[Document Name] Abstract

[Abstract]

[Object]

To provide a vehicle lock system which can lock a vehicle into a state in which it cannot run, even at the time of getting off the vehicle temporarily and can easily unlock the vehicle to return it to a state in which it can run.

[Constitution]

An ECU 140 which outputs on-vehicle/off-vehicle information on the decision as to whether or not a rider is riding on a vehicle and a portable terminal 2 attached in an attachable/detachable manner by the rider of the electric motorcycle 1 are provided, and the portable terminal 2 includes a vehicle lock control module 210 for putting the electric motorcycle 1 into a locked state or unlocked state based on the on-vehicle/off-vehicle information, a user interface 255 for outputting operation information according to unlocking operation, and a display control module 250 for displaying a method of operating the user interface 255, and decides whether or not the occupant riding on the vehicle is the rider of the electric motorcycle 1, based on the operation information, and puts the electric motorcycle 1 into the locked state depending on the result of decision.

[Selected Drawing] Fig. 3

[Document Name] Claims

[Claim 1]

A vehicle lock system (10) which, when a rider gets off a vehicle (1), locks the vehicle (1) into a state in which it cannot run, comprising:

on-vehicle/off-vehicle decision means (140, 185) which decides whether or not the rider is riding on the vehicle (1) and outputs a result of the decision as on-vehicle/off-vehicle information; and

a portable terminal (2) attached to the vehicle (1) in an attachable/detachable manner by the rider,

wherein the portable terminal (2) includes:

vehicle lock control means (210) which puts the vehicle (1) into a locked state in which it cannot run if the on-vehicle/off-vehicle information indicates that the rider is not riding on the vehicle and puts the vehicle (1) into an unlocked state in which it can run if the on-vehicle/off-vehicle information indicates that the rider is riding on the vehicle;

unlocking means (255) which outputs operation information according to operation for putting the vehicle (1) into the unlocked state; and

vehicle state display means (250) which displays a method of operating the unlocking means (255) when the vehicle (1) is controlled to be held in the locked state by the vehicle lock control means (210),

wherein the vehicle lock control means (210) makes a decision as to whether or not an occupant riding on the vehicle (1) is the rider of the vehicle (1) based on the operation

information and puts the vehicle (1) into the unlocked state depending on a result of the decision.

[Claim 2]

The vehicle lock system according to Claim 1,

wherein: the vehicle state display means (250) displays a method of entering, through the unlocking means (255), a password to put the vehicle (1) into the unlocked state; and

the vehicle lock control means (210) receives the password as the operation information from the unlocking means (255) and decides whether or not the occupant riding on the vehicle is the rider of the vehicle (1) according to whether or not the received password coincides with a predetermined and registered password.

[Claim 3]

The vehicle lock system according to Claim 1 or 2,

wherein: the unlocking means (255) is a touch panel combined with the vehicle state display means (250);

the vehicle state display means (250) displays a method of entering a password to put the vehicle (1) into the unlocked state by operating the unlocking means (255) by pressing a display screen; and

the vehicle lock control means (210) receives the password as the operation information from the unlocking means (255) and decides whether or not the occupant riding on the vehicle is the rider of the vehicle (1) according to whether or not the received password coincides with a previously registered password.

[Claim 4]

The vehicle lock system according to any one of Claims 1 to 3,

wherein: the unlocking means (255) is a touch panel combined with the vehicle state display means (250);

the vehicle state display means (250) displays a method of inputting operation to put the vehicle (1) into the unlocked state by operating the unlocking means (255) by sliding in one direction with a display screen held pressed; and

the vehicle lock control means (210) receives information indicating the direction of sliding as the operation information from the unlocking means (255) and decides whether or not the occupant riding on the vehicle is the rider of the vehicle (1) according to whether or not the input direction coincides with a predetermined and registered direction.

