

{DESCRIPTION}

{Title of Invention}

CONTROL APPARATUS FOR MECHANICAL PARKING LOT, CONTROL METHOD
THEREFOR, AND MECHANICAL PARKING LOT

{Technical Field}

{0001}

The present invention relates to a mechanical parking lot, and in particular, it relates to a control apparatus for a mechanical parking lot that is configured so that a user (driver) of a vehicle himself/herself performs an opening/closing operation of a storage/removal door when storing and removing the vehicle, to a control method therefor, and to a mechanical parking lot controlled by this control method.

{Background Art}

{0002}

With mechanical parking lots provided in office buildings, apartment buildings, and so forth, in order to allow the use thereof only by contracted users, identification numbers must be provided for the individual users in advance, or they must rent special portable authentication media, such as identification cards or remote controllers, and, when storing/removing vehicles, the individual users input or transmit the information in the above-described portable authentication media to a control panel, thereby retrieving

vehicle transporters (pallets, lifts, or the like) and performing an opening/closing operation of storage/removal doors. Because of this, there is no particular need for operation by an attendant (operator) of the parking lot, and the individual users themselves can perform the storing/removing operation.

{0003}

However, because the users themselves can perform retrieval of vehicle transporters, the opening/closing operation of storage/removal doors, and so forth in this way, without requiring operation by a parking-lot attendant, insufficient checking of the user could possibly allow another person or another vehicle to enter the entry bay located inside the storage/removal door. For example, when storing a vehicle, while a vacant vehicle transporter is being retrieved to the storage/removal gateway after the user authentication is completed at the control panel, it is conceivable that the user walks away and is absent for a while because it takes several minutes until the vehicle transporter arrives. At this time, it is possible that a vehicle of a second user happens to arrive at the parking lot, and this user proceeds to use the vehicle transporter retrieved to the entry bay for the first user without performing user authentication.

{0004}

Alternatively, in the case of a mechanical parking lot in

which a remote control panel is provided in a waiting room or the like away from the storage/removal gateway, when a user requesting to store a vehicle performs the authentication operation via remote control, it is conceivable that, while he/she is going to the storage/removal gateway, a second user intercepts the first user at the storage/removal gateway and uses the vehicle transporter in a similar manner as described above.

{0005}

Furthermore, in the case in which the user who has performed the retrieval does not appear or the arrival of the user is delayed after a vacant vehicle transporter is retrieved, as described above, there is a risk that a dangerous situation occurs in which a child can enter the entry bay while the storage/removal door thereof is open while standing by, and a transporting device of the mechanical parking lot is started up while he/she is playing inside; alternatively, an unauthorized person may intentionally intrude inside to burglarize or vandalize a parked vehicle. Hence, in order to avoid such situations, for example, a mechanical parking lot disclosed in Patent Literature 1 has been proposed.

{0006}

With the mechanical parking lot of Patent Literature 1, even though a vehicle transporter arrives at the

storage/removal gateway (entry bay) when the user authentication is completed at a sub control panel for remote control, it is mandatory to perform user authentication again at a main control panel provided at the storage/removal gateway, and the storage/removal door will not open unless the authentication information given at the sub control panel matches the authentication information given at the main control panel. By doing so, to some extent, other persons or other vehicles can be prevented from entering the entry bay in the absence of the authenticated user, or when his/her arrival is delayed.

{Citation List}

{Patent Literature}

{0007}

{PTL 1} Japanese Unexamined Patent Application, Publication No. Hei 5-280218

{Summary of Invention}

{Technical Problem}

{0008}

However, even with the mechanical parking lot of Patent Literature 1, there is a risk that, for example, while one user is present in the entry bay, a subsequent user, arriving for the purpose of storing/removing a vehicle, accidentally closes the storage/removal door and starts up the transporting device, without noticing the presence of the first user.

{0009}

In particular, mechanical parking lots provided with charging equipment for electric vehicles are recently becoming more common, and, in such parking lots, a user needs to perform tasks such as connecting a charging port provided in a vehicle body of an electric vehicle parked at the entry bay to a charging outlet installed in the entry bay by using a charging cable or disengaging the connection to retract the charging cable. Performing these tasks usually takes time, and, in addition, the user must perform these tasks by crouching down beside the vehicle body. It is difficult for other users to recognize the user who is performing the charging task by crouching down in this way in a poorly-lit entry bay, and, because of this, it is quite possible that the other user mistakenly decides that there is no-one in the entry bay and closes the storage/removal door.

{0010}

Additionally, with the mechanical parking lot of Patent Literature 1, because the user authentication must be performed separately at the sub control panel and the main control panel, in addition to the inconvenience of having to perform the authentication operation twice, an additional step of getting out of the vehicle before storing the vehicle or after removing the vehicle is required to perform the second authentication operation, which is time-consuming. Although

convenience is enhanced by enabling operation, from inside the vehicle, via a remote controller for the second authentication operation, because doing so makes it possible to close the storage/removal door even from a remote position, even if someone remains inside the entry bay, this cannot be checked adequately. Furthermore, because the first authentication operation and the second authentication operation can be performed by different persons, it is highly likely that someone accidentally gets trapped inside, as described above.

{0011}

The present invention has been conceived in order to solve the above-described problems, and an object thereof is to provide a control apparatus of a mechanical parking lot, a control method therefor, and a mechanical parking lot controlled by the control method, which enable only the user who has originally performed user authentication to perform a series of tasks related to storing/removing a vehicle; a safe operation by preventing entry by an unauthorized person and another vehicle, as well as by reliably preventing a storage/removal door from being closed in a state in which a person remains in an entry bay; and a reduction of cumbersome tasks associated with the authentication operation and storing/removing operation.

{Solution to Problem}

{0012}

In order to achieve the above-described problems, the present invention provides the following solutions.

Specifically, a first aspect of a mechanical-parking-lot control apparatus according to the present invention is equipped with an external control panel that is provided outside of a storage/removal door and that is used for performing an authentication operation of a user, a start-up operation of a mechanical parking lot, an opening/closing operation of the storage/removal door, and so forth; a portable authentication medium that stores authentication information specific to the user and that allows the user to operate the external control panel when brought into an external authentication area formed in a limited area in the vicinity of the external control panel; an external-authentication-area forming means that forms the external authentication area, detects the portable authentication medium brought into the external authentication area, and emits an external authentication signal on the basis of the authentication information specific to the portable authentication medium; and a control means that permits the user to operate the external control panel, on the condition that the external authentication signal is being received.

{0013}

With such a control apparatus, when the user carrying the portable authentication medium enters the external

authentication area formed in a limited area in the vicinity of the external control panel, the external-authentication-area forming means detects the portable authentication medium and emits an external authentication signal on the basis of authentication information specific to this portable authentication medium, and the control means that has received this external authentication signal permits the user carrying the portable authentication medium, that is, only the user in the vicinity of the external control panel, to operate the external control panel. In this way, because the control means permits the operation of the external control panel, on the condition that the external authentication signal is being received, the person who can open or close the storage/removal door by operating the external control panel is restricted to the user carrying the portable authentication medium.

{0014}

Because of this, at the stage when the vehicle transporter has arrived at the entry bay and the storage/removal door is to be opened, the storage/removal door will not be opened unless the user who has retrieved the vehicle transporter is in the external authentication area formed in the vicinity of the storage/removal door. Therefore, it is possible to prevent a situation in which an unauthorized person who has not received authentication or another user operates the external control panel without

permission and opens the storage/removal door in the absence of the user who has performed the retrieval, thus making it possible for the unauthorized person or another vehicle to enter the entry bay.

{0015}

Moreover, at the stage when storing/removing of a vehicle has been completed and the storage/removal door is to be closed, while a user is still in the entry bay, another user who does not know the situation will not be able to close the storage/removal door by operating the external control panel without permission. Accordingly, the mechanical parking lot can safely be operated by reliably preventing the storage/removal door from being closed in a state in which a person remains in the entry bay.

{0016}

In addition, with a second aspect of the mechanical-parking-lot control apparatus according to the present invention, the user authentication in the first aspect is automatically performed when the portable authentication medium is brought into the external authentication area and when the control means receives the external authentication signal.

{0017}

With the above-described configuration, the user authentication can automatically be completed upon the entry

of the user carrying the portable authentication medium into the external authentication area. Accordingly, because it is possible to eliminate time-consuming tasks involved in a user manually executing the authentication operation at the external control panel, it is possible to reduce cumbersome tasks associated with the authentication operation.

{0018}

In addition, a third aspect of the mechanical-parking-lot control apparatus according to the present invention includes, in the first aspect, a remote-authentication-area forming means that forms a remote authentication area in a location away from the storage/removal gateway, that detects the portable authentication medium brought into the remote authentication area, and that emits a remote authentication signal on the basis of the authentication information specific to the portable authentication medium, wherein the user authentication is automatically performed when the portable authentication medium is brought into the remote authentication area and when the control means receives the remote authentication signal.

{0019}

With the above-described configuration, the user authentication can automatically be completed upon the entry of the user carrying the portable authentication medium into the remote authentication area, in a mechanical parking lot in

which the remote control panel is provided in a waiting room or the like away from the storage/removal gateway. Then, a predetermined vehicle transporter can be retrieved while the authenticated user moves to the storage/removal gateway. Accordingly, a reduction in waiting time can be achieved, time-consuming tasks involved in the user manually performing the authentication operation at the external control panel can also be eliminated, and thus, cumbersome tasks associated with the authentication operation can be reduced.

{0020}

In addition, a fourth aspect of the mechanical-parking-lot control apparatus according to the present invention includes, in one of the first to third aspects, an internal-authentication-area forming means that forms an internal authentication area in the interior of an entry bay inside the storage/removal door, wherein the internal-authentication-area forming means detects the portable authentication medium brought into the internal authentication area and emits an internal authentication signal; and when the internal authentication signal is received, the control means performs control in such a way that the fact that the user is inside the entry bay and that the portable authentication medium is in the entry bay is displayed on the external control panel.

{0021}

With the above-described configuration, when the user who

is carrying the portable authentication medium and has been authenticated in the external authentication area is in the entry bay, the portable authentication medium carried by this user is recognized by the internal-authentication-area forming means, and the fact that the user is in the entry bay and that the portable authentication medium is in the entry bay is displayed on the external control panel. Because of this, for example, even if the next user who does not know the situation arrives while the user who has been authenticated first is charging an electric vehicle or the like in the entry bay, this user can recognize the presence of the person (the user who has been authenticated first) in the entry bay by checking the external control panel.

{0022}

In addition, in the case in which the user leaves the portable authentication medium in the entry bay (inside a vehicle or the like), the portable authentication medium left therein is recognized by the internal-authentication-area forming means, and the fact that the portable authentication medium is in the entry bay is displayed on the external control panel; moreover, because the portable authentication medium is not in the external authentication area, the door-closing operation of the storage/removal door cannot be performed at the external control panel; therefore, it is possible for the user to realize that he/she has left the

portable authentication medium, to immediately return to the entry bay, and to perform the door-closing operation of the storage/removal door by returning to the area in front of the external control panel again. Accordingly, the amount of time by which the door-closing operation of the storage/removal door is interrupted can be minimized, the waiting time for other users can be reduced, and thus, cumbersome tasks associated with the authentication operation can be reduced.

{0023}

In addition, a fifth aspect of the mechanical-parking-lot control apparatus according to the present invention includes, in one of the first to fourth aspects, an external sensing sensor that detects a person approaching the vicinity of the external control panel and the storage/removal gateway and that emits an external sensing signal to the control means; and a warning means, wherein, when the external sensing signal is received, the control means performs control in such a way that it is judged whether or not the portable authentication medium has been authenticated in the external authentication area, and, if not authenticated, a warning is issued by means of the warning means, and a management system of the mechanical parking lot is also notified, on the condition that the reception of the external sensing signal continues for a predetermined amount of time or longer.

{0024}

With the above-described configuration, for example, when an unauthorized person with a malicious intent, who does not have a portable authentication medium, approaches the vicinity of the external control panel or the storage/removal door to attempt illegal entry, this unauthorized person is detected by the external sensing sensor and the external sensing signal is emitted. The control means that has received this external sensing signal judges whether or not the portable authentication medium has been authenticated in the external authentication area; however, because the authentication has obviously not been performed, the control means issues a warning by means of the warning means after the reception of the external sensing signal has continued for the predetermined amount of time or longer, and also notifies the management system of the mechanical parking lot. Accordingly, an unauthorized person cannot stay in the vicinity of the external control panel and the storage/removal door for a long time, and thus, illegal entry to the parking device is prevented.

{0025}

In addition, a sixth aspect of the mechanical-parking-lot control apparatus according to the present invention includes, in the fourth aspect, an internal sensing sensor that detects a person or a vehicle entering the entry bay and that emits an internal sensing signal to the control means; and a warning

means, wherein, when the internal sensing signal is received, the control means judges whether or not the portable authentication medium has been authenticated in the internal authentication area; if the portable authentication medium has not been authenticated in the internal authentication area, a warning is issued by means of the warning means, and the management system of the mechanical parking lot is also notified; and if the portable authentication medium has been authenticated in the internal authentication area, a warning is issued by means of the warning means, and the management system of the mechanical parking lot is also notified, on the condition that the reception of the internal sensing signal continues for the predetermined amount of time or longer.

{0026}

With the above-described configuration, assuming that the storage/removal door is open and an unauthorized person or another vehicle enters the entry bay when the user who has received authentication via the portable authentication medium is not in the entry bay, the internal sensing sensor detects this and emits the internal sensing signal. Upon receiving the internal sensing signal, the control means judges whether or not the portable authentication medium has been authenticated in the internal authentication area; however, because the authentication has obviously not been performed, the control means issues a warning by means of the warning

means and also notifies the management system of the mechanical parking lot. Accordingly, an unauthorized person or another vehicle is prevented from illegally entering the entry bay.

{0027}

On the other hand, in the case in which the internal sensing signal is received, and, additionally, the portable authentication medium has been authenticated in the internal authentication area, the control means issues a warning by means of the warning means, on the condition that the reception of the internal sensing signal continues for the predetermined amount of time or longer, and also notifies the management system of the mechanical parking lot. By doing so, for example, even when an official user loses consciousness in the entry bay, when the user is unable to move for some reason, or when the user does not understand the charging operation, the attendant of the mechanical parking lot or a person outside can quickly become aware of the situation and provide first-aid, assistance, and so forth.

{0028}

In addition, with a seventh aspect of the mechanical-parking-lot control apparatus according to the present invention, in one of the first to sixth aspects, the portable authentication medium is provided with a remote controller function that enables remote control of the external control

panel, on the condition that the portable authentication medium is recognized by the control means in the external authentication area.

