mode is stored in the storage unit 21a immediately when the diagnostic results for each operation mode become available. That is, diagnostic result information indicating the results of diagnostic

check performed in the low-speed operation mode is stored in the storage unit 21a immediately when the diagnostic check in the low-speed operation mode is completed and the diagnostic results become available.

5 Similarly, diagnostic result information indicating the results of diagnostic check performed in the energy-saving operation mode is stored in the storage unit 21a immediately when the diagnostic check in the energy-saving operation mode is completed and the diagnostic results are obtained. Further, diagnostic result information indicating the results of diagnostic check performed in the normal operation mode is stored in the storage unit 21a immediately when the diagnostic check in the normal operation mode is completed and the diagnostic results are obtained.

15 When all diagnostic result information related to the diagnostic operations is stored in the storage unit 21a, the diagnostic result information stored in the storage unit 21a is transmitted to the monitoring center (not shown) via the remote monitoring device 27.

20 Note here that the information processing unit 21d does not start the escalator 10 when the determination result obtained by the user presence/absence determination unit 21b at the start time indicates that there is a user on the escalator 10, as there is a risk that the user may tumble and fall.

25 Further, the determination result obtained by the user presence/absence determination unit 21b when the escalator 10 begins operation in each operation mode or when the diagnostic check in each operation mode is completed, indicates that there is a user on the escalator 10, the information processing unit 21d outputs an instruction to the operation control unit

21e to switch the operation mode of the escalator 10 to the normal operation mode. In this case, the information processing unit 21d transmits diagnostic result information indicating that the diagnostic check of various devices constituting the escalator 10 have failed to the monitoring center via the remote monitoring device 27. Or, the information processing unit 21d transmits diagnostic result information indicating the results of diagnostic check performed prior to the determination that there is a user on the escalator 10, among the diagnostic checks performed in each operation mode, to the monitoring center via the remote monitoring device 27.

FIG. 3 is a flowchart illustrating an example of the operation of the passenger conveyor system according to this embodiment.

When the startup time indicated by the startup time information stored in the storage unit 21a arrives (step S1), the user presence/absence determination unit 21b determines whether or not there is a user on the escalator 10 based on the detection result obtained from the detection device 26 at this timing (step S2).

If the result of the determination performed in step S2 indicates that there is a user on the escalator 10 (Yes in step S2), the information processing unit 21d does not start the escalator 10 and repeats the above-described processing in step S2.

On the other hand, if the determination result in step S2 indicates that there is no user on the escalator 10 (No in step S2), the weather condition determination unit 21c determines whether it rained or snowed between the previous start time and the current start time based on the weather information included in

the metrological data stored in the storage unit 21a (step S3).

5 If the determination result in step S3 indicates that it rained or snowed between the previous startup time and the current startup time (Yes in step S3), the information processing unit 21d outputs an instruction to the operation control unit 21e to start the escalator 10 and set the operation mode of the escalator 10 to the normal operation mode. The
10 operation control unit 21e controls the operation of the drive unit 18 in accordance with the above-described instruction from the information processing unit 21d to operate the escalator 10 in the normal operation mode (step S4). Thereafter, the information
15 processing unit 21d transmits diagnostic result information indicating that the diagnostic check of various devices constituting the escalator 10 has failed to the monitoring center via the remote monitoring device 27 (that is, notifies the monitoring
20 center that the diagnostic check has failed) (step S5), thereby terminating the series of operations. Note that the weather condition determination unit 21c determines that it has snowed and the snow accumulation on the escalator 10 is separately detected, the
25 information processing unit 21d may as well operate to stop the operation of the escalator 10 without starting it.

On the other hand, if the determination result in step S3 indicates that no rainfall or snowfall occurred
30 between the previous start time and the current start time (No in step S3), the information processing unit 21d starts the escalator 10 and outputs an instruction to the operation control unit 21e to set the operation

mode of the escalator 10 to the low-speed operation mode. The operation control unit 21e controls the operation of the drive unit 18 in accordance with the above-described instruction from the information processing unit 21d to operate the escalator 10 at low speed (step S6).