[Claim 5]

The vehicle lock system according to any one of Claims 1 to 4,

wherein: the unlocking means (255) is a touch panel combined with the vehicle state display means (250);

the vehicle state display means (250) displays a method of inputting operation to put the vehicle (1) into the unlocked state by operating the unlocking means (255) by pressing a plurality of predetermined spots on a display screen in a predetermined order or sliding in a predetermined trajectory; and

the vehicle lock control means (210) receives information indicating the order in which the predetermined plural spots have been pressed or information indicating the trajectory of sliding as the operation information from the unlocking means (255) and decides whether or not the occupant riding on the vehicle is the rider of the vehicle (1) according to whether or not the input

order or trajectory coincides with a predetermined and registered order or trajectory.

[Claim 6]

The vehicle lock system according to any one of Claims 1 to 5,

wherein the portable terminal (2) further includes:

a photographing means (271) which takes an image of an occupant of the vehicle (1) and outputs the image; and

rider recognition means (270) which recognizes the rider by checking features of the occupant included in the image against previously registered features of a user of the portable terminal (2) based on the image taken by the photographing means (271) and outputs a result of the recognition as rider recognition information, and

wherein the vehicle lock control means (210) decides whether or not the occupant is the rider of the vehicle (1) based on the rider recognition information outputted from the rider recognition means (270).

[Claim 7]

The vehicle lock system according to Claim 6,

wherein: the unlocking means (255) is a touch panel combined with the vehicle state display means (250); and

the vehicle state display means (250) displays a method of starting check by the rider recognition means (270) by operating the unlocking means (255) by pressing a display screen.

[Claim 8]

The vehicle lock system according to Claim 7, wherein the rider recognition means (270) recognizes the rider based on

features of a face of, or a thing worn by, the occupant included in the image taken by the photographing means (271) as a subject of photography.

[Claim 9]

The vehicle lock system according to any one of Claims 1 to 8,

wherein: the vehicle (1) is a saddle-ride type electric vehicle (1) in which a drive mechanism (104) includes an electric motor (131); and

the vehicle lock control means (210) controls the saddle-ride type electric vehicle (1) to put it into either the locked state or the unlocked state by controlling power supply control means (140) for controlling electric power supplied to the electric motor (131).

Dated this 25 day of March 2013.