{0029}

With the above-described configuration, after stopping the vehicle in front of the storage/removal gateway when storing/removing the vehicle, the user can be authenticated by making the portable authentication medium he/she is carrying recognized in the external authentication area, and the user can also perform, without getting out of the vehicle, start-up of a device or a opening/closing operation of the storage/removal door through the remote control of the external control panel by using remote controller function of the portable authentication medium. Accordingly, time-consuming tasks of getting out of the vehicle to perform authentication or the opening/closing operation of the storage/removal door can be eliminated, and thus, cumbersome tasks associated with the authentication operation and the storing/removing operation can be reduced.

Moreover, because this remote control of the external control panel via the portable authentication medium cannot be performed from an area other than the external authentication area, it is not possible for the user to close the storage/removal door from a remote position that is too far to check the interior of the entry bay. Accordingly, it is

possible to prevent a person left inside the entry bay from being overlooked, and thus, it is possible to realize a safe operation of the mechanical parking lot.

{0030}

In addition, a first aspect of a mechanical-parking-lot control method according to the present invention includes first external authentication processing of authenticating a user upon recognizing that a portable authentication medium storing authentication information specific to the user is brought into a predetermined authentication area; transport retrieval processing of, on the condition that the first external authentication processing has been completed, automatically retrieving a predetermined vehicle transporter to an entry bay inside the storage/removal door, or retrieving the vehicle transporter via the user performing a start-up operation at an external control panel provided outside the storage/removal door; second external authentication processing of, after the vehicle transporter has arrived at the entry bay, recognizing that the portable authentication medium is in an external authentication area formed in a limited area in the vicinity of the external control panel; first verification processing of judging whether or not the portable authentication medium separately authenticated in the first and the second external authentication processing is the same; door-opening processing of, on the condition that the

first verification processing results in an affirmative judgment, automatically opening the storage/removal door, or of opening the storage/removal door via the user performing a door-opening operation at the external control panel; third external authentication processing of recognizing again that the portable authentication medium is in the external authentication area after the user finishes storing/removing a vehicle; second verification processing of judging whether or not the portable authentication medium recognized in the third external authentication processing is the same as the one recognized in the first and second external authentication processing; and door-closing processing of permitting the user to perform a door-closing operation at the external control panel, on the condition that the second verification processing results in an affirmative judgment and also that the portable authentication medium is in the external authentication area until the storage/removal door is closed completely.

{0031}

With such a control method, the portable authentication medium carried by the user is authenticated in the first external authentication processing that is executed before the transport retrieval processing, as well as in the second external authentication processing that is executed after transport retrieval processing; if the portable authentication

media authenticated in the first and second external authentication processing are the same, the first verification processing results in an affirmative judgment; and, in the subsequent door-opening processing, the storage/removal door is automatically opened, or the user is permitted to perform the door-opening operation at the external control panel.

{0032}

In this way, because the control means performs the door-opening processing of the storage/removal door, on the condition that the details of authentication performed via the portable authentication medium match between the first and second external authentication processing executed before and after the transport retrieval processing, the storage/removal door will not automatically be opened in the absence of the user after the vehicle transporter arrives, and the storage/removal door cannot be opened by another user, for example, even if a user who has completed the first external authentication processing leaves for some reason and becomes absent during the process of the transport retrieval processing which requires a waiting time of several minutes. In addition, after the storage/removal door is opened, the storage/removal door will not automatically be closed, nor will it be closed by another user even if the user who has performed the first and second external authentication processing is absent.

{0033}

Therefore, the person who can perform the series of tasks including vehicle transporter retrieval, opening of the storage/removal door, storing/removing of a vehicle, and closing of the storage/removal door is restricted to the user who has received predetermined authentication by using the portable authentication medium, and who is also carrying this portable authentication medium. Because of this, for example, even if the user becomes absent in the middle of the process, it is not possible for an unauthorized person to intrude into the entry bay by opening/closing the storage/removal door, or for another vehicle to enter. Moreover, because the door-closing processing that permits the user to perform the door-closing operation at the external control panel is executed, on the condition that the portable authentication medium of the user is in the external authentication area until the storage/removal door is completely closed, the storage/removal door will immediately be opened if the user who is performing the door-closing operation leaves while the door-closing operation of the storage/removal door is still in progress. Accordingly, it is possible to reliably prevent the storage/removal door from being closed in a state in which a person remains in the entry bay. This allows a safe operation of the mechanical parking lot.

{0034}

In addition, with a second aspect of the mechanical-parking-lot control method according to the present invention, the predetermined authentication area in the first aspect is the external authentication area.

{0035}

With the above-described configuration, the user authentication can automatically be completed upon the entry of the user carrying the portable authentication medium into the external authentication area. Accordingly, because it is possible to eliminate time-consuming tasks involved in a user manually executing the authentication operation at the external control panel, it is possible to reduce cumbersome tasks associated with the authentication operation.

{0036}

In addition, with a third aspect of the mechanical-parking-lot control method according to the present invention, in the first aspect, the predetermined authentication area is a remote authentication area formed at a location away from the storage/removal gateway.

{0037}

With the above-described configuration, the user authentication can automatically be completed upon the entry of the user carrying the portable authentication medium into the remote authentication area, in a mechanical parking lot in which the remote control panel is provided in a waiting room

or the like away from the storage/removal gateway. Then, a predetermined vehicle transporter can be retrieved while the authenticated user moves to the storage/removal gateway. Accordingly, a reduction in waiting time can be achieved, time-consuming tasks involved in the user manually performing the authentication operation at the external control panel can also be eliminated, and thus, cumbersome tasks associated with the authentication operation can be reduced.

{0038}

In addition, a fourth aspect of the mechanical-parking-lot control method according to the present invention includes, in one of the first to third aspects, internal authentication processing of, after the door-opening processing, recognizing that the same portable authentication medium as the one authenticated in the first and second external authentication processing is brought into an internal authentication area formed inside the entry bay; and internal-presence display processing of displaying the fact that the user is in the entry bay and that the portable authentication medium is in the entry bay on the external control panel.

{0039}

With the above-described control method, when the user who has been authenticated in the first and second external authentication processing is in the entry bay, the internal authentication processing is executed when the portable

authentication medium carried by this user is in the internal authentication area; the internal-presence display processing is executed in addition, and thus, the fact that the user is in the entry bay and that the portable authentication medium is in the entry bay is displayed on the external control panel. Because of this, for example, even if the next user who does not know the situation arrives while the user who has been authenticated first is charging an electric vehicle or the like in the entry bay, this user can recognize the presence of the user who has been authenticated first in the parking device by checking the external control panel.

{0040}

In addition, in the case in which the user leaves the portable authentication medium in the entry bay (inside a vehicle or the like), the presence of the portable authentication medium left in the internal authentication area is recognized and the internal-presence display processing is executed; moreover, because the portable authentication medium is not in the external authentication area, the door-closing operation of the storage/removal door cannot be performed at the external control panel; therefore, it is possible for the user to realize that he/she has left the portable authentication medium, to immediately return to the entry bay, and to perform the door-closing operation of the storage/removal door by returning to the area in front of the

external control panel again. Accordingly, the amount of time by which the door-closing operation of the storage/removal door is interrupted can be minimized, the waiting time for other users can be reduced, and thus, cumbersome tasks associated with the authentication operation can be reduced.

{0041}

In addition, a fifth aspect of the mechanical-parking-lot control method according to the present invention includes, in one of the first to fourth aspects, unauthorized-person-approach warning processing of, in the case in which an external sensing signal emitted from an external sensing sensor that detects a person approaching the vicinity of the external control panel is received, and the portable authentication medium also has not been authenticated in the external authentication area, issuing a warning by means of a warning means, on the condition that the reception of the external sensing signal continues for a predetermined amount of time or longer, and also of notifying a management system of the mechanical parking lot.

{0042}

With the above-described control method, for example, when an unauthorized person with a malicious intent, who does not have a portable authentication medium, approaches the vicinity of the external control panel or the storage/removal door to attempt illegal entry, this unauthorized person is

detected by the external sensing sensor, and the external sensing signal is emitted. The control means that has received this external sensing signal judges whether or not the portable authentication medium has been authenticated in the external authentication area; however, because the authentication has obviously not been performed, the control means issues a warning by means of the warning means after the reception of the external sensing signal has continued for the predetermined amount of time or longer, and also notifies the management system of the mechanical parking lot. Accordingly, an unauthorized person cannot stay in the vicinity of the external control panel and the storage/removal door, and thus, illegal entry to the parking device is prevented.

{0043}

In addition, a sixth aspect of the mechanical-parking-lot control method according to the present invention includes, in one of the first to fifth aspects, unauthorized-person-intrusion warning processing of, in the case in which an internal sensing signal emitted from an internal sensing sensor that detects a person or a vehicle entering the entry bay is received, and, additionally, the portable authentication medium has not been authenticated in the internal authentication area, issuing a warning by means of the warning means and also of notifying a management system of the mechanical parking lot; and user-state-confirmation

warning processing of, in the case in which the internal sensing signal is received, and, additionally, the portable authentication medium has been authenticated in the internal authentication area, issuing a warning by means of the warning means, on the condition that the reception of the internal sensing signal continues for a predetermined amount of time or longer, and also of notifying the management system of the mechanical parking lot.

{0044}

With the above-described control method, if an unauthorized person or another vehicle enters the interior of the entry bay when the storage/removal door is open, the internal sensing sensor detects this and emits the internal sensing signal. Upon receiving the internal sensing signal, the control means judges whether or not the portable authentication medium has been authenticated in the internal authentication area; however, because the authentication has obviously not been performed, the control means executes unauthorized-person-intrusion warning processing, thus issuing a warning by means of the warning means, and also notifies the management system of the mechanical parking lot. Accordingly, an unauthorized person or another vehicle is prevented from illegally entering the entry bay.

{0045}

On the other hand, in the case in which the internal

sensing signal is received, and, additionally, the portable authentication medium has been authenticated in the internal authentication area, on the condition that the reception of the internal sensing signal continues for the predetermined amount of time or longer, the control means executes the user-state-confirmation warning processing, thus issuing a warning by means of the warning means, and also notifies the management system of the mechanical parking lot. Accordingly, for example, even when an official user loses consciousness in the entry bay or when the user is unable to move for some reason, a person outside can quickly become aware of the situation and provide first-aid.

{0046}

In addition, a seventh aspect of the mechanical-parking-lot control method according to the present invention includes, in one of the first to sixth aspects, reservation processing of, in the case in which a second user carrying a portable authentication medium arrives and is standing by while a first user is performing an storing/removing operation, making a storage/removal reservation by judging whether this standby user is requesting to store a vehicle or requesting to remove a vehicle on the basis of authentication information in the portable authentication medium, at the point in time when the portable authentication medium carried by the standby user is brought into the external

authentication area.

{0047}

With the above-described control method, because the storage/removal reservation is made for the standby user while the first user is performing the storing/removing operation, even when there are many standby users, an order is determined and confusion can be avoided, the time required for authenticating the individual standby users can be reduced, and thus, smooth operation of the mechanical parking lot can be realized.

{0048}

In addition, an eighth aspect of the mechanical-parking-lot control method according to the present invention includes, in the seventh aspect, rearranging processing of, to the extent possible, replacing the vehicle transporter planned to be transported for the standby user to a position from which the vehicle transporter is most easily transported after the reservation processing, while the first user is storing/removing a vehicle.

{0049}

With the above-described control method, because the vehicle transporter to be transported for the standby user is replaced to a location from which it is most easily transported, while the first user is storing/removing the vehicle, it is possible to considerably reduce the time

required for the subsequent storage/removal, and thus, it is possible to reduce cumbersome tasks associated with the storing/removing operation.

{0050}

In addition, a mechanical parking lot according to the present invention is controlled by a mechanical-parking-lot control method according to one of the first to eighth aspects. With such a mechanical parking lot, because only the user who has originally performed the user authentication can perform the series of tasks related to storing/removing a vehicle, it is possible to prevent an unauthorized person or another vehicle from entering, and also to reliably prevent the storage/removal door from being closed in a state in which a person remains in the entry bay.

{Advantageous Effects of Invention}

{0051}

As described above, a control apparatus for a mechanical parking lot, a control method therefor, and a mechanical parking lot according to the present invention enable only the user who has originally performed user authentication to perform a series of tasks including opening a storage/removal door, storing/removing a vehicle, and closing the storage/removal door; a safe operation by preventing the entry by an unauthorized person and another vehicle, as well as by reliably preventing a storage/removal door from being closed

in a state in which a person remains in an entry bay; and a reduction of cumbersome tasks associated with the authentication operation.

{Brief Description of Drawings}

{0052}

{Fig. 1} Fig. 1 is a longitudinal sectional view showing an example of a mechanical parking lot to which a control apparatus and a control method according to the present invention can be applied.

{Fig. 2} Fig. 2 is a perspective view of the vicinity of a storage/removal gateway showing a state in which a storage/removal door is closed.

{Fig. 3} Fig. 3 is a perspective view of the vicinity of the storage/removal gateway showing a state in which the storage/removal door is open and a vehicle is in the process of being stored.

{Fig. 4} Fig. 4 is a perspective view showing a state in which a vehicle has been stored a parking device.

{Fig. 5} Fig. 5 is a diagram showing, in outline, the configuration of a mechanical-parking-lot control apparatus according to a first embodiment of the present invention.

{Fig. 6} Fig. 6 is a plan view showing the positional relationship among an entry bay, a storage/removal gateway (storage/removal door), a control panel, and so forth.

{Fig. 7} Fig. 7 is a plan view showing the procedure for

storing a vehicle to the mechanical parking lot.

{Fig. 8} Fig. 8 is a plan view showing the procedure for removing a vehicle from the mechanical parking lot.

{Fig. 9} Fig. 9 is a diagram showing the first half of a flowchart for the control method according to the present invention.

{Fig. 10} Fig. 10 is a diagram showing the second half of the flowchart for the control method according to the present invention.

{Fig. 11} Fig. 11 is a diagram showing, with a flowchart, a control method of internal authentication processing and internal-presence display processing.

{Fig. 12} Fig. 12 is a diagram showing, with a flowchart, a control method of unauthorized-person-approach warning processing.

{Fig. 13} Fig. 13 is a diagram showing, with a flowchart, a control method of the unauthorized-person-intrusion warning processing and user-state-confirmation warning processing.

{Fig. 14} Fig. 14 is a diagram showing, with a flowchart, a control method of reservation processing and rearranging processing.

{Fig. 15} Fig. 15 is a plan view of a mechanical parking lot, showing a second embodiment of the present invention.

{Fig. 16} Fig. 16 is a plan view showing the procedure for storing a vehicle to a mechanical parking lot, showing a third

embodiment of the present invention.