When the escalator 10 begins operating in the low-speed operation mode, the user presence/absence determination unit 21b determines whether or not there is a user on the escalator 10 based on the detection results obtained from the detection device 26 at this timing (step S7).

If the determination result obtained in step S7 indicates that there is a user on the escalator 10 (Yes in step S7), the processing in steps S4 and S5 described above are executed in sequence. That is, the information processing unit 21d and the operation control unit 21e switch the operation mode of the escalator 10 to the normal operation mode, notify the monitoring center that the diagnostic check on various devices constituting the escalator 10 has failed, and terminate the series of operations at this point.

On the other hand, the determination result obtained in step S7 indicates that there is no user on the escalator 10 (No in step S7), the information processing unit 21d performs diagnostic check on the various devices that constitute the escalator 10 while operating the escalator 10 in the low-speed operation mode (step S8).

When the diagnostic check in the low-speed operation mode is completed, the user presence/absence determination unit 21b determines whether there is a user on the escalator 10 based on the detection result

obtained from the detection device 26 at this timing
(step S9).

5 If the determination result obtained in step S9
indicates that there is a user on the escalator 10 (Yes
in step S9), the processing in steps S4 and S5
described above are executed in sequence.

10 On the other hand, if the determination result
obtained in step S9 indicates that there is no user on
the escalator 10 (No in step S9), the information
processing unit 21d outputs an instruction to the
operation control unit 21e to switch the operation mode
of the escalator 10 from the low-speed operation mode
to the energy-saving operation mode. The operation
control unit 21e controls the operation of the drive
15 unit 18 in accordance with the above-described
instruction from the information processing unit 21d to
operate the escalator 10 in the energy-saving operation
mode (step S10).

20 When the escalator 10 begins operating the in
energy-saving operation mode, the user presence/absence
determination unit 21b determines whether or not there
is a user on the escalator 10 based on the detection
result obtained from the detection device 26 at this
timing (step S11).

25 If the determination result obtained in step S11
indicates that there is a user on the escalator 10 (Yes
in step S11), the processing in steps S4 and S5
described above are executed in sequence.

30 On the other hand, if the determination result
obtained in step S11 indicates that there is no user on
the escalator 10 (No in step S11), the information
processing unit 21d performs diagnostic check on
various devices constituting the escalator 10 while the

escalator 10 is being operated in the energy-saving operation mode (step S12).

5 When the diagnostic check in the energy-saving operation mode is completed, the user presence/absence determination unit 21b determines whether or not there is a user on the escalator 10 based on the detection result obtained from the detection device 26 at this timing (step S13).

10 If the determination result obtained in step S13 indicates that there is a user on the escalator 10 (Yes in step S13), the processing in steps S4 and S5 described above are executed in sequence.

15 On the other hand, if the determination result obtained in step S13 indicates that there is no user on the escalator 10 (No in step S13), the information processing unit 21d outputs an instruction to the operation control unit 21e to switch the operation mode of the escalator 10 from the energy-saving operation mode to the normal mode. The operation control unit
20 21e controls the operation of the drive unit 18 in accordance with the above-described instruction from the information processing unit 21d to operate the escalator 10 in normal operation (step S14).

25 When the escalator 10 begins operating in the normal operation mode, the user presence/absence determination unit 21b determines whether or not there is a user on the escalator 10 based on the detection result obtained from the detection device 26 at this timing (step S15).

30 If the determination in step S15 indicates that there is a user on the escalator 10 (step S15 Yes), the processes in steps S4 and S5 described above are executed in sequence.

On the other hand, if the determination result obtained in step S15 indicates that there is no user on the escalator 10 (No in step S15), the information processing unit 21d performs diagnostic check on various devices constituting the escalator 10 while the escalator 10 is being operated in the normal operation mode (step S16).

After a while, the information processing unit 21d transmits (notifies) the diagnostic result information indicating the results of the diagnostic check performed in each operation mode to the monitoring center via the remote monitoring device 27 (step S17), thereby terminating the series of operations described above.

