However, in the system of PTL 1, a piece of equipment, such as the elevator, is controlled on the basis of a signal transmitted to the piece of equipment by an object, such as the autonomous vehicle. Here, assume that a plurality of pieces of equipment are provided in a facility, such as a building, in the system and that a plurality of devices work in the facility. In this case, a communication format needs to be defined for each of combinations of pieces of equipment and devices. Thus, coordination between pieces of equipment and devices is not easy.

[0005]

The present disclosure relates to solving of the above-described problem. The present disclosure provides a communication system in which a piece of equipment in a facility and a device working in the facility cooperate easily with each other, an equipment server and a device server in the communication system, and a data structure which is to be communicated in the communication system.

[Solution to Problem]

[0006]

An equipment server according to the present disclosure includes a first communication unit that transmits and receives a message in a common data format to and from a plurality of device servers which communicate with a device in a facility and control the device, and an equipment control unit that controls a piece of equipment in the facility on the basis of a message received by the first communication unit, wherein the message includes ~~first information for identification of the device, second information representing a transmission direction of the message, and~~ third information representing a process related to the message.

[0007]

A device server according to the present disclosure includes a second communication unit that transmits and receives a message in a common data format to and from an equipment server that controls a piece of equipment in a facility, and a device control unit that controls a device in the facility on the basis of a message received by the second communication unit, wherein the message includes ~~first information for identification of the device, second information representing a transmission direction of the message, and~~ third information representing a process related to the message.

[0008]

A communication system according to the present disclosure includes an equipment server and a plurality of device servers, wherein the equipment server includes a first communication unit that transmits and receives a message in a common data format to and from the plurality of device servers, and an equipment control unit that controls a piece of equipment in a facility on the basis of a message received by the first communication unit, each of the plurality of device servers includes a second communication unit that transmits and receives the message in the common data format to and from the equipment server, and a device control unit that controls a device in the facility on the basis of a message received by the second communication unit, and the message includes ~~first information for identification of the device, second information representing a transmission direction of the message, and~~ third information representing a process related to the message.

[0009]

A ~~data structure~~storage medium according to the present disclosure is the ~~data structure~~storage medium for a message that is to be transmitted and received in a common data format between a plurality of device servers that communicate with a device in a facility and control the

device and an equipment server that controls a piece of equipment in the facility, ~~and includes first information for identification of the device in the facility; second information representing a transmission direction of the message; and third information representing a process to be executed by a control target in the message~~ wherein the message includes third information representing a process related to the message, and when any server of the plurality of device servers or the equipment server receives the message, the message is used for a process to cause a control target in the message to execute a process represented by the third information.

[Advantageous Effects of Invention]

[0010]

The equipment server or device server or the communication system according to the present disclosure allows a piece of equipment in a facility and a device working in the facility to cooperate easily with each other. The data structure according to the present disclosure also allows a piece of equipment in a facility and a device working in the facility to cooperate easily with each other.

[Brief Description of Drawings]

[0011]

[Fig. 1] A configuration diagram of a communication system according to Embodiment 1.

[Fig. 2] A chart showing an example of a structure of a topic name in a message in the communication system according to Embodiment 1.

[Fig. 3] A sequence chart showing an example of operation of the communication system according to Embodiment 1.

[Fig. 4] A sequence chart showing an example of operation of the communication system according to Embodiment 1.

[Fig. 5] A sequence chart showing an example of operation of the communication system according to Embodiment 1.

Claims

[Claim 1]

An equipment server comprising a first communication unit that transmits and receives a message in a common data format to and from a plurality of device servers which communicate with a device in a facility and control the device, and an equipment control unit that controls a piece of equipment in the facility on the basis of the message received by the first communication unit,

wherein the message includes

~~first information for identification of the device,~~

~~second information representing a transmission direction of the message, and~~

third information representing a process related to the message.

[Claim 2]

The equipment server according to claim 1, wherein

the message includes first information for identification of the device.

[Claim 3]

The equipment server according to claim 2, wherein

the equipment control unit causes an access control apparatus that is the piece of equipment in the facility to authenticate the device on the basis of the first information.

[Claim 4~~2~~]

The equipment server according to any one of claims 1 to 3, wherein

the device is a robot or a mobility device.

[Claim 5~~3~~]

The equipment server according to any one of claims 1 to~~or~~ 4~~2~~, wherein

the equipment control unit selects a piece of equipment to be controlled from among a plurality of pieces of equipment in the facility, on the basis of the third information.