{Fig. 17} Fig. 17 is a plan view showing the procedure for removing a vehicle from the mechanical parking lot, showing the third embodiment of the present invention.

{Description of Embodiments}

{0053}

[First Embodiment]

A first embodiment of the present invention will be described below with reference to the drawings. Note that, the present invention is widely applicable to mechanical parking lots so long as they allow a vehicle 2 to be parked in a parking space formed inside a storage/removal gateway 3 that is opened and closed by a storage/removal door 12, and it is not limited only to a multistory parking lot using an elevator system, described below.

{0054}

Fig. 1 is a perspective view showing an example of a mechanical parking lot to which a control apparatus according to the present invention can be applied. This mechanical parking lot 1 is a multistory parking lot facility that uses an elevator system, that can accommodate a plurality of vehicles 2, that is provided in, for example, an office building, an apartment building, or the like, and that permits only contracted users store/remove vehicles.

{0055}

The mechanical parking lot 1 is provided with a parking tower 4 in which a storage/removal gateway 3 through which the vehicle 2 enters and exits is provided at a portion above ground; a ground level inside the parking tower 4 serves as an entry bay 5; and a turntable 7 that changes the direction of the vehicle 2 is installed on the floor thereof. The configuration of the turntable 7 is such that a turning plate 9 and a turning drive portion 10 (an electric motor, a gear mechanism, and so forth) are provided in a depressed pit 8 formed in the floor of the entry bay 5.

{0056}

As also shown in Fig. 2, the storage/removal gateway 3 is provided with the storage/removal door 12, and by opening the storage/removal door 12, the vehicle 2 can be stored in the entry bay 5 from the storage/removal gateway 3, as shown in Figs. 3 and 4. As shown in Figs. 1 to 3, as well as Fig. 5, an external control panel 14 for performing start-up operation of the mechanical parking lot 1 and opening/closing operation of the storage/removal door 12 is installed at an external wall surface of parking tower 4 in the vicinity of the storage/removal door 12 on the outside thereof, and a storage control lamp 15 is provided above the storage/removal gateway 3. The storage control lamp 15 changes from red to green when the storage/removal door 12 is opened and the vehicle 2 can advance therethrough. In addition, an external sensing sensor

17 is provided at an external wall surface above the storage/removal gateway 3. Furthermore, as shown in Figs. 1, 4, and 5, an internal control panel 19 for performing a charging operation or the like of an electric vehicle 2, as well as an internal sensing sensor 21 are provided inside the entry bay 5 at a wall surface at the back side thereof, and a storage-position indicating board 22 and a mirror 23 are provided at positions that directly face the vehicle 2 that has stored in the entry bay. The external sensing sensor 17 and the internal sensing sensor 21 are, for example, motion sensors.

{0057}

As shown in Fig. 1, a vertical ascending/descending pathway 26 is formed at a center portion of the parking tower 4, and an elevator-like transport platform 27 is provided thereinside so that it can ascend and descend in the up/down direction. The transport platform 27 is carried at four corners thereof by, for example, a plurality of wire ropes 28 extending downward from a winch (not shown) provided at the top of the parking tower 4, and, by activating the above-described winch, the transport platform 27 can ascend and descend inside the ascending/descending pathway 26 in the up/down direction.

{0058}

On both sides of the ascending/descending pathway 26,

vehicle-accommodating shelves 30 are provided so as to form multiple levels in the top-to-bottom direction flanking the ascending/descending pathway 26. Each vehicle-accommodating shelf 30 accommodates one pallet 31 (vehicle transporter) made of a pressed steel plate for loading the vehicle 2. Note that, support pillars and so forth of the vehicle-accommodating shelves 30 are omitted in the drawings. Floors of the transport platform 27 and the vehicle-accommodating shelves 30 are provided with transfer mechanisms (not shown) that make it possible to transfer a vacant pallet 31 or a pallet 31 loaded with the vehicle 2 in both directions between the transport platform 27 and a vehicle-accommodating shelf 30, when the heights of the floors of the two, that is 27 and 30, are flush with each other.

{0059}

When storing a vehicle 2 in this mechanical parking lot 1, the pallet 31 of a vehicle-accommodating shelf 30 on which no vehicle 2 is accommodated is retrieved onto the turntable 7 (turning plate 9) of the entry bay 5 by means of the transport platform 27. The vehicle 2 coming through the storage/removal gateway 3 stops on the pallet 31 placed on the turntable 7, and, subsequently, the turntable 7 turns in the entry bay 5, and the direction of the vehicle 2 is changed together with the pallet 31 so that the orientation thereof becomes parallel to the orientation of the vehicle-accommodating shelf 30. The

pallet 31 whose direction has been changed is transported upward by the transport platform 27, is positioned at the height of the vehicle-accommodating shelf 30 in which no vehicle 2 is accommodated, and is moved in a sliding manner from the floor of the transport platform 27 to the floor of the vehicle-accommodating shelf 30. By doing so, the vehicle 2 is accommodated on the vehicle-accommodating shelf 30 together with the pallet 31.

{0060}

When removing a vehicle, the transport platform 27 ascends to and stops at the height of the vehicle-accommodating shelf 30 on which the vehicle 2 to be removed is accommodated; the vehicle 2 accommodated on the vehicle-accommodating shelf 30 is transferred to the transport platform 27 together with the pallet 31; the transport platform 27 descends to the entry bay 5 where the pallet 31 and the vehicle 2 are placed on the turntable 7; and the vehicle 2 is removed after the direction thereof is changed by the turntable 7 so as to face the direction of the storage/removal gateway 3.

{0061}

Note that this mechanical parking lot 1 is equipped with charging devices 34, electric vehicles 2E that travel by means of motive power provided by electric motors can be parked in addition to general vehicles 2 that travel by means of motive

power provided by internal combustion engines, and vehicle-installed batteries can be charged by using the charging devices 34 after transporting the electric vehicles 2E to the vehicle-accommodating shelves 30. The charging devices 34 are provided with power receivers 35 installed in the pallets 31 and power transmitters 36 that are installed in the individual vehicle-accommodating shelves 30 and that supply power to the power receivers 35 from an external power source (commercial power source) by coming into contact with the power receivers 35.

{0062}

The power receivers 35 are installed at top surfaces of curb portions provided at both side edges of the pallets 31 in an upright manner. They are disposed at diagonal positions on the rectangular pallets 31, for example, at the front end of one of the left and right curb portions and at the rear end of the other one of the left and right curb portions. The power receivers 35 may be installed at a greater number of positions in the curb portions. The power receivers 35 are provided with outlet portions (not shown) into which charging cables of the electric vehicles 2E are inserted, and, in the case in which the vehicle-installed batteries need to be charged while the electric vehicles 2E are parked, after the electric vehicles 2E are taken into the entry bay 5, users (drivers) connect charging-cable connecting portions (not shown)

provided in vehicle bodies of the electric vehicles 2E to the outlet portions of the power receivers 35 via the charging cables.

{0063}

On the other hand, the power transmitters 36 are secured to floor slabs or the like of the vehicle-accommodating shelves 30; when the pallets 31 are moved onto the vehicle-accommodating shelves 30 in a sliding manner, contact terminals (not shown) provided in the power transmitters 36 are pressed into contact with contact terminals (not shown) of the power receivers 35 provided in the pallets 31; and the power is supplied from the external power source to the power transmitters 36 → the power receivers 35 → the charging cables → the electric vehicles 2E, in this order. When removing the electric vehicles 2E, the users disengage and retract the charging cables when the electric vehicles 2E are brought down to the entry bay 5, and then the electric vehicles 2E are removed therefrom. Note that, although the power transmitters 36 are provided in all vehicle-accommodating shelves 30 and pallets 31 in the case of Fig. 1, they may be provided only in some of them.

{0064}

The thus-configured mechanical parking lot 1 is controlled by a control apparatus 40 and a control method according to the present invention. Fig. 5 is a diagram

showing, in outline, the configuration of the control apparatus 40, and Fig. 6 is a plan view of the entry bay 5. The control apparatus 40 includes a main control portion 41 (control means), which is a CPU. In addition, a user database 42, a storage/removal door opening/closing control portion 43, and a transport-platform ascending/descending control portion 44 are connected to the main control portion 41, and they are centrally controlled by the main control portion 41. Also, the main control portion 41 includes an authentication verifying portion 46. The user database 42 stores IDs of contracted users, storage/removal records of vehicles they own, and so forth.

{0065}

The storage/removal door opening/closing control portion 43 is connected to a storage/removal door opening/closing mechanism 48 that opens and closes the storage/removal door 12 and a storage/removal door position sensor 49 that detects the open position and the closed position of the storage/removal door 12 and feeds them back to the storage/removal door opening/closing control portion 43. In addition, the transport-platform ascending/descending control portion 44 is connected to a transport-platform ascending/descending mechanism 51 that causes the transport platform 27 to ascend and descend, as well as to a transport-platform position sensor 52 that detects the position of the transport platform

27 and feeds it back to the transport-platform ascending/descending control portion 44. The external control panel 14, the internal control panel 19, the external sensing sensor 17, and the internal sensing sensor 21 are also connected to the main control portion 41. In addition, although not illustrated, the main control portion 41 is connected to a turntable driving mechanism that drives the turntable 7, as well as to a turntable position sensor that detects the position of the turntable 7 and feeds it back to the turntable driving mechanism.

{0066}

The external control panel 14 is manually operated or remotely operated (remote controlled) by a user and performs the user authentication operation, the start-up operation of mechanical parking lot 1, the opening/closing operation of the storage/removal door 12, and so forth. As shown in Figs. 2, 3, and 5, the external control panel 14 is provided with, for example, an operation display screen 56 using a liquid-crystal touch screen system, an IC card reader 57, an announcement loudspeaker 58 (also serves as a warning means), a remote-controller sensing portion 59, an emergency stop button 60, an external-authentication-area antenna 61 (external-authentication-area forming means), and so forth. In this case, the external-authentication-area antenna 61 is integrally provided in the external control panel 14; however,

it may be disposed separately from the external control panel 14.

{0067}

The external-authentication-area antenna 61 forms an external authentication area A1 in a limited area in the vicinity (near the front side) of the external control panel 14 (see Figs. 2, 5, and 6). As described later, this external authentication area A1 is an area for recognizing the portable authentication medium 70 carried by the user.

{0068}

In addition, the external sensing sensor 17 forms an external sensing area A2 over a predetermined area near the front side of the external control panel 14 and the storage/removal gateway 3. The external sensing area A2 is an area for detecting a person approaching the area near the external control panel 14 and the storage/removal gateway 3. In this embodiment, the area of the external authentication area A1 formed by the external-authentication-area antenna 61 is smaller than the external sensing area A2 formed by the external sensing sensor 17, and the external authentication area A1 is arranged so as to fall within the area of the external sensing area A2; however, the sizes (areas) and the positions of the external authentication area A1 and the external sensing area A2 can be appropriately set and adjusted in accordance with the configuration and the usage of the

mechanical parking lot 1.

{0069}

On the other hand, the internal control panel 19 is an control panel mainly for the user to perform a charging operation for the electric vehicle 2E inside the entry bay 5 and is provided with, as with the external control panel 14, an operation display screen 64 using a touch screen system, an announcement loudspeaker 65 (also serves as a warning means), and an internal-authentication-area antenna 66 (internal-authentication-area forming means). Although the internal-authentication-area antenna 66 is integrally provided in the internal control panel 19, it may be disposed separately from the internal control panel 19. The internal-authentication-area antenna 66 forms an internal authentication area B1 in a front region inside the entry bay 5 (see Figs. 4 to 6). As described later, the internal authentication area B1 is an area for recognizing the portable authentication medium 70 carried by the user. Although the size of the internal authentication area B1 is assumed to fall within in an area closer to the back side of the entry bay 5, it may be formed over a greater area.

{0070}

In addition, the internal sensing sensor 21 forms an internal sensing area B2 inside the entry bay 5. The internal sensing area B2 is an area for detecting entry into the entry

bay 5 by a person or a vehicle 2. The internal sensing sensor 21 is not limited to one location, and it may be provided at multiple locations. Effectively, in order to realize simple and reliable sensing, it is preferable that a plurality of photodetectors be provided as the internal sensing sensors 21 in diagonal positions of the entry bay 5. In this embodiment, the size of the internal sensing area B2 is assumed to cover the entire area inside the entry bay 5, and the internal authentication area B1 is arranged so as to be included in the area of the internal sensing area B2; however, it is assumed that the sizes (areas) and the positions of the internal authentication area B1 and the internal sensing area B2 can appropriately be set and adjusted in accordance with the internal layout of the entry bay 5, the usage, and so forth.

{0071}

The portable authentication medium 70 that stores authentication information specific to the user himself/herself is lent to the user, and the user is required to be carrying it when using the mechanical parking lot 1. The portable authentication medium 70 is formed, for example, in the form of a tag or something like a key holder, and is carried together with the vehicle key or carried in a briefcase, a bag, and so forth. The portable authentication medium 70 has a built-in battery and emits a unique radio wave signal. Note that the portable authentication medium 70 may

be attached to a cellular phone or the function of the portable authentication medium 70 may be installed in the cellular phone. However, it is essential that the portable authentication medium 70 moves together with the user's body, and, for example, the user must not get out of the vehicle with the portable authentication medium 70 left inside the parked vehicle.

{0072}

Note that in the case in which, as with this mechanical parking lot 1, the mechanical parking lot 1 is provided in an office building, an apartment building, or the like, and several people from a certain office or household in an apartment building store/remove the same vehicle in/from the mechanical parking lot 1, these several people may share a single portable authentication medium 70; however, it is preferable that each person separately carry portable authentication media 70 storing different user identification information. By doing so, even if multiple persons in the vehicle separately carry the portable authentication media 70, by restricting the person performing the opening/closing operation of the storage/removal door 12 to one person, it is possible to prevent, for example, an error caused by different persons performing the door-opening operation and the door-closing operation.

{0073}

As shown in Figs. 5 and 6, when the portable authentication medium 70 carried by the user is brought into the external authentication area A1 formed near the external control panel 14, it is detected by the external-authentication-area antenna 61; the external-authentication-area antenna 61 emits an external authentication signal SIG. 1 on the basis of the user-specific authentication information stored in the portable authentication medium 70; and the main control portion 41 receives this external authentication signal SIG. 1. By receiving the external authentication signal SIG. 1 in this way, the main control portion 41 automatically performs authentication of the user and permits the user to operate the external control panel 14.