As described above, the passenger conveyor system according to this embodiment comprises a remote monitoring device 27 which periodically acquires from a meteorological data server, meteorological data including at least weather information indicating the weather conditions in the area where the escalator 10 is installed, a storage unit 21a which stores meteorological data acquired by the remote monitoring device 27 between the previous startup time of the escalator 10 and the current startup time, a weather condition determination unit 21c which, at the time of start of the escalator 10, determines whether or not rainfall or snowfall has occurred between the previous startup time and the current startup time based on weather information included in the meteorological data stored in the storage unit 21a, and an information processing unit 21d which controls the operation of the escalator 10 to perform diagnostic operation if the weather condition determination unit 21c determines

that no rainfall or snowfall occurred, and not to perform diagnostic operation if the weather condition determination unit 21c determines that rainfall or snowfall occurred.

5 With the above-described configuration, it is possible to prevent diagnostic operation from being performed in a state of insufficient amount of lubricating oil, where lubricating oil applied to chains such as the coupling chain 14 has flowed away
10 due to rainfall or snowfall. That is, according to the passenger conveyor system of the present embodiment, it is possible to perform diagnostic operation under the same weather conditions, thereby making it possible to obtain accurate diagnostic results from the outdoor
15 escalator 10.

 Note that in this embodiment, the information processing unit 21d is configured not to perform diagnostic operation when the weather condition determination unit 21c determines that it has rained or
20 snowed. But, as long as diagnostic result information including weather information added thereto is transmitted to the monitoring center, diagnostic operation may be performed even if the weather condition determination unit 21c determines that it has
25 rained or snowed.

 In the case where diagnostic operation is not performed due to rain or snowfall, accurate diagnostic results can always be obtained. However, there will days when diagnostic operation is not performed. In
30 such cases, for example, if data analysis is to be carried out on diagnostic result information over a certain period as a target, data gaps may occur, thereby disabling to perform accurate data analysis.

In contrast, by conducting diagnostic operation even when rain or snowfall is detected and collecting diagnostic result information with weather information added as reference data, the above-described data gaps will not occur, making it possible to perform accurate data analysis (highly reliable data analysis).

Further, in this embodiment, the information processing unit 21d is configured not to perform diagnostic operation when the weather condition determination unit 21c determines that there has been rainfall or snowfall. But, even when it is determined that there has been rainfall or snowfall, diagnostic operation may be performed while supplying lubricating oil to the coupling chain 14 via the automatic oil supply device 24. With this configuration, even if moisture enters the truss structure due to rain or snowfall and causes the lubricating oil applied to the coupling chain 14 and other chains to flow away, it is possible to perform diagnostic operation while replenishing lubricating oil.

In this embodiment, the information processing unit 21d is configured to determine not to perform a diagnostic operation when the determination result by the weather condition determination unit 21c indicates that there has been rainfall or snowfall. But, for example, when the weather condition determination unit 21c determines that there has been rainfall or snowfall, it may further determine whether the escalator 10 is still affected by rain or snow based on information other than weather information included in the metrological data stored in the storage unit 21a (that is, for example, at least one of temperature, humidity, precipitation amount, snowfall amount, solar

radiation amount, wind direction, and wind speed), and the information processing unit 21d may determine whether or not to perform a diagnostic operation based on the result of this determination by the weather condition determination unit 21c.

Specifically, the information processing unit 21d, when the above-described determination result by the weather condition determination unit 21c indicates that the elevator is still affected by rain or snow, does not perform diagnostic operation but operates the escalator 10 in the normal operation mode, whereas when the above-described determination result by the weather condition determination unit 21c indicates that the elevator is no longer affected by rain or snow (for example, rainfall or snowfall occurred, but the amount of rainfall or snowfall was small, and further considering temperature, humidity, and the like, it can be determined that the effects of rainfall or snowfall are no longer present), the diagnostic operation may be performed.

Further, the passenger conveyor system according to this embodiment, at the start time indicated by the start time information stored in advance in the storage unit 21a, determines whether or not there is a user on the escalator 10 based on the detection result obtained from the detection device 26 at the start time, and starts the escalator 10 when it is determined that there is no user present. With this configuration, the escalator 10 can be started safely and automatically, and therefore it is possible to eliminate the need for an operator to go to the site to start the escalator 10 and thereby to reduce the burden on the operator.