~~[Claim 4]~~

~~The equipment server according to any one of claims 1 to 3, wherein~~

~~the equipment control unit selects the piece of equipment to be controlled from among the plurality of pieces of equipment in the facility, on the basis of position information of the device which is stored in association with information on the device identified by the first information.~~

[Claim 6~~5~~]

The equipment server according to any one of claims 1 to 5~~4~~, wherein

the equipment control unit causes the piece of equipment ~~to be controlled~~ in the facility to start operation if the third information represents a request to start the operation of the piece of equipment.

~~[Claim 6]~~

~~The equipment server according to any one of claims 1 to 5, wherein~~

~~the equipment control unit causes the piece of equipment to be controlled to stop the operation if the third information represents a request to stop the operation of the piece of equipment.~~

[Claim 7]

The equipment server according to any one of claims 1 to 6, wherein

the equipment control unit changes an operating state of the piece of equipment ~~to be controlled~~ in the facility if the third information represents a request to change the operating state of the piece of equipment.

~~[Claim 8]~~

~~The equipment server according to any one of claims 1 to 7, wherein~~

~~the equipment control unit causes an access control apparatus that is the piece of equipment to be controlled to authenticate the device on the basis of the first information.~~

[Claim ~~8~~9]

The equipment server according to any one of claims 1 to ~~8~~7, wherein

the device is a first device that is controlled by a first device server among the plurality of device servers and moves in the facility, and

the equipment control unit registers, in an elevator that is the piece of equipment in the facility~~to be controlled~~, a hall call calling a first car of the elevator if the third information represents the hall call.

~~[Claim 10]~~

~~The equipment server according to claim 9, wherein~~

~~the equipment control unit identifies a floor, on which the first device is located, on the basis of position information of the first device which is stored in association with information on the first device identified by the first information and registers, in the elevator, the hall call for the identified floor.~~

~~[Claim 11]~~

~~The equipment server according to claim 9 or 10, wherein~~

~~if the elevator has a plurality of cars, the first communication unit includes, in the message, information for identification of the first car that is caused to respond to the hall call of the first device among the plurality of cars and transmits the message to the first device server.~~

~~[Claim 12]~~

~~The equipment server according to any one of claims 9 to 11, wherein~~

~~the first communication unit transmits the message including the third information representing a request to board the first car to the first device server when a door of the first car opens on a start floor of the hall call.~~

~~[Claim 13]~~

~~The equipment server according to claim 12, wherein~~

~~the equipment control unit causes the elevator to close the door of the first car after the equipment control unit transmits the message including the third information representing the request to board to the first device server and when the equipment control unit receives the message including the third information representing completion of boarding of the first car from the first device server.~~

~~[Claim 14]~~

~~The equipment server according to claim 12 or 13, wherein~~

~~if the equipment control unit does not receive the message including the third information representing completion of boarding of the first car from the first device server by the time a predetermined time period elapses since the transmission of the message including the third information representing the request to board to the first device server, the equipment server judges that the first device is unsuccessful in boarding the first car and transmits the message including the third information representing a request to abort boarding the first car to the first device server.~~

~~[Claim 15]~~

~~The equipment server according to any one of claims 9 to 14, wherein~~

~~the equipment control unit~~

~~includes a boarding observation unit that observes a status of the device of boarding a car of the elevator, and~~

~~judges whether the first device is unsuccessful in boarding the first car on the basis of a status of the first device of boarding the first car which is observed by the boarding observation unit, and transmits the message including the third information representing the request to abort boarding the first car to the first device server if the equipment control unit judges that the first device is unsuccessful in boarding the first car.~~

~~[Claim 16]~~

~~The equipment server according to claim 15, wherein~~

~~the boarding observation unit observes the status of the first device of boarding by at least any of~~

~~the position information of the first device stored in association with the information on the first device identified by the first information,~~

~~presence or absence of detection by a passage detector that is provided at a doorway to the first car and detects a body passing through the doorway to the first car,~~

~~a measurement value from a scale that measures a load on the first car, or~~

~~an image of the first device which is shot by a camera that is provided for the elevator.~~

~~[Claim 17]~~

~~The equipment server according to any one of claims 14 to 16, wherein~~

~~the equipment control unit causes the first car to perform dedicated running for the first device when the equipment control unit causes the first car to respond to the hall call, and causes the first car to cancel the dedicated running if the equipment control unit judges that the first device is unsuccessful in boarding the first car.~~

~~[Claim 18]~~

~~The equipment server according to any one of claims 14 to 17, wherein~~

~~the equipment control unit transmits the message including the third information representing a request for the first device to move to a predetermined position outside the first car to the first device server if the equipment control unit judges that the first device is unsuccessful in boarding the first car.~~