{0074}

The remote control of the external control panel 14 may be enabled by adding a remote controller function to the portable authentication medium 70 and by making the presence of the portable authentication medium 70 in the external authentication area A1 as well as continuous recognition thereof by the main control portion 41 essential conditions. By doing so, after stopping the vehicle 2 in front of the storage/removal gateway 3 when storing/removing the vehicle 2, without getting out of the vehicle 2, the user can be automatically authenticated by allowing the portable authentication medium 70 he/she is carrying to be recognized

in the external authentication area A1, and the user can also remotely control the external control panel 14 by using the remote controller function of the portable authentication medium 70. The remote controller signal transmitted from the portable authentication medium 70 is sensed by the remote-controller sensing portion 59 of the external control panel 14.

{0075}

In this way, by enabling the remote control of the external control panel 14 by adding the remote controller function to the portable authentication medium 70, it is possible to eliminate time-consuming task of the user getting out of the vehicle 2 to perform the authentication and the opening/closing operation of the storage/removal door 12, as well as to reduce the cumbersome task associated with the authentication operation and the storing/removing operation. Additionally, because this remote control of the external control panel 14 via the portable authentication medium 70 cannot be performed from an area other than the external authentication area A1, it is not possible for the user to close the storage/removal door 12 from a remote position that is too far to check the interior of the entry bay 5. Accordingly, it is possible to prevent a person remaining inside the entry bay 5 from being overlooked, and thus, it is possible to realize a safe operation of the mechanical parking

lot 1. In addition, because the operation from an area other than the external authentication area A1 is not possible even when two or more vehicles are waiting in a line in front of the mechanical parking lot 1 to perform the storing operation, it is possible to prevent switching of the storage order.

{0076}

On the other hand, when a person or a vehicle 2 enters the external sensing area A2, the external sensing sensor 17 detects this and emits an external sensing signal SIG. 2 to the main control portion 41. In addition, when the portable authentication medium 70 carried by the user is brought into the internal authentication area B1 formed in a front region inside the entry bay 5, the internal-authentication-area antenna 66 detects this, and emits an internal authentication signal SIG. 3 on the basis of the user-specific authentication information stored in the portable authentication medium 70. Furthermore, when a person or a vehicle 2 enters the internal sensing area B2 formed over the entire interior of the entry bay 5, the internal sensing sensor 21 detects this, and emits an internal sensing signal SIG. 4 to the main control portion 41.

{0077}

On the condition that the external authentication signal SIG. 1 is being received, the main control portion 41 permits the user to operate the external control panel 14 retrieves

the pallet 31, thus allowing the user to perform tasks such as door-opening and door-closing of the storage/removal door 12. Specifically, when the user carrying the portable authentication medium 70 enters the external authentication area A1 formed near the external control panel 14, the external-authentication-area antenna 61 detects the portable authentication medium 70 and emits the external authentication signal SIG. 1 on the basis of the authentication information specific to the portable authentication medium 70, and the main control portion 41 that has received this external authentication signal SIG. 1 permits the user carrying the portable authentication medium 70 to operate the external control panel 14. In this way, the person who can operate the external control panel 14 is restricted only to the user who has performed authentication while carrying the portable authentication medium 70.

{0078}

The procedure for storing a vehicle 2 in the mechanical parking lot 1 configured as above, as well as the control and operation of the mechanical parking lot 1, will be described below. The storing procedure is shown by numbers (1) to (7) in Fig. 7. Note that, here, a case in which the vehicle to be stored is an electric vehicle 2E that requires charging of a vehicle-installed battery will be described.

{0079}

First, a user (driver of the electric vehicle 2E) stops the electric vehicle 2E in front of the storage/removal gateway 3 (storage/removal door 12); if there is any passenger, allows the passenger to get out of the vehicle; folds the door mirrors; and retracts the antenna (1). Next, the user gets out of the electric vehicle 2E and approaches the external control panel 14 (2). During (1) and (2) described above, when the portable authentication medium 70 carried by the user is brought into a predetermined authentication area, for example, the external authentication area A1 in this case, the external-authentication-area antenna 61 recognizes it, the external-authentication-area antenna 61 emits the external authentication signal SIG. 1, the user ID is verified at the authentication verifying portion 46 (see Fig. 5) of the main control portion 41 that has received this external authentication signal SIG. 1, and user authentication (first external authentication processing) is performed if the user is an officially contracted user of the mechanical parking lot 1. This user authentication is performed entirely automatically.

{0080}

In the case in which the external authentication area A1 is formed large enough to cover also the driver's seat of the vehicle, the user authentication can be performed without requiring the user to get out of the vehicle, and, in addition

to this, as described later, by making it possible to operate the external control panel 14 from the vehicle by adding a remote controller function to the portable authentication medium 70, convenience can be enhanced. In contrast, if the area of the external authentication area A1 is intentionally made small, thus making impossible for the user to be automatically authenticated via the portable authentication medium 70 unless he/she gets out of the vehicle, because the user temporarily moves away from the vehicle and returns again to get into the vehicle, naturally, this makes it possible to for the user to check the safety in the surroundings of the vehicle, and thus, it is possible to make the user aware of a dangerous situation, for example, that a child is near the vehicle or the like, thus making it possible to perform the operation safely. It is possible to appropriately set the area of the external authentication area A1 by adjusting the capacity of the external-authentication-area antenna 61.

{0081}

Then, the user is permitted to operate the external control panel 14, on the condition that the first external authentication processing has been completed in this way and the main control portion 41 is continuing to receive the external authentication signal SIG. 1. Specifically, for example, an authentication input screen (not shown), such as a numerical keypad or the like, is displayed on the operation

display screen 56 of the liquid-crystal external control panel 14, and a text display on the operation display screen 56 and audio from the loudspeaker 58 prompt the user to perform the authentication operation by inputting the identification number via the numerical keypad, or touching a special IC card against the IC card reader 57. Therefore, it is not possible for an unauthorized person who has not performed authentication via the portable authentication medium 70 to operate the operation display screen 56 (numerical keypad or the like are not displayed by the liquid crystal display).
{0082}

When the user performs the authentication operation at the external control panel 14, user authentication is performed again at the authentication verifying portion 46 of the main control portion 41. At this time, if the authentication details input by the user are not correct, an error is indicated by the text display on the operation display screen 56 and the audio from the loudspeaker 58, the storing operation by this user is cancelled, and the storing/removing operation of the next user is accepted (cancelling processing). The authentication is performed again by requiring the user to operate the external control panel 14 in this way so that, for example, when an officially contracted user loses the portable authentication medium 70 and an unauthorized person finds and attempts to misuse this

portable authentication medium 70, the storage/removal door 12 is prevented from being opened, thus allowing that person to enter without going through this process.

{0083}

When the authentication input operation at the external control panel 14 is successfully performed, a start-up button (not shown) is displayed on the operation display screen 56 next, and, when the user presses (touches) this start-up button, a predetermined pallet 31 is retrieved to the entry bay 5 (transport retrieval processing). At this time, as shown in Fig. 5, the main control portion 41 automatically judges whether the user is requesting to store a vehicle or requesting to remove a vehicle on the basis of the storage/removal records stored in the user database 42 connected to the main control portion 41. In this way, when storing a vehicle, a vacant pallet 31 that is not loaded with a vehicle 2 is retrieved to the entry bay 5. While this retrieval is in progress, "retrieving" is displayed on the operation display screen 56 of the external control panel 14.

{0084}

After the vacant pallet 31 has arrived at the entry bay 5, the main control portion 41 recognizes that the same external authentication signal SIG. 1 as the external authentication signal SIG. 1 authenticated during the first external authentication processing is being received again,

that is to say, that the portable authentication medium 70 belonging to the same user as the user who has been authenticated in the first external authentication processing is in the external authentication area A1 again (second external authentication processing). Here, in the case in which the portable authentication medium 70 is not in the external authentication area A1, an error is indicated by means of text display on the operation display screen 56 and audio from the loudspeaker 58, and the user is also instructed to return to the area in front of the external control panel 14. However, if the user does not return to the area in front of the external control panel 14 and the main control portion 41 cannot receive the external authentication signal SIG. 1 again, the storing operation by this user is cancelled after a predetermined amount of time (for example, 1 minute) has passed, and the storing/removing operation of the next user is accepted.

{0085}

If the user is in front of the external control panel 14 and the main control portion 41 receives the external authentication signal SIG. 1 again, it is subsequently judged whether or not the portable authentication medium 70 recognized during each of the first external authentication processing and the second external authentication processing is the same (first verification processing). Then, on the

condition that this first verification processing results in an affirmative judgment, that is, on the condition that the same user as the user authenticated in the first external authentication processing is in the external authentication area A1 (facing the external control panel 14), the storage/removal door 12 is automatically opened or an open button (not shown) is displayed on the operation display screen 56 and the storage/removal door 12 is opened by the user pressing the open button (door-opening processing).

{0086}

Together with the opening of the storage/removal door 12, the storage control lamp 15 shown in Fig. 2 changes from red to green. Note that, if the first verification processing results in a negative judgment, that is, if the user authenticated in the first external authentication processing is not in the external authentication area A1 or if another user is in the external authentication area A1, an error occurs, details of that error are displayed on the operation display screen 56 of the external control panel 14, and an audio announcement is also made via the loudspeaker 58. Then, the storing operation of this user is cancelled after a predetermined amount of time (for example, 1 minute) has passed in this state, and the storing/removing operation of the next user is accepted (cancelling operation).

{0087}

As described above, because the storage/removal door 12 is opened after the pallet 31 arrives at the entry bay 5, on the condition that the same portable authentication medium 70 as the one that has been authenticated in first external authentication processing is in the external authentication area A1, the storage/removal door 12 does not open unless the user carrying this portable authentication medium 70 is in the external authentication area A1. Accordingly, for example, even if the user who retrieved the pallet 31 leaves the vicinity of the storage/removal door 12 for some reason, it is possible to prevent, during this time, an unauthorized person or another user who has not been authenticated from opening the storage/removal door 12, as well as to prevent the unauthorized person, another user, or another vehicle from entering the entry bay 5. Note that, if the user who retrieved the pallet 31 remains absent and does not return, the storing operation by this user is cancelled after a predetermined amount of time (for example, 1 minute) has passed, and the storing/removing operation by the next user is accepted (cancelling processing).

{0088}

As shown in Fig. 7, once the door-opening operation of the storage/removal door 12 is completed in this way, the user gets into the electric vehicle 2E again (3). Then, he/she drives the electric vehicle 2E forward to pass through the

storage/removal gateway 3 that has been opened, thus causing the electric vehicle 2E to enter the entry bay 5 and get on the pallet 31 (4). At this time, the user adjusts the front, rear, left, and right positions of the electric vehicle 2E by viewing an indication shown by an indicator lamp, such as "advance", "stop", or "pull back", on the storage-position indicating board 22 shown in Fig. 4 and also by checking the position of the electric vehicle 2E reflected in the mirror 23, thus stopping the electric vehicle 2E at a prescribed position on the pallet 31, and the user gets out of the electric vehicle 2E after engaging the parking brake.

{0089}

Next, the user connects a charging-cable connecting portion formed in the vehicle body of the electric vehicle 2E and an outlet portion of power receiver 35 provided in the pallet 31 with a charging cable and approaches the internal control panel 19 in the entry bay 5 (5). At this time, because the portable authentication medium 70 carried by the user is brought into the internal authentication area B1 formed in a region in a front region inside the entry bay 5, the internal-authentication-area antenna 66 detects this and emits an internal authentication signal SIG. 3, as described above. When the main control portion 41 receives this internal authentication signal SIG. 3, the main control portion 41 recognizes that the same portable authentication

medium 70 as the one that has been authenticated in the first and second external authentication processing is brought into the internal authentication area B1 (internal authentication processing).

{0090}

With the execution of the internal authentication processing, re-authentication of the user is completed, and the user is permitted to operate the internal control panel 19. Specifically, a numerical keypad and charging reservation buttons are displayed on the operation display screen 64 of the internal control panel 19, and, by touching these, the user sets the type of charging (normal charging or rapid charging), charging time, and so forth, thus completing the charging reservation. The actual charging is started after the pallet 31 is transported upward by the transport platform 27 and is accommodated on a predetermined vehicle-accommodating shelf 30. By executing this internal authentication processing, even if an unauthorized person who has not performed authentication in the external authentication area A1 has intruded into the entry bay 5, it is impossible for that person to operate the operation display screen 56 of the internal control panel 19.

{0091}

Next, the user leaves the entry bay 5 and performs the door-closing operation at the external control panel 14 (6).

At this time, it is re-confirmed that the portable authentication medium 70 is in the external authentication area A1 (third external authentication processing). Then, it is judged whether or not the portable authentication medium 70 that is recognized in this third external authentication processing is the same as the one recognized in the first and second external authentication processing (second verification processing). On the condition that this second verification processing results in an affirmative judgment, a close button is displayed on the operation display screen 56 of the external control panel 14.

{0092}

Because the close button is displayed on the operation display screen 56 in this way, on the condition that the same portable authentication medium 70 is authenticated in the first to third external authentication processing and, additionally, that this portable authentication medium 70 is in the external authentication area A1, the storage/removal door 12 will not be closed unless the user carrying this portable authentication medium 70 is in the vicinity of the external control panel 14. In other words, the user who can perform the door-closing operation is restricted to the same user as the user who has performed the door-opening operation. Because of this, while the user who has entered the entry bay 5 still remains therein, the storage/removal door 12 will not

be closed by another user who operates the external control panel 14 without knowing about the presence of the user.

Accordingly, it is possible to safely operate the mechanical parking lot 1 by reliably preventing the storage/removal door 12 from being closed in the state in which a person remains in the entry bay 5. At the same time, it is possible to prevent the portable authentication medium 70 from being left inside the vehicle.

{0093}

Note that, if the user who has finished storing a vehicle starts to leave, forgetting to perform the door-closing operation of the storage/removal door 12, although the portable authentication medium 70 brought out of the entry bay 5 temporarily enters the external authentication area A1, it is brought out of the external authentication area A1 without remaining therein; therefore, by detecting this and by giving an instruction to close the storage/removal door 12 via audio from the loudspeaker 58, it is possible to prevent someone forgetting to close the storage/removal door 12.

{0094}

Once the affirmative judgment in the second verification processing causes the close button to be displayed on the operation display screen 56, the user closes the storage/removal door 12 by pressing the close button. The condition at this time is that the portable authentication

medium 70 is in the external authentication area A1 until the storage/removal door 12 is completely closed. In other words, because the main control portion 41 cannot receive the external authentication signal SIG. 1 if the user who has pressed the close button leaves the external authentication area A1 before the storage/removal door 12 is completely closed, the storage/removal door 12 is immediately reopened and the user is instructed via the loudspeaker 58 to return to the area in front of the external control panel 14. Once the storage/removal door 12 is completely closed, the user can leave the mechanical parking lot 1 (7). Note that, when the second verification processing results in a negative judgment, for example, when another user is in front of the external control panel 14 and a different portable authentication medium 70 is recognized, an error is indicated by text display on the operation display screen 56 and audio from the loudspeaker 58.