Further, the passenger conveyor system according

to this embodiment, when the escalator 10 is started, operates the escalator 10 in the low-speed operation mode, the energy-saving operation mode, and the normal operation mode, which have movement speeds different from each other, in sequence, and performs diagnostic check on various devices constituting the escalator 10. With this configuration, the automatic diagnostic check of the escalator 10 can be performed each time the escalator 10 is started, thus making possible to detection of any abnormalities that may occur in the escalator 10 at an early stage. Further, maintenance personnel can perform regular inspection tasks based on the results of the automatic diagnostic check conducted each time the escalator 10 is started, thereby making it possible to expect the reduction of the number of operation steps of the workload during regular inspections (that is, alleviating the burden on maintenance personnel during regular inspections).

Note that this embodiment is described for the case of how to safely and automatically start escalator 10, but by performing the same processing as that of when starting the escalator 10 (that is, executing the processing shown in steps S1 and S2 in FIG. 3), it is also possible to safely and automatically stop the escalator 10 as well. With this configuration, the burden on the administrator can be reduced not only when the escalator 10 is started but also when it is stopped.

Note that this embodiment is explained for the case where the detection device 26 is an infrared beam sensor, but the configuration is not limited to this. For example, the detection device 26 may be of any type as long as it can detect the presence of a user on the

escalator 10. For example, the detection device 26 may be a camera mounted on a sensor pole and capable of capturing images on and above the escalator 10.

5 Furthermore, this embodiment is described for the case where the passenger conveyor included in the passenger conveyor system is an outdoor escalator 10, but the configuration is not limited to this. For example, the passenger conveyor included in the passenger conveyor system may be an "outdoor moving
10 walkway".

According to the embodiment described above, it is possible to provide a passenger conveyor system which can obtain accurate diagnostic results during diagnostic operation of an outdoor passenger conveyor.

15 While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms;
20 furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their
25 equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

WHAT IS CLAIMED IS:

1. A passenger conveyor system for diagnosing a state of an outdoor passenger conveyor, the system comprising:

5 a control device which controls operation of the outdoor passenger conveyor; and

 a remote monitoring device which periodically acquires from a meteorological data server, meteorological data including at least weather
10 information indicating weather conditions in an area where the outdoor passenger conveyor is installed;

 wherein

 the control device comprises:

 a storage unit which stores time information
15 indicating startup time of the outdoor passenger conveyor, and the meteorological data acquired by the remote monitoring device from a previous startup time of the outdoor passenger conveyor until a current startup time,

20 a weather condition determination unit which, when the startup time indicated by the time information arrives, determines whether rainfall or snowfall occurred during a period from the previous startup time to the current startup time based on the weather
25 information contained in the stored meteorological data, and

 an information processing unit which, when the weather condition determination unit determines that no rainfall or snowfall occurred, starts the outdoor
30 passenger conveyor and operates it in a predetermined operation mode, and diagnoses the state of the outdoor passenger conveyor.

2. The passenger conveyor system of claim 1,

wherein

the information processing unit, when the weather condition determination unit determines that rainfall or snowfall occurred, starts the outdoor passenger conveyor without diagnosing the state of the outdoor passenger conveyor and operates the outdoor passenger conveyor in a normal operation mode different from the predetermined operation mode.

3. The passenger conveyor system of claim 1,
wherein

the information processing unit, when the weather condition determination unit determines that rainfall or snowfall occurred, diagnoses the state of the outdoor passenger conveyor and adds the weather information to a diagnostic result information indicating the result of the diagnosing of the state of the outdoor passenger conveyor.

4. The passenger conveyor system of claim 1,
further comprising:

an oil supply device which can supply lubricating oil to a coupling chain for coupling steps of the outdoor passenger conveyor,

wherein

the information processing unit, when the weather condition determination unit determines that rainfall or snowfall occurred, diagnoses the state of the outdoor passenger conveyor while supplying the lubricating oil to the coupling chain via the oil supply device.

5. The passenger conveyor system of claim 1,
wherein

the information processing unit, when the weather condition determination unit determines that snowfall

occurred and snow accumulation is detected on the outdoor passenger conveyor, does not start the outdoor passenger conveyor.