~~[Claim 19]~~

~~The equipment server according to any one of claims 14 to 16, wherein~~

~~the equipment control unit causes the first car to perform dedicated running for the first device when the equipment control unit causes the first car to respond to the hall call, transmits the message including the third information representing a request for the first device to move to a predetermined position outside the first car to the first device server if the equipment control unit judges that the first device is unsuccessful in boarding the first car, and causes the first car to cancel the dedicated running when the equipment control unit receives the message including the third information representing completion of movement based on the request to move from the first device server after the transmission.~~

~~[Claim 20]~~

~~The equipment server according to any one of claims 9 to 19, wherein~~

~~the first communication unit transmits the message including the third information representing a request to alight from the first car to the first device server when the door of the first car of the elevator with the first device on board opens on a destination floor of the hall call.~~

~~[Claim 21]~~

~~The equipment server according to claim 20, wherein~~

~~the equipment control unit causes the elevator to close the door of the first car after the equipment control unit transmits the message including the third information representing the request to alight to the first device server and when the equipment control unit receives the message including the third information representing completion of alighting from the first car from the first device server.~~

~~[Claim 22]~~

~~The equipment server according to claim 20 or 21, wherein~~

~~if the equipment control unit does not receive the message including the third information representing completion of alighting from the first car from the first device server by the time a predetermined time period elapses since the transmission of the message including the third information representing the request to alight to the first device server, the equipment control unit judges that the first device is unsuccessful in alighting from the first car and transmits the message including the third information representing a request to abort alighting from the first car to the first device server.~~

~~[Claim 23]~~

~~The equipment server according to any one of claims 9 to 22, wherein~~

~~the equipment control unit~~

~~includes an alighting observation unit that observes a status of the device of alighting from a car of the elevator, and~~

~~judges whether the first device is unsuccessful in alighting from the first car on the basis of a status of the first device of alighting from the first car which is observed by the alighting observation unit, and transmits the message including the third information representing the request to abort alighting from the first car to the first device server if the~~

~~equipment control unit judges that the first device is unsuccessful in alighting from the first car.~~

~~[Claim 24]~~

~~The equipment server according to claim 23, wherein~~

~~the alighting observation unit observes the status of the first device of alighting by at least any of~~

~~the position information of the first device stored in association with the information on the first device identified by the first information,~~

~~presence or absence of detection by the passage detector that is provided at the doorway to the first car and detects the body passing through the doorway to the first car,~~

~~a measurement value from the scale that measures the load on the first car, or~~

~~an image of the first device which is shot by the camera that is provided for the elevator.~~

~~[Claim 25]~~

~~The equipment server according to any one of claims 22 to 24, comprising~~

~~a notification unit that gives notification of a failure in alighting if the equipment control unit judges that the first device is unsuccessful in alighting from the first car.~~

~~[Claim 26]~~

~~The equipment server according to any one of claims 1 to 25, wherein~~

~~when occurrence of a movement request event that is an event requiring a request for the device to move is detected, the first communication unit transmits the message including the third information representing a request for the device to move appropriate to a type of the movement request event to a device server that controls the device.~~

[Claim 9~~27~~]

A device server comprising a second communication unit that transmits and receives a message in a common data format to and from an equipment server that controls a piece of equipment in a facility, and a device control unit that controls a device in the facility on the basis of a message received by the second communication unit,

wherein the message includes

~~first information for identification of the device,~~

~~second information representing a transmission direction of the message, and~~

third information representing a process related to the message.

[Claim 10]

The device server according to claim 9, wherein

the message includes first information for identification of the device.

[Claim 11~~28~~]

A communication system comprising an equipment server and a plurality of device servers,

wherein the equipment server includes a first communication unit that transmits and receives a message in a common data format to and from the plurality of device servers, and an equipment control unit that controls a piece of equipment in a facility on the basis of a message received by the first communication unit,

each of the plurality of device servers includes a second communication unit that transmits and receives the message in the common data format to and from the equipment server, and a device control unit that controls a device in the facility on the basis of a message received by the second communication unit, and

the message includes

~~first information for identification of the device,~~

~~second information representing a transmission direction of the message, and~~

third information representing a process related to the message.

[Claim 12]

The communication system according to claim 11, wherein

the message includes first information for identification of the device.

[Claim 13~~29~~]

A storage medium storing ~~A data structure for~~ a message that is to be transmitted and received in a common data format between a plurality of device servers that communicate with a device in a facility and control the device and an equipment server that controls a piece of equipment in the facility, ~~comprising~~ wherein:

~~first information for identification of the device in the facility;~~

~~second information representing a transmission direction of the message; and~~

~~third information representing a process to be executed by a control target in the message.~~

the message includes third information representing a process related to the message, and

when any server of the plurality of device servers or the equipment server receives the message, the message is used for a process to cause a control target in the message to execute a process represented by the third information.

[Claim 14]

The storage medium storing the message according to claim 13, wherein

the message includes first information for identification of the device.