{0095}

Once the storage/removal door 12 is closed, the turntable 7 changes direction so that the orientation of the pallet 31 is parallel to the orientation of the vehicle-accommodating shelf 30. Subsequently, the pallet 31 is lifted by the transport platform 27, is accommodated on a predetermined vehicle-accommodating shelf 30 located above, and charging is started.

{0096}

Note that, in the case in which the remote controller function is added to the portable authentication medium 70, it is not necessary to get out of the vehicle 2 and to get into it again in steps (2) and (3), the start-up (retrieval of the pallet 31) and door-opening operations of the storage/removal door 12 can be performed by the user once he/she is authenticated upon entering the external authentication area A1 while remaining in the vehicle and subsequently operating the portable authentication medium 70 to remotely operate the external control panel 14. Accordingly, it is possible to further reduce cumbersome tasks associated with the removing operation.

{0097}

As in (4) and (5) above, when the user who is carrying the portable authentication medium 70 and who has been authenticated in the external authentication area A1 is in the entry bay 5, the above-described internal authentication processing is performed, and, at the same time, the fact that the user is inside the entry bay 5 and that the portable authentication medium 70 is inside the entry bay 5 is displayed on the operation display screen 56 of the external control panel 14 (internal-presence display processing). Because of this, for example, even if a second user who does not know the situation arrives while the user who has been

authenticated first is preparing for the charging of the electric vehicle 2E or the like in the entry bay 5, this user can recognize that a person (the user who has been authenticated first) is in the entry bay 5 by checking the external control panel 14.

{0098}

In addition, also when the user leaves the portable authentication medium 70 in the entry bay 5 (inside the vehicle, or the like), the portable authentication medium 70 left therein is recognized by the internal-authentication-area forming means, the internal-presence display processing is executed, and thus, the fact that the portable authentication medium 70 is in the entry bay 5 is displayed on the external control panel 14; moreover, because the portable authentication medium 70 is not in the external authentication area A1, it is not possible to perform the door-closing operation of the storage/removal door 12 via the external control panel 14; and therefore, it is possible for the user to immediately return to the entry bay 5 to retrieve the portable authentication medium 70 by realizing that he/she has left it therein, and to perform the door-closing operation of the storage/removal door 12 by coming to the area in front of the external control panel 14 again. Accordingly, it is possible to minimize the amount of time during which the door-closing operation of the storage/removal door 12 is

interrupted, to reduce the waiting time for other users, and to reduce cumbersome tasks associated with the authentication operation.

{0099}

As described above, the external sensing sensor 17 forms the external sensing area A2 over the predetermined area in the vicinity of the external control panel 14 and the storage/removal gateway 3 on the front side thereof (see Figs. 5 and 6), and emits the external sensing signal SIG. 2 by detecting the entry of a person or a vehicle into this external sensing area A2. The main control portion 41 performs control so that whether or not the portable authentication medium 70 is authenticated in the external authentication area A1 is judged upon receiving this external sensing signal SIG. 2; so that, if it is not authenticated therein, a warning is issued via the warning means, on the condition that the reception of the external sensing signal SIG. 2 has continued for a predetermined amount of time (for example, 3 minutes) or longer; and so that unauthorized-person-approach warning processing is also performed to notify the management system of the mechanical parking lot 1.

{0100}

With the above-described control method, for example, when an unauthorized person with a malicious intent who does not have a portable authentication medium 70 approaches the

vicinity of the external control panel 14 or the storage/removal door 12 to attempt illegal entry, this unauthorized person is detected by the external sensing sensor 17, and the external sensing signal SIG. 2 is emitted. The main control portion 41 that has received this external sensing signal SIG. 2 judges whether or not the portable authentication medium 70 has been authenticated in the external authentication area A1 (whether or not the external authentication signal SIG. 1 has been received). However, because the authentication has obviously not been performed, the unauthorized-person-approach warning processing is executed after the reception of the external sensing signal SIG. 2 alone has continued for the predetermined amount of time or longer, and the management system is notified by issuing audio and visual warnings via the loudspeaker 58, a rotating lamp (not shown), or the like. Accordingly, it is possible to prevent illegal intrusion into the entry bay 5, burglary of vehicles, vehicle theft, and so forth by deterring an unauthorized person from remaining in the vicinity of the external control panel 14 and the storage/removal door 12 for a long time.

{0101}

On the other hand, when the internal sensing sensor 21 detects that a person or a vehicle 2 has entered the internal sensing area B2 formed inside the entry bay 5, it emits an

internal sensing signal SIG. 4 to the main control portion 41. The main control portion 41 performs control so that whether or not the portable authentication medium 70 has been authenticated in the internal authentication area B1 is judged upon receiving the internal sensing signal SIG. 4; so that, if it is not authenticated therein, a warning is issued via the warning means; and so that the unauthorized-person-intrusion warning processing is also performed to notify the management system of the mechanical parking lot 1.

{0102}

With the above-described control method, assuming that the storage/removal door 12 is open and an unauthorized person or another vehicle 2 enters the entry bay 5 when the user who has been authenticated via the portable authentication medium 70 is not in the entry bay 5, the internal sensing sensor 21 detects this and emits the internal sensing signal SIG. 4. Upon receiving the internal sensing signal SIG. 4, the main control portion 41 judges whether or not the portable authentication medium 70 has been authenticated in the internal authentication area B1 (whether or not the internal authentication signal SIG. 3 has been received). However, because the authentication has obviously not been performed, the unauthorized-person-intrusion warning processing is executed after the reception of the internal sensing signal SIG. 4 alone has continued for the predetermined amount of

time or longer; audio and visual warnings are issued via the loudspeakers 58 and 65 in the external control panel 14 and the internal control panel 19, the rotating lamp (not shown), or the like; and the management system is also notified. Accordingly, an unauthorized person or another vehicle is prevented from illegally entering the entry bay 5.

{0103}

In addition, when the portable authentication medium 70 has been authenticated in the internal authentication area B1 when the main control portion 41 receives the internal sensing signal SIG. 4, the main control portion 41 is similarly controlled so that audio and visual warnings are issued via the loudspeakers 58 and 65, the rotating lamp, or the like, on the condition that the reception of the internal sensing signal SIG. 4 continues for a predetermined amount of time (for example, 3 minutes) or longer, and so that the user-state-confirmation warning processing is also performed to notify the management system of the mechanical parking lot 1. Accordingly, for example, even if the official user loses consciousness in the entry bay 5 or becomes unable to move for some reason, a person outside can quickly become aware of the situation and perform first-aid or the like.

{0104}

Next, the procedure for removing a vehicle parked in the mechanical parking lot 1, as well as the control and operation

of the mechanical parking lot 1 will be described. The removing procedure is shown by numbers (8) to (14) in Fig. 8. Note that, here, a case in which the vehicle to be removed is an electric vehicle 2E that has completed charging of the vehicle-installed battery will briefly be described.

{0105}

First, the user (driver of the electric vehicle 2E) approaches the external control panel 14 (8). Then, the authentication and the door-opening operation are performed at the external control panel 14. Here, as with the procedure for storing a vehicle, the first external authentication processing is performed when the portable authentication medium 70 carried by the user is brought into the external authentication area A1; if the user is an officially contracted user, on the condition that the user is in the external authentication area A1, the operation of the external control panel 14 is permitted; and the user retrieves the pallet 31 by pressing the start-up button. At this time, the main control portion 41 judges that the user is requesting to remove a vehicle on the basis of the storage/removal records stored in the user database 42; the pallet 31 loaded with the corresponding electric vehicle 2E is retrieved to the entry bay 5 (transport retrieval processing); and, during this time, "retrieving" is displayed on the operation display screen 56 of the external control panel 14.

{0106}

As with the procedure for storing a vehicle, the second external authentication processing and the first verification processing are executed after the pallet 31 loaded with electric vehicle 2E has arrived at the entry bay 5, and, on the condition that the first verification processing results in an affirmative judgment, the storage/removal door 12 is automatically opened, or the open button (not shown) is displayed on the operation display screen 56, and the storage/removal door 12 is opened by the user pressing this open button (door-opening processing).

{0107}

Once the storage/removal door 12 is open, the user enters the entry bay 5, disengages the charging cable connecting the charging-cable connecting portion of the electric vehicle 2E and the power receiver 35 of the pallet 31, and retracts it into the vehicle (9). In the case in which this task is being performed at the back side of the entry bay 5, because the portable authentication medium 70 of the user is in the internal authentication area B1, the internal authentication processing is performed, and, at the same time, the fact that the user is inside the entry bay 5 is displayed on the operation display screen 56 of the external control panel 14 (internal-presence display processing). Accordingly, even if the next user who does not know the situation arrives while

the first user is performing the task of disengaging the charging cable at the back side of the entry bay 5, it is possible for this next user to recognize the presence of a person (the user who has been authenticated first) in the entry bay 5 by checking the external control panel 14. It is of course not possible for the user who arrives later to close the storage/removal door 12 by operating the external control panel 14.

{0108}

Next, the user gets into the electric vehicle 2E (10), removes the electric vehicle 2E to stop it in front of the storage/removal gateway 3 (11), gets out of the vehicle and approaches the external control panel 14, and performs the authentication and door-closing operation (12). Here, as with the procedure for storing a vehicle, the third external authentication processing and the second verification processing are executed, and, on the condition that the second verification processing results in an affirmative judgment, the close button is displayed on the operation display screen 56 of the external control panel 14. The user closes the storage/removal door 12 by pressing the close button. As with the procedure for storing a vehicle, the condition at this time is that the portable authentication medium 70 is in the external authentication area A1 until the storage/removal door 12 is completely closed.

{0109}

By doing so, the user stays in the vicinity of the external control panel 14 located outside the storage/removal door 12 until the storage/removal door 12 is completely closed. Therefore, it is impossible that the user leaves the vicinity of the storage/removal door 12 before the storage/removal door 12 is completely closed, and that an unauthorized person sneaks into the entry bay 5 during this time. As a matter of course, it is also impossible that, even though the user who has completed the storage tasks is still in the entry bay 5, the storage/removal door 12 is closed by another user who does not know this. Accordingly, it is possible to safely operate the mechanical parking lot 1. Then, once the storage/removal door 12 is closed, the user gets into the electric vehicle 2E again (13), and leaves the mechanical parking lot 1 (14).

{0110}

Figs. 9 and 10 show flowcharts of the control method according to this embodiment. This control program is stored in the main control portion 41. In addition, for the most part, this control program is identical for storing and removing the vehicle 2.

{0111}

To describe the flow of this control in sequence, after starting the control, first, in Step S1, it is judged whether

or not the portable authentication medium 70 carried by the user is brought into the external authentication area A1, and whether or not the external authentication signal SIG. 1 is received by the main control portion 41. If the judgment result in this Step S1 is a negative judgment, the process returns to the start, and if it is an affirmative judgment, the process advances to Step S2 in which the user ID is verified by executing the first external authentication processing, and the user authentication is performed if the portable authentication medium 70 is a legitimate unit.

{0112}

In Step S3 that follows, the authentication input screen, such as a numerical keypad or the like, is displayed on the operation display screen 56 of the external control panel 14; and the user performs the authentication operation by inputting an identification number or by using the IC card in the subsequent Step S4. Then in Step S5 that follows, at the authentication verifying portion 46 of the main control portion 41, it is judged whether or not the authentication details input by the user match the authentication details in the first external authentication processing in Step S2; an error is indicated in Step S6 if the judgment result is a negative judgment; and the cancelling processing is subsequently performed in Step S7, thus cancelling the storing operation.

{0113}

In addition, if the judgment result in Step S5 is an affirmative judgment, the process advances to Step S8 in which the start-up button is displayed on the operation display screen 56 of the external control panel 14; and, in the subsequent Step S9, the user presses the start-up button to start up the mechanical parking lot 1. Accordingly, the process advances to Step S10 in which the transport retrieval processing is executed, and a predetermined pallet 31 is transported to the entry bay 5.

{0114}

After the pallet 31 arrives, whether or not the external authentication signal SIG. 1 is received by the main control portion 41 is judged again in Step S11. If the judgment result in Step S11 is a negative judgment, because this indicates the absence of the user in the external authentication area A1, an error is indicated in Step S12, and the user is also instructed to return to the area in front of the external control panel 14. Then, whether or not the predetermined amount of time (for example, 1 minute) has passed is judged in Step S13; if this results in a negative judgment, the process returns to Step S11 and standby processing is performed by repeating Steps S11, S12, and S13 for the predetermined amount of time; and, if the predetermined amount of time has passed without receiving the

external authentication signal SIG. 1 (if Step S13 results in an affirmative judgment), the process advances to Step S7 and the cancelling processing is performed, thus cancelling the storing operation.

{0115}

On the other hand, if the judgment result in Step S11 is an affirmative judgment, the process advances to Step S14, where the second external authentication processing is executed; the process further advances to Step S15 in which the first verification processing is performed, and it is judged whether or not the portable authentication medium 70 recognized during each of the first external authentication processing (Step S2) and the second external authentication processing (Step S14) is the same. If this judgment result in Step S15 is a negative judgment, the process advances to Step S16 in which an error is indicated, and the user is also instructed to return to the area in front of the external control panel 14. Then, whether or not the predetermined amount of time (for example, 1 minute) has passed is judged in Step S17; if this results in a negative judgment, the process returns to Step S15 and the standby processing is performed by repeating Steps S15, S16, and S17 for the predetermined amount of time; and, if the predetermined amount of time has passed without receiving the external authentication signal SIG. 1 (if Step S17 results in an affirmative judgment), the process

advances to Step S7, where the cancelling processing is performed, thus cancelling the storing operation.

{0116}

On the other hand, if the judgment result in Step S15 is an affirmative judgment, the process advances to Step S18 (moves on to Fig. 10), where the door-opening processing is executed. Specifically, the storage/removal door 12 is automatically opened, or the open button is displayed on the operation display screen 56, and the storage/removal door 12 is opened by the user pressing this open button. Next, after the user finishes storing or removing the vehicle 2 in Step S19, he/she gets out of the vehicle and returns to the area in front of the external control panel 14. In Step S20 that follows, whether or not the external authentication signal SIG. 1 is received by the main control portion 41 is judged again. If the judgment result in this Step S20 is a negative judgment, because this indicates the absence of the user in the external authentication area A1, the process advances to Step S21; an error is indicated, and the user is also instructed to return to the area in front of the external control panel 14.