6. The passenger conveyor system of claim 1,
5 wherein

the weather condition determination unit, when it determines that rainfall or snowfall occurred between the previous startup time and the current startup time, further determines whether the outdoor passenger
10 conveyor is still affected by rain or snow based on at least one of information including a temperature, humidity, precipitation amount, snowfall amount, solar radiation amount, wind direction, and wind speed included in the stored metrological data, and

15 the information processing unit, when a result of a determination from the weather condition determination unit indicates that the outdoor passenger conveyor is still affected by rain or snow, starts the outdoor passenger conveyor without diagnosing its state
20 and operates the outdoor passenger conveyor in a normal operation mode different from the predetermined operation mode, or when the result of the determination from the weather condition determination unit indicates that the outdoor passenger conveyor is no longer
25 affected by rain or snow, diagnoses the state of the outdoor passenger conveyor.

7. The passenger conveyor system of claim 1, further comprising:

30 a detection device installed near a boarding or landing area of the outdoor passenger conveyor, which detects a passenger on the outdoor passenger conveyor, wherein

the control device further comprises a user

presence/absence determination unit which continuously determines whether or not there is a user on the outdoor passenger conveyor based on a result of detection from the detection device after the start time,

the weather condition determination unit, when a result of determination performed at the start time by the user presence/absence determination unit indicates that there is no user on the outdoor passenger conveyor, determines whether rainfall or snowfall occurred during a period from the previous start time until the current start time.

8. The passenger conveyor system of claim 7, wherein

the information processing unit, when the result of the determination performed by the user presence/absence determination unit indicates that there is no user on the outdoor passenger conveyor at the time when the diagnosing in the predetermined operation mode is completed, operates the outdoor passenger conveyor in an other operation mode having a movement speed higher than that of the predetermined operation mode, and further diagnoses the state of the outdoor passenger conveyor, and

when the result of the determination performed by the user presence/absence determination unit indicates that that there is no user on the outdoor passenger conveyor at the time when the diagnosing in the other operation mode is completed, operates the outdoor passenger conveyor in a normal operation mode having a movement speed higher than that of the other operation mode, and further diagnoses the state of the outdoor passenger conveyor.

9. The passenger conveyor system of claim 8,
wherein

the information processing unit transmits
diagnostic result information indicating the result of
5 diagnosing for each operation mode to the monitoring
center via the remote monitoring device.

10. The passenger conveyor system of claim 9,
wherein

the information processing unit, when the result
10 of the determination performed at the startup time by
the user presence/absence determination unit indicates
that there is a user on the outdoor passenger conveyor,
does not start the outdoor passenger conveyor, and

when the diagnosing in the predetermined operation
15 mode is completed, or when the diagnosing in the other
operation mode is completed, when the result of the
determination performed by the user presence/absence
determination unit indicates that there is a user on
the outdoor passenger conveyor, transmits diagnostic
20 result information indicating that the diagnosing
failed to the monitoring center.

11. The passenger conveyor system of claim 9,
wherein

the information processing unit, when the result
25 of the determination performed at the startup time by
the user presence/absence determination unit indicates
that there is a user on the outdoor passenger conveyor,
does not start the outdoor passenger conveyor,

when the result of the determination performed by
30 the user presence/absence determination unit when the
diagnosing in the predetermined operation mode is
completed indicates that there is a user on the outdoor
passenger conveyor, transmits diagnostic result

information indicating the result of the diagnosing in the predetermined operation mode, and

when the result of the determination performed by the user presence/absence determination unit when the diagnosing in the other operation mode is completed indicates that there is a user on the outdoor passenger conveyor, transmits diagnostic result information indicating the result of the diagnosing in each of the predetermined operation mode and the other operation mode to the monitoring center.

12. The passenger conveyor system of claim 7, wherein

the detection device is an infrared beam sensor including an emitter and a receiver,

the emitter is installed on a deck cover near a boarding area such that an irradiation port which irradiates an infrared beam opposes a landing area side, and

the receiver is installed on the deck cover near the landing area such that a receiving surface which receives the infrared beam opposes the boarding area side.

13. The passenger conveyor system of claim 7, wherein

the detection device is a camera which can capture images on and above the outdoor passenger conveyor.