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25 MAR 2013

ORIGINAL

1277 /CHE/ 2013

FIG. 1

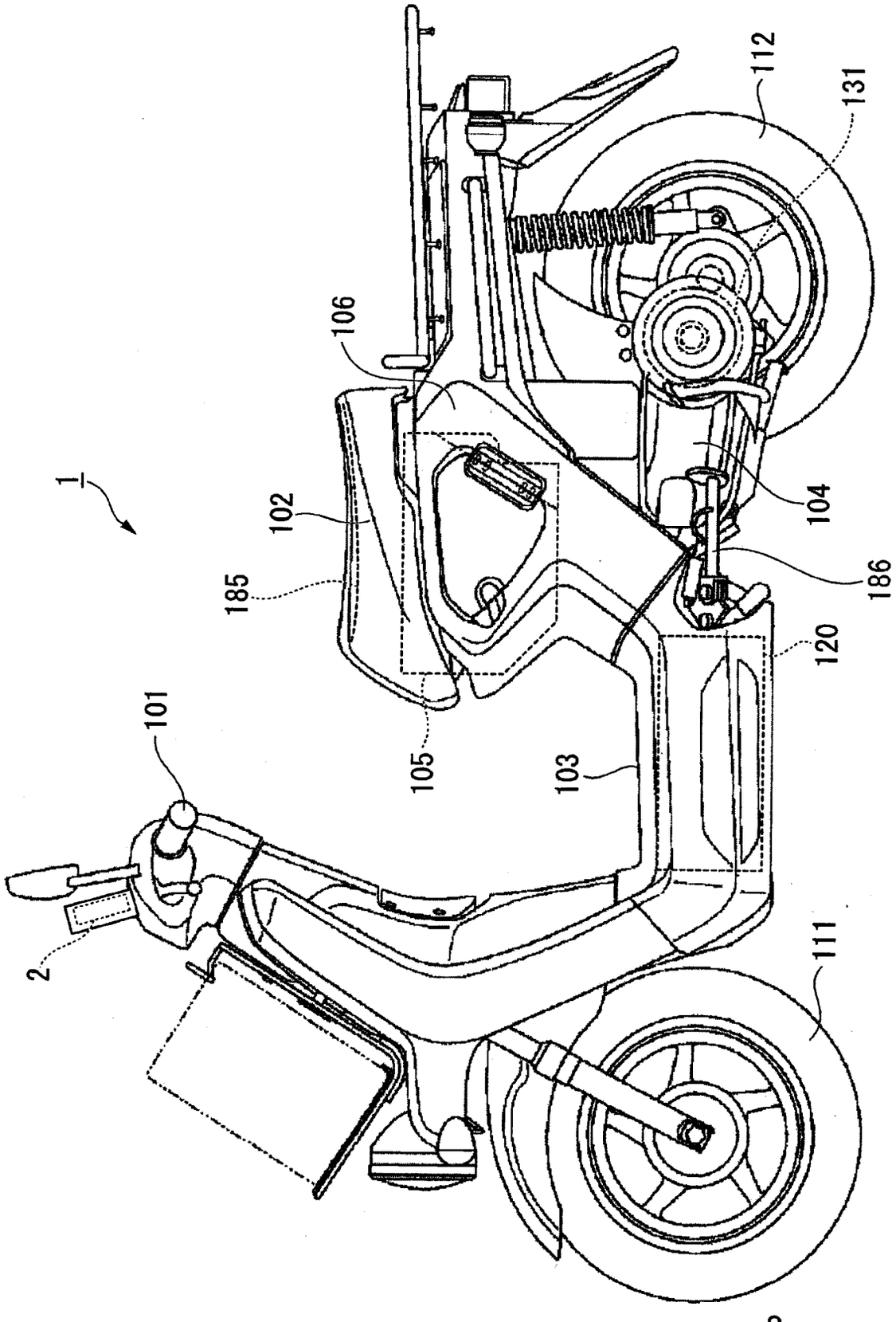