{0117}

If the judgment result in Step S20 is an affirmative judgment, the process advances to Step S22, where the third external authentication processing is executed. Next, the

process advances to Step S23 in which the second verification processing is performed, and it is judged whether or not the portable authentication media 70 separately recognized in the first to third external authentication processing (Steps S2, S14, and S22) are the same. If the judgment result in Step S23 is a negative judgment, the process advances to Step S21, where an error is indicated. If the judgment result in Step S23 is an affirmative judgment, the process advances to Step S24 in which the close button is displayed on the operation display screen 56 of the external control panel 14, and, when the user presses the close button in the Step S25 that follows, closing of the storage/removal door 12 is started in the subsequent Step S26. Together with this, whether or not the external authentication signal SIG. 1 has stopped being received is judged in Step S27.

{0118}

If this judgment result in Step S27 is an affirmative judgment, because the user is not in the external authentication area A1, the storage/removal door 12 is immediately reopened in Step S28; in Step S29, an error is indicated, and the user is also instructed to return to the area in front of the external control panel 14. In addition, if the judgment result in Step S27 is a negative judgment, closing of the storage/removal door 12 is continued, and the closing is completed in Step S30, thus ending the control.

Note that the control from Steps S24 to S30 constitutes the door-closing processing.

{0119}

As has been described above, the feature of this control method of the mechanical parking lot 1 is that it includes the first external authentication processing in which the portable authentication medium 70 carried by the user is recognized when brought into the external authentication area A1, thus authenticating the user; the transport retrieval processing in which a predetermined pallet 31 is retrieved to the entry bay 5, on the condition that the first external authentication processing has been completed; the second external authentication processing in which, after the pallet 31 has arrived at the entry bay 5, the presence of the portable authentication medium 70 is recognized in the external authentication area A1 formed in a limited area near the external control panel 14; first verification processing in which it is judged whether or not the portable authentication media 70 separately recognized in the first and second external authentication processing are the same; door-opening processing in which the storage/removal door 12 is opened, on the condition that the first verification processing results in an affirmative judgment; third external authentication processing in which the presence of the portable authentication medium 70 in the external authentication area

A1 is recognized again after the user completes storing/removing a vehicle; second verification processing in which it is judged whether or not the portable authentication media 70 recognized in the first, second, and third external authentication processing are the same; and door-closing processing in which the user is permitted to perform the door-closing operation at the external control panel 14, on the condition that the second verification processing results in an affirmative judgment, and that the portable authentication medium 70 is in the external authentication area A1 until the storage/removal door 12 is completely closed.

{0120}

This control method enables only the user who has originally performed the user authentication to perform a series of tasks related to storing/removing a vehicle; a safe operation by preventing the entry by an unauthorized person and another vehicle, as well as by reliably preventing the storage/removal door 12 from being closed in a state in which a person remains in the entry bay 5; and a reduction of cumbersome tasks associated with the authentication operation and storing/removing operation.

{0121}

Next, a control method for the above-described internal authentication processing and internal-presence display processing will be described by using a flowchart shown in

Fig. 11.

{0122}

After the first verification processing is completed in Step S15 described by using the flowcharts in Figs. 9 and 10, and after the storage/removal door 12 is opened by performing the door-opening processing in Step S18, whether or not the internal authentication signal SIG. 3 is received by the main control portion 41 is judged in Step S35 shown in Fig. 11. If this judgment result in Step S35 is a negative judgment, control is performed so that the process returns to Step S35 again, and, if the judgment result in Step S35 is an affirmative judgment, the process advances to Step S36 in which the internal authentication processing is executed. By performing this internal authentication processing, the operation of the internal control panel 19 by an unauthorized person is restricted.

{0123}

Next, the process advances to Step S37 in which the internal-presence display processing is executed, and the fact that the user is inside the entry bay 5 and that the portable authentication medium 70 is inside the entry bay 5 is displayed on the operation display screen 56 of the external control panel 14, as described above. Subsequently, the process advances to Step S38, where it is judged again whether or not the internal authentication signal SIG. 3 is received

by the main control portion 41. If this judgment result in Step S38 is an affirmative judgment, the process returns to Step S37, and Steps S37 and S38 are repeated. In addition, if the judgment result in Step S38 is a negative judgment, the process shifts to Step S20, and the above-described control is continued.

{0124}

Next, a control method of the above-described unauthorized-person-approach warning processing will be described by using a flowchart shown in Fig. 12.

{0125}

First, after the control is started, whether or not the external sensing signal SIG. 2 is received by the main control portion 41 is judged in Step S41. If this judgment result in Step S41 is an affirmative judgment, the process advances to Step S42, where it is judged whether or not the external authentication signal SIG. 1 is received by the main control portion 41. Then, if this judgment result in Step S42 is a negative judgment, the process advances to Step S43, where it is judged whether or not the predetermined amount of time (for example, 3 minutes) has passed. If this results in an affirmative judgment, the unauthorized-person-approach warning processing is executed in Step S44, thus ending the control.

{0126}

In addition, in all of the cases in which Step S41

results in a negative judgment, Step S42 results in an affirmative judgment, and Step S43 results in a negative judgment, control is performed so that the process returns to Step S41. By repeating the routine from Steps S41 to S43 in this way, it is possible to prevent illegal intrusion into the entry bay 5, burglary of a vehicle, vehicle theft, and so forth by deterring an unauthorized person from remaining in the vicinity of the external control panel 14 and the storage/removal door 12 for a long time.

{0127}

Next, a control method of the above-described unauthorized-person-intrusion warning processing and user-state-confirmation warning processing will be described by using a flowchart in Fig. 13.

{0128}

First, after starting the control, whether or not the internal sensing signal SIG. 4 is received by the main control portion 41 is judged in Step S51. If the judgment result in Step S51 is a negative judgment, the control that causes the process to return to Step S51 again is repeated. In addition, if the judgment result in Step S51 is an affirmative judgment, the process advances to Step S52, where it is judged whether or not the internal authentication signal SIG. 3 is received by the main control portion 41. If this judgment result in Step S52 is a negative judgment, the process advances to Step

S53, where the unauthorized-person-intrusion warning processing is executed, thus ending the control.

{0129}

On the other hand, if the judgment result in Step S52 is an affirmative judgment, the process advances to Step S54, where it is judged whether or not the predetermined amount of time (for example, 3 minutes) has passed. If this results in an affirmative judgment, the user-state-confirmation warning processing is executed in Step S55, thus ending the control.

{0130}

By performing such control, it is possible to effectively prevent an unauthorized person who has not performed authentication at the external control panel 14 from intruding into the entry bay 5 to burglarize a vehicle, and so forth.

{0131}

In a case in which one or more several users carrying portable authentication media 70 arrive and are waiting while the first user is performing the series of storing/removing operations like those described above, at the point in time at which these standby users approach the external control panel 14 and their portable authentication media 70 are brought into the external authentication area A1, the authentication verifying portion 46 judges whether these standby users are requesting to store vehicles or requesting to remove vehicles on the basis of the authentication information in their

portable authentication media 70 and the storage/removal records stored in the user database 42 connected to the main control portion 41, and thus storage/removal reservations (order determination) are made (reservation processing).
{0132}

By executing this reservation processing, the storage/removal reservations are made for the standby users while the first user is performing the storing/removing operation; therefore, in the case in which there are many standby users, it is possible to avoid confusion by determining the order, to reduce authentication time for the individual standby users, and to realize smooth operation of the mechanical parking lot 1.
{0133}

In addition, after this reservation processing, while the first user is storing/removing a vehicle, rearranging processing is executed in which pallets 31 planned to be transported for the standby users are rearranged so as to be, to the extent possible, in positions from which they are most easily transported.
{0134}

By executing this rearranging processing while the first user is storing/removing a vehicle, the pallets 31 to be transported for the standby users are rearranged so as to be in locations from which they are most easily transported. For

example, in the case of a mechanical parking lot using a multistory circulation system or a parallel entry system, described later, pallets 31 planned to be transported for the individual standby users can be rearranged to the most efficient positions (order) or they can be moved to the vicinity of the ascending/descending pathway 26. Accordingly, it is possible to considerably reduce the time required for storing/removing the subsequent vehicle, and thus, it is possible to reduce cumbersome tasks associated with the storing/removing operation.

{0135}

A control method of the above-described reservation processing and rearranging processing will be described by using a flowchart shown in Fig. 14.

{0136}

First, after starting the control, whether or not the storing/removing operation is in progress is judged in Step S61. If the judgment result in Step S61 is a negative judgment, that is, if the storing/removing operation is not being performed, the control that causes the process to return to Step S61 again is repeated. In addition, if the judgment result in Step S61 is an affirmative judgment, that is, if the storing/removing operation is in progress, the process advances to Step S62, and it is judged whether or not there is a reception of the external authentication signal SIG. 1 due

to the entry of the portable authentication medium 70 carried by the standby user into the external authentication area A1. If this judgment result in Step S62 is a negative judgment, the process returns to Step S61, and Steps S61 and S62 are repeated thereafter. In addition, if the judgment result in Step S62 is an affirmative judgment, the process advances to Step S63 in which the reservation processing is executed, and the process further advances to Step S64 in which the rearranging processing is executed, thus ending the control.

{0137}

[Second Embodiment]

Fig. 15 is a plan view of a mechanical parking lot showing a second embodiment of the present invention. This mechanical parking lot 91 uses a parallel entry system commonly known in the related art, in which two entry bays 5A and 5B are connected in the front-to-back direction where a storage/removal door 12A is provided at a storage/removal gateway 3A of the front-side entry bay 5A and a storage/removal door 12B is provided at a storage/removal gateway 3B of the back-side entry bay 5B. A vehicle to be stored in the back-side entry bay 5B or removed therefrom passes through the front-side entry bay 5A and the back-side storage/removal gateway 3B (storage/removal door 12B) to enter the entry bay 5B or to exit therefrom.

{0138}

In the vicinity of the storage/removal door 12A, on the outside thereof, an external control panel 14 for performing the user authentication operation, the start-up operation of the mechanical parking lot 91, the opening/closing operation of the storage/removal doors 12A and 12B, and so forth is provided, and an external-authentication-area antenna 61 built into this external control panel 14 forms an external authentication area A1 in a limited area in the vicinity (near the front side) of the external control panel 14.

Furthermore, an external sensing sensor 17 provided in the vicinity of and above the storage/removal door 12A forms an external sensing area A2 over a predetermined area near the front side of the external control panel 14 and the storage/removal gateway 3A.

{0139}

In addition, internal control panels 19A and 19B, as well as internal sensing sensors 21A and 21B are individually provided inside the entry bays 5A and 5B; an internal-authentication-area antenna 66A built into the internal control panel 19A forms an internal authentication area B1, an internal-authentication-area antenna 66B built into the internal control panel 19B forms an internal authentication area C1, the internal sensing sensor 21A forms an internal sensing area B2, and the internal sensing sensor 21B forms an internal sensing area C2.

{0140}

The relationship between the sizes of the internal authentication areas B1 and C1 and those of the internal sensing areas B2 and C2 is the same as the relationship between the size of the internal authentication area B1 and that of the internal sensing area B2 in the mechanical parking lot 1 of the first embodiment; however, it may be changed as needed. Furthermore, pallets 31 are transported into the individual entry bays 5A and 5B. In this way, aside from the fact that the two entry bays 5A and 5B are connected in the front-to-back direction, the configuration is the same as that of the mechanical parking lot 1 of the first embodiment. A user (driver) carries a portable authentication medium 70 in which authentication information specific to the user himself/herself is stored.

{0141}

When the portable authentication medium 70 carried by the user is brought into the external authentication area A1, the external-authentication-area antenna 61 detects this, the external-authentication-area antenna 61 emits an external authentication signal SIG. 1 on the basis of the user-specific authentication information stored in the portable authentication medium 70, and the main control portion 41 receives this external authentication signal SIG. 1. In addition, when a person or a vehicle enters the external

sensing area A2, the external sensing sensor 17 detects this and emits an external sensing signal SIG. 2 to the main control portion 41. Furthermore, when the portable authentication medium 70 is brought into the internal authentication area B1 in the entry bay 5A, the internal-authentication-area antenna 66A detects this and emits an internal authentication signal SIG. 3. Additionally, when a person or a vehicle enters the internal sensing area B2 in the entry bay 5A, the internal sensing sensor 21A detects this and emits an external sensing signal SIG. 4 to the main control portion 41. Similarly, when the portable authentication medium 70 is brought into the internal authentication area C1 in the entry bay 5B, the internal-authentication-area antenna 66B detects this and emits an internal authentication signal SIG. 5. In addition, when a person or a vehicle enters the internal sensing area C2 in the entry bay 5B, the internal sensing sensor 21B detects this and emits an external sensing signal SIG. 6 to the main control portion 41.

{0142}

The details of control performed by the main control portion 41 upon receiving the inputs of the individual signals SIGs. 1 to 6 described above are, for the most part, the same as those in the mechanical parking lot 1 of the first embodiment. However, because the two entry bays 5A and 5B are provided, by using two types of internal authentication

signals, SIG. 3 and SIG. 5, and two types of internal sensing signals, SIG. 4 and SIG. 6, whether or not a user is in the entry bay 5A or 5B can be determined separately.

{0143}

When storing/removing a vehicle in/from the mechanical parking lot 91, a user (driver) approaches the external control panel 14, the portable authentication medium 70 carried by the user and brought into the external authentication area A1 at this time is recognized by the external-authentication-area antenna 61, and thus user authentication is performed. Although a predetermined pallet 31 is retrieved after this user authentication, in the case in which this retrieved pallet 31 is transported to the front-side entry bay 5A, only the front-side storage/removal door 12A is opened.

{0144}

However, in the case in which the retrieved pallet 31 is transported to the back-side entry bay 5B, the front-side storage/removal door 12A and the back-side storage/removal door 12B both are opened, and a vehicle passes through the front-side entry bay 5A to enter the back-side entry bay 5B or to exit therefrom. In the case in which the front-side storage/removal door 12A and the back-side storage/removal door 12B are both opened in this way, the vehicle is stored in the back-side entry bay 5B, and the driver of this vehicle

performs a charging task or the like at the back side of the entry bay 5B, it is difficult to check the back side of the entry bay 5B through the storage/removal door 12A from the exterior thereof. Because of this, in the related art, there has been a possibility that the storage/removal doors 12A and 12B are closed without recognizing the presence of a person in the back side of the entry bay 5B.