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FIG. 2

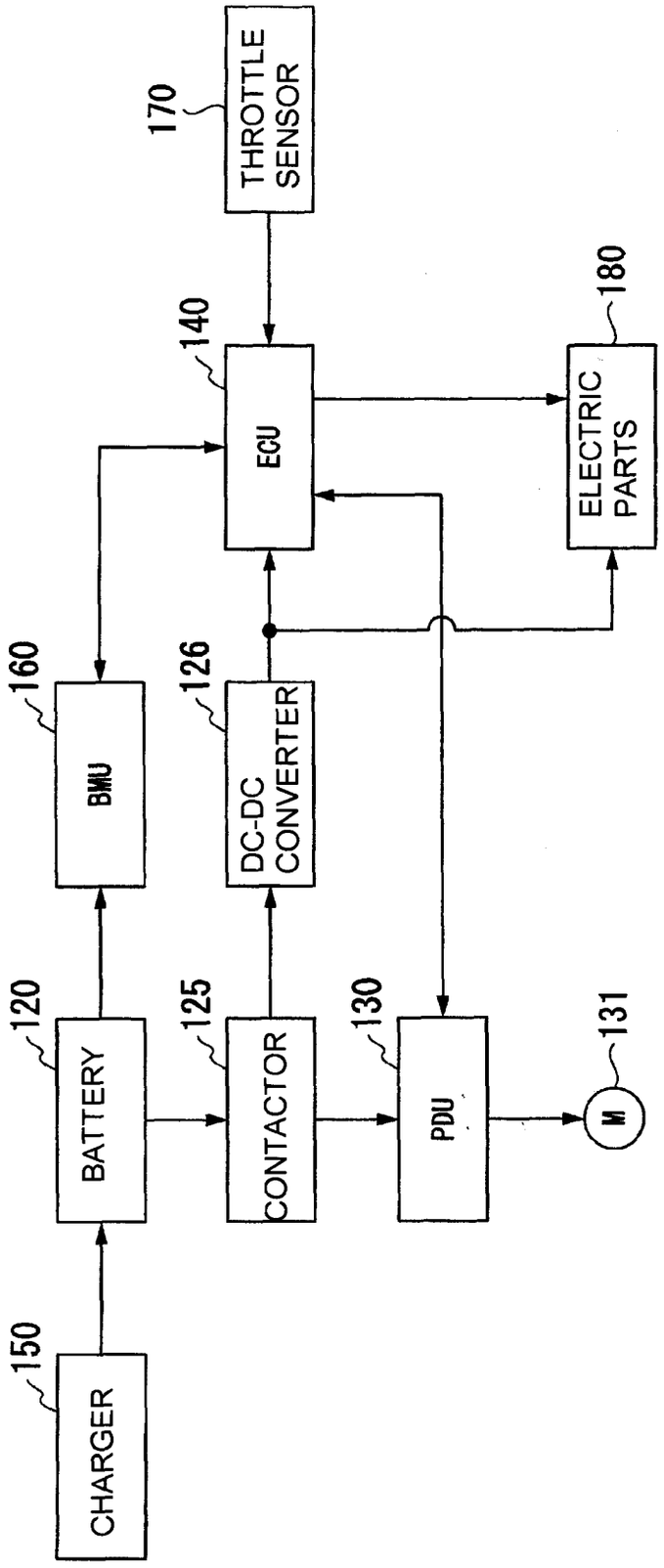

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FIG. 3

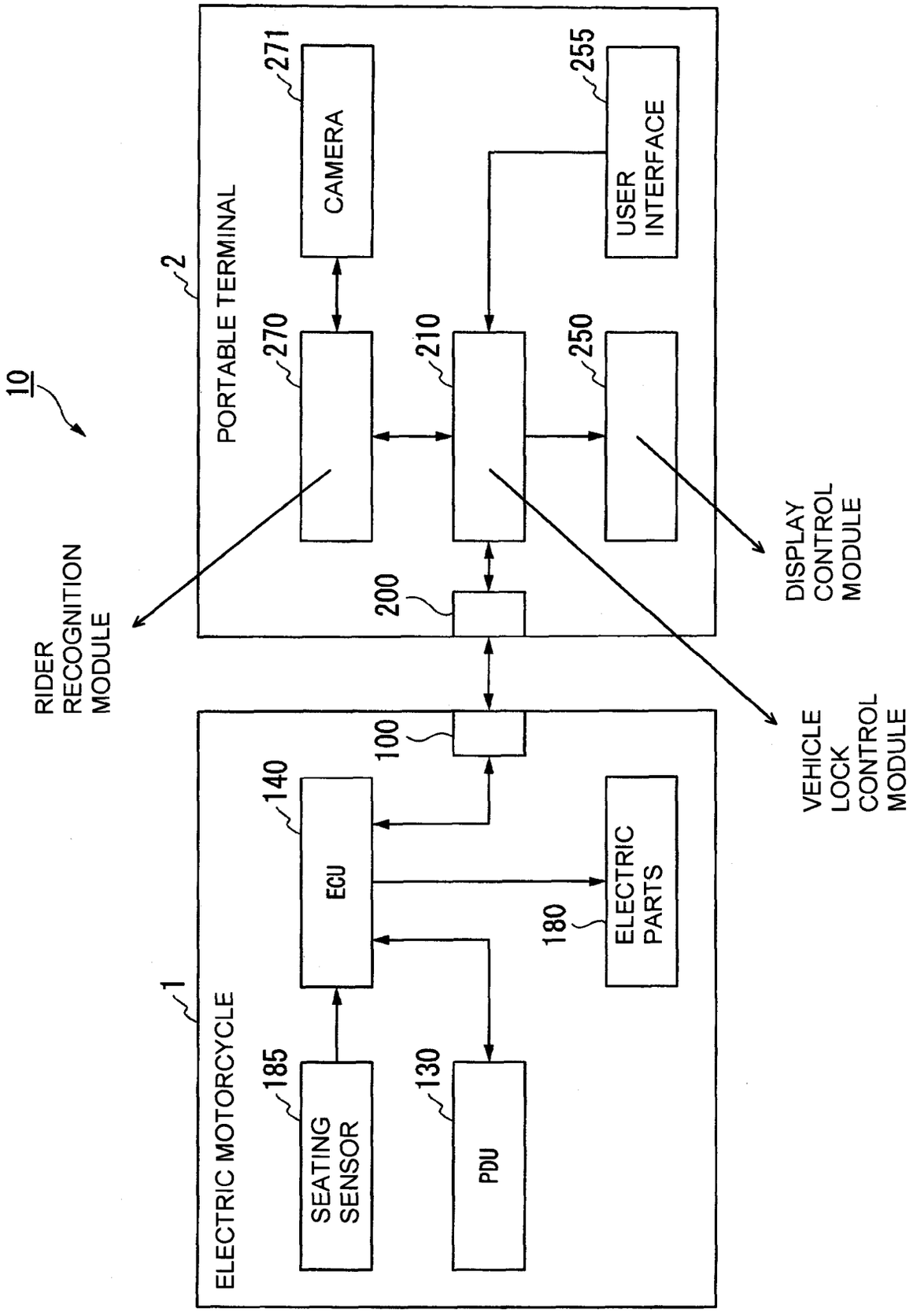

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FIG. 4

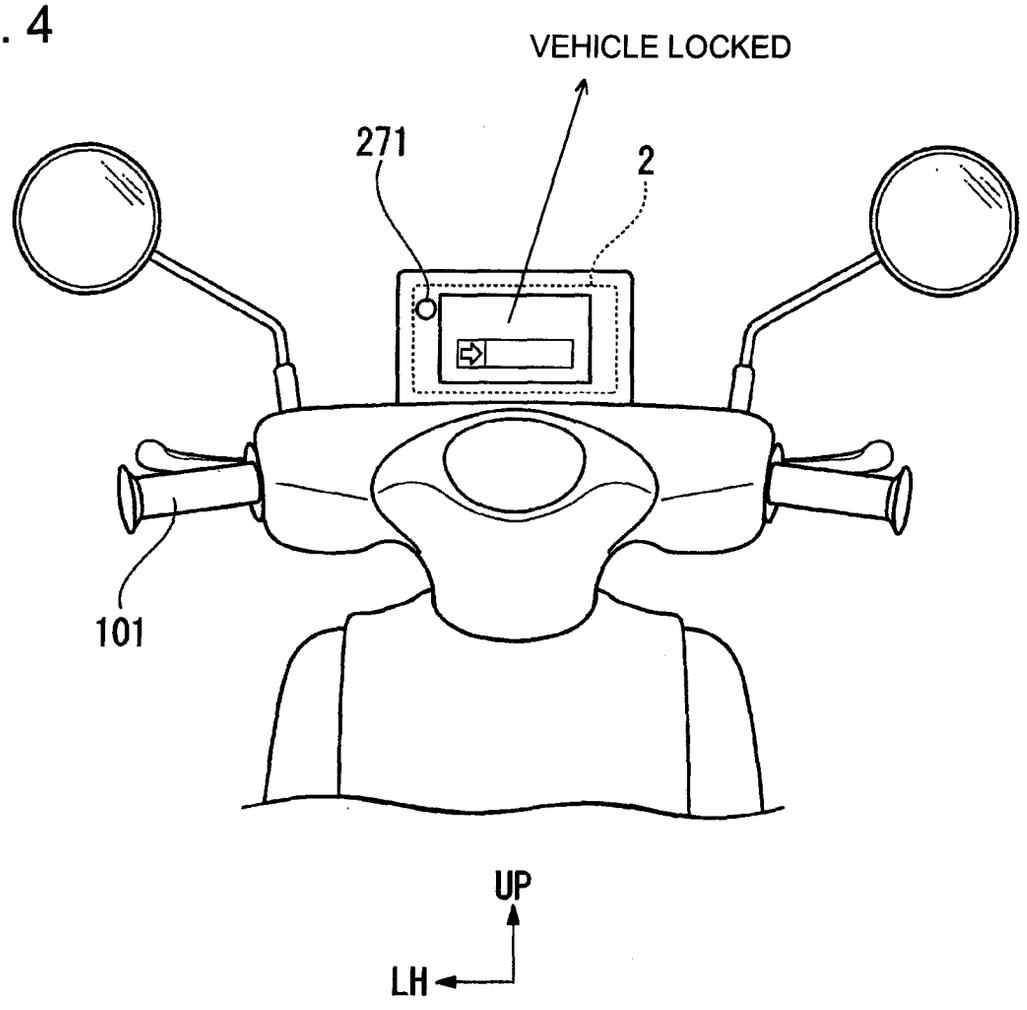