{0145}

With the configuration of this mechanical parking lot 91, inside the individual entry bay 5A and the entry bay 5B, the internal sensing sensors 21A and 21B, as well as the internal-authentication-area antennas 66A and 66B are provided, internal sensing sensors 21A and 21B form the internal sensing areas B2 and C2, and the internal-authentication-area antennas 66A and 66B form the internal authentication areas B1 and C1; therefore, even if there is a user who is performing a charging task or the like inside the entry bay 5B at the back side thereof where it is difficult to be seen, this user is reliably recognized by the main control portion 41; and, by doing so, it is possible to prevent a person being left inside the entry bay 5A or 5B from being overlooked, and thus, it is possible to realize a safe operation of the mechanical parking lot 91.

{0146}

[Third Embodiment]

Figs. 16 and 17 are plan views of a mechanical parking lot showing a third embodiment of the present invention. Fig. 16 shows the configuration of this mechanical parking lot 101, as well as the procedure for storing a vehicle, and Fig. 17 similarly shows the procedure for removing the vehicle. In this mechanical parking lot 101, two entry bays 5L and 5R are arranged side-by-side, a storage/removal door 12L is provided at a storage/removal gateway 3L of the first entry bay 5L, and a storage/removal door 12R is provided at a storage/removal gateway 3R of the second entry bay 5R.

{0147}

In the vicinity of the storage/removal door 12L, on the outside thereof, an external control panel 14L for performing the user authentication operation, the start-up operation of the mechanical parking lot 101, the opening/closing operation of the storage/removal door 12L, and so forth is provided, and an external-authentication-area antenna 61L built into this external control panel 14L forms an external authentication area AL in a limited area in the vicinity (near the front side) of the external control panel 14L. Similarly, in the vicinity of the storage/removal door 12R, on the outside thereof, an external control panel 14R for performing the user authentication operation, the start-up operation of the mechanical parking lot 101, the opening/closing operation of the storage/removal door 12R, and so forth is provided, and an

external-authentication-area antenna 61R built into this external control panel 14R forms an external authentication area AR in a limited area in the vicinity (near the front side) of the external control panel 14R.

{0148}

For example, when a user enters the external authentication area AR, a portable authentication medium 70 carried by the user is recognized by the external-authentication-area antenna 61R, the external-authentication-area antenna 61R emits a remote authentication signal SIG. 1 on the basis of the authentication information specific to the portable authentication medium 70 to the main control portion 41, the user ID is verified at an authentication verifying portion 46 (see Fig. 5) of the main control portion 41 that has received this remote authentication signal SIG. 1, and the user authentication is automatically performed if the user is an officially contracted user of the mechanical parking lot 101.

{0149}

In addition, internal control panels 19L and 19R are individually provided inside the entry bays 5L and 5R, and they individually have internal-authentication-area antennas 66L and 66R built thereinto. These internal-authentication-area antennas 66L and 66R form internal authentication areas BL and BR inside the entry bays 5L and 5R.

{0150}

For example, when a user enters the internal authentication area BR, the portable authentication medium 70 carried by the user is recognized by the internal-authentication-area antenna 66R, the internal-authentication-area antenna 66R emits an internal authentication signal SIG. 3 on the basis of authentication information specific to the portable authentication medium 70 to the main control portion 41, the user ID is verified at the authentication verifying portion 46 (see Fig. 5) of the main control portion 41 that has received this internal authentication signal SIG. 3, and the user authentication is automatically performed if the user is an officially contracted user of the mechanical parking lot 101. In addition, the presence of the user in the entry bay 5R is recognized.

{0151}

In addition, as shown in Fig. 16, a remote authentication area antenna 106 (remote-authentication-area forming means) is provided at a storage pathway 105 that serves as an entrance to the mechanical parking lot 101 and that is separated from the storage/removal gateways 3L and 3R, and this remote authentication area antenna 106 forms a remote authentication area D1 over the storage pathway 105. All vehicles to be stored in this mechanical parking lot 101 pass through the storage pathway 105, and all vehicles pass through the remote

authentication area D1 at that time. When a vehicle passes through the remote authentication area D1, the portable authentication medium 70 carried by the user (driver) is recognized by the remote authentication area antenna 106, the remote authentication area antenna 106 emits a remote authentication signal SIG. 7 on the basis of authentication information specific to the portable authentication medium 70 to the main control portion 41, the user ID is verified at the authentication verifying portion 46 (see Fig. 5) of the main control portion 41 that has received this remote authentication signal SIG. 7, and the user authentication is automatically performed if the user is an officially contracted user of the mechanical parking lot 101.

{0152}

On the other hand, as shown in Fig. 17, a removal waiting room 108 is provided adjacent to the mechanical parking lot 101, and a remote authentication area antenna 110 (remote-authentication-area forming means) provided inside thereof forms a remote authentication area D2 inside the removal waiting room 108. A user who has entered the removal waiting room 108 in order to remove the vehicle enters this remote authentication area D2; by doing so, the portable authentication medium 70 carried by the user is recognized by the remote authentication area antenna 110, the remote authentication area antenna 110 emits a remote authentication

signal SIG. 8 on the basis of authentication information specific to the portable authentication medium 70 to the main control portion 41, the user ID is verified at the authentication verifying portion 46 (see Fig. 5) of the main control portion 41 that has received this remote authentication signal SIG. 8, and the user authentication is automatically performed if the user is an officially contracted user of the mechanical parking lot 101. Then, the operation that automatically transports a pallet 31 loaded with a predetermined vehicle to the entry bay 5L or 5R is started, and waiting time required until the vehicle can be removed is displayed inside the removal waiting room 108. In addition, when the predetermined pallet 31 will arrive soon, this information is displayed.

{0153}

The procedure of storing a vehicle in the mechanical parking lot 101 configured as above, as well as control and operation of the mechanical parking lot 101, will be described below. The storing procedure is shown by numbers (1) to (8) in Fig. 16. Note that, here, a case in which the vehicle to be stored is an electric vehicle 2E that requires charging of a vehicle-installed battery will be described.

{0154}

First, the user (driver of the electric vehicle 2E) enters the mechanical parking lot 101 by passing through the

storage pathway 105 (1). At this time, when the electric vehicle 2E passes through the remote authentication area D1, the portable authentication medium 70 carried by the user is recognized by the remote authentication area antenna 106, the remote authentication area antenna 106 emits a remote authentication signal SIG. 7 on the basis of authentication information specific to the portable authentication medium 70 to the main control portion 41, and the user authentication is automatically performed. The main control portion 41 checks for vacant spaces in the mechanical parking lot 101, and instructs the user to go to the storage/removal gateway 3L or 3R via a storage/removal gateway guiding display (not shown) or the like. For example, the user who has been instructed to go to the storage/removal gateway 3R stops the electric vehicle 2E in front of the storage/removal gateway 3R (storage/removal door 12R); if there is any passenger, allows the passenger to get out of the vehicle; folds the door mirrors; and retracts the antenna (2).

{0155}

On the other hand, (when there is no user in front performing the storing/removing operation) the main control portion 41 starts the operation that transports a vacant pallet 31 provided with a power receiver 35 to the entry bay 5R without waiting for the electric vehicle 2E to arrive in front of the storage/removal gateway 3R. When there is a user

in front performing the storing/removing operation, the reservation processing and the rearranging processing described in the first embodiment are executed, thus reducing the amount of time required for the next storing operation. The fact that the vehicle to be stored is an electric vehicle 2E that requires charging of the vehicle-installed battery becomes clear at the point at which the portable authentication medium 70 of the user is recognized by the remote authentication area antenna 106, and this information is transmitted to the main control portion 41.

{0156}

Next, the user gets out of the electric vehicle 2E and approaches the external control panel 14 (3). During (2) and (3) described above, when the portable authentication medium 70 carried by the user is brought into the external authentication area AR, the external-authentication-area antenna 61R recognizes it, the external-authentication-area antenna 61R emits an external authentication signal SIG. 1, the user ID is verified at the authentication verifying portion 46 (see Fig. 5) of the main control portion 41 that has received this external authentication signal SIG. 1, and the user authentication is performed if the user is an officially contracted user of the mechanical parking lot 101.

{0157}

In the case in which the external authentication area AR

is formed large enough to cover also the driver's seat of the vehicle 2, the user authentication can be performed without requiring the user to get out of the vehicle 2, and, in addition to this, as described later, by making it possible to operate the external control panel 14R from the vehicle by adding a remote controller function to the portable authentication medium 70, time-consuming task of getting out of the vehicle can be eliminated and convenience can be enhanced.

{0158}

Then, the user is permitted to operate the external control panel 14R, on the condition that this user authentication has been completed and the main control portion 41 is continuing to receive the external authentication signal SIG. 1. Specifically, for example, an authentication input screen, such as a numerical keypad or the like, is displayed on the operation display screen (not shown) of the external control panel 14R by the liquid crystal system, and a text display on the operation display screen and audio from the loudspeaker prompt the user to perform the authentication operation by inputting the identification number via the numerical keypad, or by touching a special IC card against the IC card reader.

{0159}

When the user performs the authentication operation at

the external control panel 14R, user authentication is performed again at the authentication verifying portion 46 of the main control portion 41. At this time, if the details of authentication input by the user are not correct, an error is indicated by text display or audio, the storing operation by this user is cancelled, and the storing/removing operation of the next user is accepted.

{0160}

When the authentication input operation at the external control panel 14R is successfully performed and the predetermined vacant pallet 31 has not arrived at an entry bay 5R, "retrieving" is displayed on the operation display screen of the external control panel 14R. When the pallet 31 arrives at the entry bay 5R, the storage/removal door 12R is automatically opened, on the condition that the portable authentication medium 70 of the user is in the external authentication area AR. Here, if the portable authentication medium 70 is not in the external authentication area AR, an error is indicated by text display and audio, and the user is also instructed to return to the area in front of the external control panel 14R. However, if the user does not return to the area in front of the external control panel 14R and the main control portion 41 cannot receive the external authentication signal SIG. 1 again, the storing operation by this user is cancelled after a predetermined amount of time

(for example, 1 minute) has passed in this state, and the storing/removing operation of the next user is accepted.

{0161}

Together with the opening of the storage/removal door 12R, the storage control lamp 15 shown in Fig. 2 changes from red to green. Once the storage/removal door 12 is open, the user gets into the electric vehicle 2E again (4). Then, he/she drives the electric vehicle 2E forward to pass through the storage/removal gateway 3R that has been opened, thus causing the electric vehicle 2E to enter the entry bay 5R and get on the pallet 31 (5). Once the electric vehicle 2E is stopped at a prescribed position on the pallet 31, the user gets out of the electric vehicle 2E after engaging the parking brake, connects a charging-cable connecting portion formed in the vehicle body of the electric vehicle 2E and an outlet portion of power receiver 35 provided in the pallet 31 with a charging cable, and approaches the internal control panel 19R in the entry bay 5R (6). At this time, because the portable authentication medium 70 carried by the user is brought into the internal authentication area BR formed in a region in the interior of the entry bay 5R on the front side thereof, the internal-authentication-area antenna 66R detects this and emits an internal authentication signal SIG. 3, as described above. When the main control portion 41 receives this internal authentication signal SIG. 3, the main control

portion 41 recognizes that the same portable authentication medium 70 as the one that has been authenticated in the remote authentication area D1 and external authentication area AR is brought into the internal authentication area BR.

{0162}

By doing so, re-authentication of the user is completed, and the user is permitted to operate the internal control panel 19R. Specifically, a numerical keypad and charging reservation buttons are displayed on the operation display screen (not shown) of the internal control panel 19R, and, by the user touching these, the type of charging (normal charging or rapid charging), charging time, and so forth are set, thus completing the charging reservation. By executing this authentication in the internal authentication area BR, even if an unauthorized person who has not performed authentication in the external authentication area AR has intruded into the entry bay 5R, it is impossible for that person to operate the operation display screen of the internal control panel 19R.

{0163}

Next, the user leaves the entry bay 5R and performs the door-closing operation at the external control panel 14R (7). At this time, it is re-confirmed that the portable authentication medium 70 is in the external authentication area AR. Then, on the condition that the portable authentication medium 70 authenticated at this time is the

same as the one authenticated in the internal authentication area BR, a close button is displayed on the operation display screen of the external control panel 14R. Because the close button is displayed on the operation display screen in this way, on the condition that the same portable authentication medium 70 is recognized by the main control portion 41 throughout the process, the storage/removal door 12R will not be closed unless the user carrying this portable authentication medium 70 is in the vicinity of the external control panel 14R; accordingly, the storage/removal door 12R is prevented from being closed by another user while the user who has entered entry bay 5R still remains therein, and thus, it is possible to realize a safe operation of the mechanical parking lot 101. Note that, if the user who has finished storing a vehicle starts to leave, forgetting to perform the door-closing operation of the storage/removal door 12R, as in the case of the first embodiment, he/she is instructed via audio to close the storage/removal door 12R.

{0164}

Once the close button is displayed on the operation display screen of the external control panel 14R, the user closes the storage/removal door 12R by pressing the close button. The condition at this time is that the portable authentication medium 70 is in the external authentication area AR until the storage/removal door 12R is completely

closed, and this is the same as the first embodiment. Accordingly, the storage/removal door 12R is prevented from being closed without confirmation by the user. Once the storage/removal door 12R is completely closed, the user can leave the mechanical parking lot 101 (8). Subsequently, the turntable 7 shown in Fig. 1 turns in the entry bay 5R, and thus, the direction of the electric vehicle 2E is changed together with the pallet 31 so that the orientation thereof becomes parallel to the orientation of the vehicle-accommodating shelf 30. The pallet 31 whose direction has been changed is accommodated, by means of the transport platform 27, on a predetermined vehicle-accommodating shelf located above, and charging is started.

{0165}

Note that, in the case in which the remote controller function is added to the portable authentication medium 70, it is not necessary to get out of the electric vehicle 2E and get into it again in steps (3) and (4), and it is possible to perform user authentication by entering the external authentication area AR while remaining in the vehicle; therefore, it is possible to further reduce cumbersome tasks associated with the removing operation.

{0166}

In addition, when the user who is carrying the portable authentication medium 70 and who has been authenticated in the

external authentication area AR is in the entry bay 5R, as in the first embodiment, the fact that the user is inside the entry bay 5R and that the portable authentication medium 70 is inside the entry bay 5R is displayed on the operation display screen of the external control panel 14R (internal-presence display processing).

{0167}

Next, the procedure for removing a vehicle parked in the mechanical parking lot 101, as well as the control and operation of the mechanical parking lot 101, will be described. The removing procedure is shown by numbers (9) to (15) in Fig. 17. Note that, here, a case in which the vehicle to be removed is an electric vehicle 2E that has completed charging of the vehicle-installed battery will briefly be described.

{0168}

First, the user (driver of the electric vehicle 2E) enters the removal waiting room 108, and enters the remote authentication area D2 formed by the remote authentication area antenna 110 provided inside thereof (9). By doing so, the portable authentication medium 70 carried by the user is recognized by the remote authentication area antenna 110, the remote authentication area antenna 110 emits a remote authentication signal SIG. 8 on the basis of authentication information specific to the portable authentication medium 70

to the main control portion 41, and the user authentication is automatically performed. The main control portion 41 determines to which one of the entry bays 5L and 5R the pallet 31 loaded with the electric vehicle 2E will be transported and starts the operation thereof. Then, announcements are made about the waiting time required until the vehicle can be removed, instruction regarding the entry/exit gate (3L or 3R) from which the vehicle is to be removed, and arrival of the vehicle.

{0169}

When the pallet 31 loaded with the electric vehicle 2E is soon to arrive at the entry bay 5R, this information is announced in the removal waiting room 108, whereupon the user leaves the removal waiting room 108 and approaches the storage/removal gateway 3R (10). At this time, the user is made to pass in front of the external control panel 14R of the entry bay 5R, and, as with the procedure for storing a vehicle, the portable authentication medium 70 carried by the user is brought into the external authentication area AR, and thus, external authentication processing is automatically performed. The configuration here may be such that the user himself/herself performs the authentication operation again by inputting the identification number at the external control panel 14R or by touching the IC card against the IC card reader. If it is confirmed that the user is an officially

contracted user as a result of this authentication, the storage/removal door 12R is automatically opened, on the condition that the portable authentication medium 70 of the user is in the external authentication area AR.

{0170}

Once the storage/removal door 12R is opened, the user enters the entry bay 5R, disengages the charging cable connecting the charging-cable connecting portion of the electric vehicle 2E and the power receiver 35 of the pallet 31, and retracts it into the vehicle. In the case in which this task is being performed at the back side of the entry bay 5R, because the portable authentication medium 70 of the user is in the internal authentication area BR, the internal authentication processing is performed, and, at the same time, the fact that the user is inside the entry bay 5R is displayed on the operation display screen of the external control panel 14R.

{0171}

Next, the user gets into the electric vehicle 2E (11), removes the electric vehicle 2E to stop it in front of the storage/removal gateway 3R (12), gets out of the vehicle to approach the external control panel 14R, and performs the authentication and door-closing operation (13). Here, as with the procedure for storing a vehicle, the external authentication processing is executed when the portable

authentication medium 70 is brought into the external authentication area AR, and, on the condition that there is no authentication error, the close button is displayed on the operation display screen of the external control panel 14R. The user closes the storage/removal door 12R by pressing the close button. As with the procedure for storing a vehicle, the condition at this time is that the portable authentication medium 70 is in the external authentication area AR until the storage/removal door 12R is completely closed; accordingly, the user can perform a safety check until the storage/removal door 12R is completely closed, and it is possible to safely operate the mechanical parking lot 101. Once the storage/removal door 12R is closed, the user gets into the electric vehicle 2E again (14), and leaves the mechanical parking lot 101 (15).

{0172}

With the above configuration, the user authentication can automatically be completed when the user carrying the portable authentication medium 70 enters the remote authentication areas D1 and D2. Then, a predetermined pallet 31 can be retrieved while the authenticated user moves to the storage/removal gateway 3L or 3R. By doing so, it is possible to achieve a reduction in waiting time, and it is also made possible to eliminate time-consuming tasks where the user manually performs the authentication operation at the external

control panel 14L or 14R, and thus, it is possible to reduce cumbersome tasks associated with the authentication operation.

{0173}

In addition, because the presence of the portable authentication medium 70 is verified in the individual authentication areas AR (AL), BR (BL), D1, and D2 throughout the process, for example, from the authentication, in the remote authentication area D1, of a user requesting to store a vehicle to the completion of the storage, it is possible to prevent, for example, a vehicle of another user from intercepting and entering the storage/removal door 12L or 12R opened for a first user after the authentication in the remote authentication area D1 is completed. Moreover, because the storage/removal doors 12L and 12R are not opened unless an authenticated user is in the vicinity, it is possible to prevent an unauthorized person from intruding into the entry bays 5L and 5R while the authenticated user is absent, as well as to prevent a person from being trapped inside the entry bay 5L or 5R.

{0174}

As has been described above, according to the present invention, the control apparatus for a mechanical parking lot, the control method therefor, and the mechanical parking lot controlled by the control method enable only the user who has originally performed the user authentication to perform a

series of tasks related to storing/removing a vehicle; a safe operation by preventing the entry by an unauthorized person or another vehicle, as well as by reliably preventing the storage/removal door from being closed in a state in which a person remains in the entry bay; and a reduction of cumbersome tasks associated with the authentication operation and storing/removing operation.

{0175}

The present invention is not limited to the individual embodiments described above, and appropriate alterations can be added within a range that does not depart from the scope of the present invention. For example, the above-described embodiments describe multistory mechanical parking lots using a bottom entry system in which vehicles enter and leave through a storage/removal gateway 3, 3L, or 3R provided at the bottom of a parking tower 4 built above ground; however, for example, it is permissible that a multistory mechanical parking lot uses a top entry system in which vehicles to be parked enter and leave through a storage/removal gateway provided above ground for parking spaces built under ground.

{0176}

In addition, the installed number of the external sensing sensor 17, the internal sensing sensors 21, 21A, and 21B, and so forth may be more than one. Furthermore, it is also conceivable to simplify the control by employing a

configuration in which the external sensing sensor 17 and the internal sensing sensors 21, 21A, and 21B are omitted.

{Reference Signs List}

{0177}

1, 91, 101 mechanical parking lot

3 storage/removal gateway

5 entry bay

12 storage/removal door

14, 14L, 14R external control panel

17 external sensing sensor

19, 19A, 19B, 19L, 19R internal control panel

21, 21A, 21B internal sensing sensor

40 control apparatus

41 main control portion (control means)

58, 65 audio buzzer (warning means)

61, 61L, 61R external-authentication-area antenna (external-authentication-area forming means)

66, 66A, 66B, 66L, 66R internal-authentication-area antenna (internal-authentication-area forming means)

70 portable authentication medium

105 storage pathway

106, 110 remote authentication area antenna (remote-authentication-area forming means)

108 removal waiting room

A1, AL, AR external authentication area

A2 external sensing area

B1, BL, BR, C1 internal authentication area

B2, C2 internal sensing area

D1, D2 remote authentication area

S2 first external authentication processing

S10 transport retrieval processing

S14 second external authentication processing

S15 first verification processing

S18 door-opening processing

S22 third external authentication processing

S23 second verification processing

S24 to S30 door-closing processing

S36 internal authentication processing

S37 internal-presence display processing

S44 unauthorized-person-approach warning processing

S53 unauthorized-person-intrusion warning processing

S55 user-state-confirmation warning processing

S63 reservation processing

S64 rearranging processing

SIG. 1 external authentication signal

SIG. 2 external sensing signal

SIG. 3, SIG. 5 internal authentication signal

SIG. 4, SIG. 6 internal sensing signal

SIG. 7 remote authentication signal

SIG. 8 remote authentication signal

CLAIMS:

{Claim 1}

A mechanical-parking-lot control apparatus comprising:

5 an external control panel that is provided outside of a storage/removal door and that performs an authentication operation of a user, a start-up operation of a mechanical parking lot, an opening/closing operation of the storage/removal door, and so forth;

10 a portable authentication medium that stores authentication information specific to the user and that allows the user to operate the external control panel when brought into an external authentication area formed in a limited area in the vicinity of the external control panel;

15 an external-authentication-area forming means that forms the external authentication area, detects the portable authentication medium brought into the external authentication area, and emits an external authentication signal on the basis of the authentication information specific to the portable
20 authentication medium; and

 a control means that permits the user to operate the external control panel, on the condition that the external authentication signal is being received.

25 {Claim 2}

A mechanical-parking-lot control apparatus according to Claim 1, wherein the user authentication is automatically performed when the portable authentication medium is brought into the external authentication area and when the control
5 means receives the external authentication signal.

{Claim 3}

A mechanical-parking-lot control apparatus according to Claim 1, further comprising:

10 a remote-authentication-area forming means that forms a remote authentication area in a location away from a storage/removal gateway, that detects the portable authentication medium brought into the remote authentication area, and that emits a remote authentication signal on the
15 basis of the authentication information specific to the portable authentication medium,

wherein the user authentication is automatically performed when the portable authentication medium is brought into the remote authentication area and when the control means
20 receives the remote authentication signal.

{Claim 4}

A mechanical-parking-lot control apparatus according to Claim 1, further comprising:

25 an internal-authentication-area forming means that forms

an internal authentication area in the interior of an entry bay inside the storage/removal door,

wherein the internal-authentication-area forming means detects the portable authentication medium brought into the internal authentication area and emits an internal authentication signal; and

when the internal authentication signal is received, the control means performs control in such a way that the fact that the user is inside the entry bay and that the portable authentication medium is in the entry bay is displayed on the external control panel.

{Claim 5}

A mechanical-parking-lot control apparatus according to Claim 1, further comprising:

an external sensing sensor that detects a person approaching the vicinity of the external control panel and a storage/removal gateway and that emits an external sensing signal to the control means; and

a warning means,

wherein, when the external sensing signal is received, the control means performs control in such a way that it is judged whether or not the portable authentication medium has been authenticated in the external authentication area, and, if not authenticated, a warning is issued by means of the

warning means, and a management system of the mechanical parking lot is also notified, on the condition that the reception of the external sensing signal continues for a predetermined amount of time or longer.

5

{Claim 6}

A mechanical-parking-lot control apparatus according to Claim 4, further comprising:

an internal sensing sensor that detects a person or a
10 vehicle entering the entry bay and that emits an internal sensing signal to the control means; and

a warning means,

wherein, when the internal sensing signal is received, the control means performs control in such a way that it is
15 judged whether or not the portable authentication medium has been authenticated in the internal authentication area;

if the portable authentication medium has not been authenticated in the internal authentication area, a warning is issued by means of the warning means, and a management
20 system of the mechanical parking lot is also notified; and

if the portable authentication medium has been authenticated in the internal authentication area, a warning is issued by means of the warning means, and the management system of the mechanical parking lot is also notified, on the
25 condition that the reception of the internal sensing signal

continues for the predetermined amount of time or longer.

{Claim 7}

A mechanical-parking-lot control apparatus according to
5 Claim 1, wherein the portable authentication medium is
provided with a remote controller function that enables remote
control of the external control panel, on the condition that
the portable authentication medium is recognized by the
control means in the external authentication area.

10

{Claim 8}

A mechanical-parking-lot control method comprising:
first external authentication processing of
authenticating a user upon recognizing that a portable
15 authentication medium storing authentication information
specific to the user is brought into a predetermined
authentication area;
transport retrieval processing of, on the condition that
the first external authentication processing has been
20 completed, automatically retrieving a predetermined vehicle
transporter to an entry bay inside a storage/removal door, or
retrieving the vehicle transporter via the user performing a
start-up operation at an external control panel provided
outside the storage/removal door;
25 second external authentication processing of, after the

vehicle transporter has arrived at the entry bay, recognizing that the portable authentication medium is in an external authentication area formed in a limited area in the vicinity of the external control panel;

5 first verification processing of judging whether or not the portable authentication medium separately authenticated in the first and the second external authentication processing is the same;

door-opening processing of, on the condition that the
10 first verification processing results in an affirmative judgment, automatically opening the storage/removal door, or of opening the storage/removal door via the user performing a door-opening operation at the external control panel;

third external authentication processing of recognizing
15 again that the portable authentication medium is in the external authentication area after the user finishes storing/removing a vehicle;

second verification processing of judging whether or not the portable authentication medium recognized in the third
20 external authentication processing is the same as the one recognized in the first and second external authentication processing; and

door-closing processing of permitting the user to perform a door-closing operation at the external control panel, on the
25 condition that the second verification processing results in

an affirmative judgment and also that the portable authentication medium is in the external authentication area until the storage/removal door is closed completely.

5 {Claim 9}

A mechanical-parking-lot control method according to Claim 8, wherein the predetermined authentication area is the external authentication area.

10 {Claim 10}

A mechanical-parking-lot control method according to Claim 8, wherein the predetermined authentication area is a remote authentication area formed at a location away from a storage/removal gateway.

15

{Claim 11}

A mechanical-parking-lot control method according to Claim 8, further comprising:

internal authentication processing of, after the door-opening processing, recognizing that the same portable authentication medium as the one authenticated in the first and second external authentication processing is brought into an internal authentication area formed inside the entry bay; and

25 internal-presence display processing of displaying the

fact that the user is in the entry bay and that the portable authentication medium is in the entry bay on the external control panel.

5 {Claim 12}

A mechanical-parking-lot control method according to Claim 8, further comprising:

10 unauthorized-person-approach warning processing of, in the case in which an external sensing signal emitted from an external sensing sensor that detects a person approaching the vicinity of the external control panel is received, and the portable authentication medium also has not been authenticated in the external authentication area, issuing a warning by means of a warning means, on the condition that the reception
15 of the external sensing signal continues for a predetermined amount of time or longer, and also of notifying a management system of the mechanical parking lot.

{Claim 13}

20 A mechanical-parking-lot control method according to Claim 8, further comprising:

25 unauthorized-person-intrusion warning processing of, in the case in which an internal sensing signal emitted from an internal sensing sensor that detects a person or a vehicle entering the entry bay is received, and, additionally, the

portable authentication medium has not been authenticated in the internal authentication area, issuing a warning by means of the warning means and also of notifying a management system of the mechanical parking lot; and

5 user-state-confirmation warning processing of, in the case in which the internal sensing signal is received, and, additionally, the portable authentication medium has been authenticated in the internal authentication area, issuing a warning by means of the warning means, on the condition that
10 the reception of the internal sensing signal continues for a predetermined amount of time or longer, and also of notifying the management system of the mechanical parking lot.

{Claim 14}

15 A mechanical-parking-lot control method according to Claim 8, further comprising:

 reservation processing of, in the case in which a second user carrying the portable authentication medium arrives and is standing by while a first user is performing an
20 storing/removing operation, making a storage/removal reservation by judging whether this standby user is requesting store a vehicle or requesting to remove a vehicle on the basis of authentication information in the portable authentication medium, at the point in time when the portable authentication
25 medium carried by the standby user is brought into the

external authentication area.

{Claim 15}

A mechanical-parking-lot control method according to

5 Claim 14, further comprising:

rearranging processing of, to the extent possible,
replacing the vehicle transporter planned to be transported
for the standby user to a position from which the vehicle
transporter is most easily transported after the reservation
10 processing, while the first user storing/removing a vehicle.

{Claim 16}

A mechanical parking lot controlled by a control method
according to Claim 8.

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