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FIG. 5

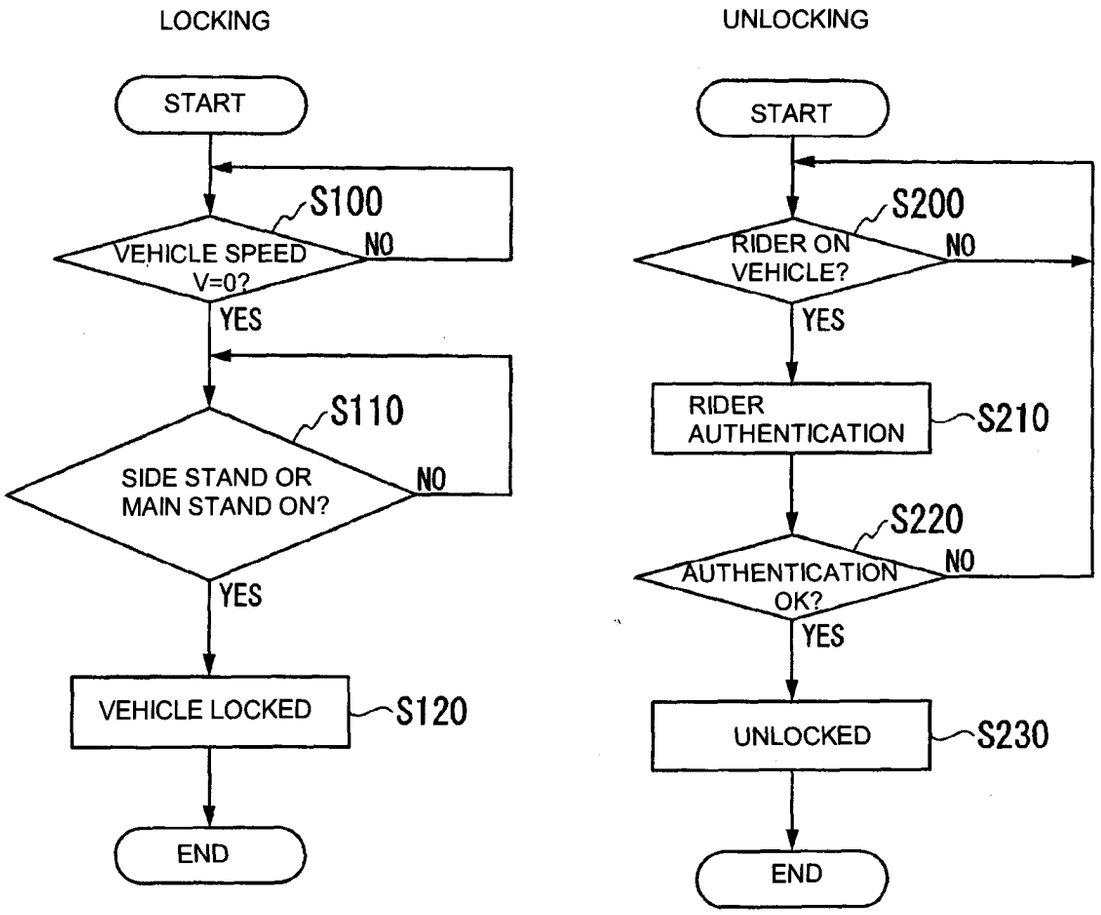

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FIG. 6

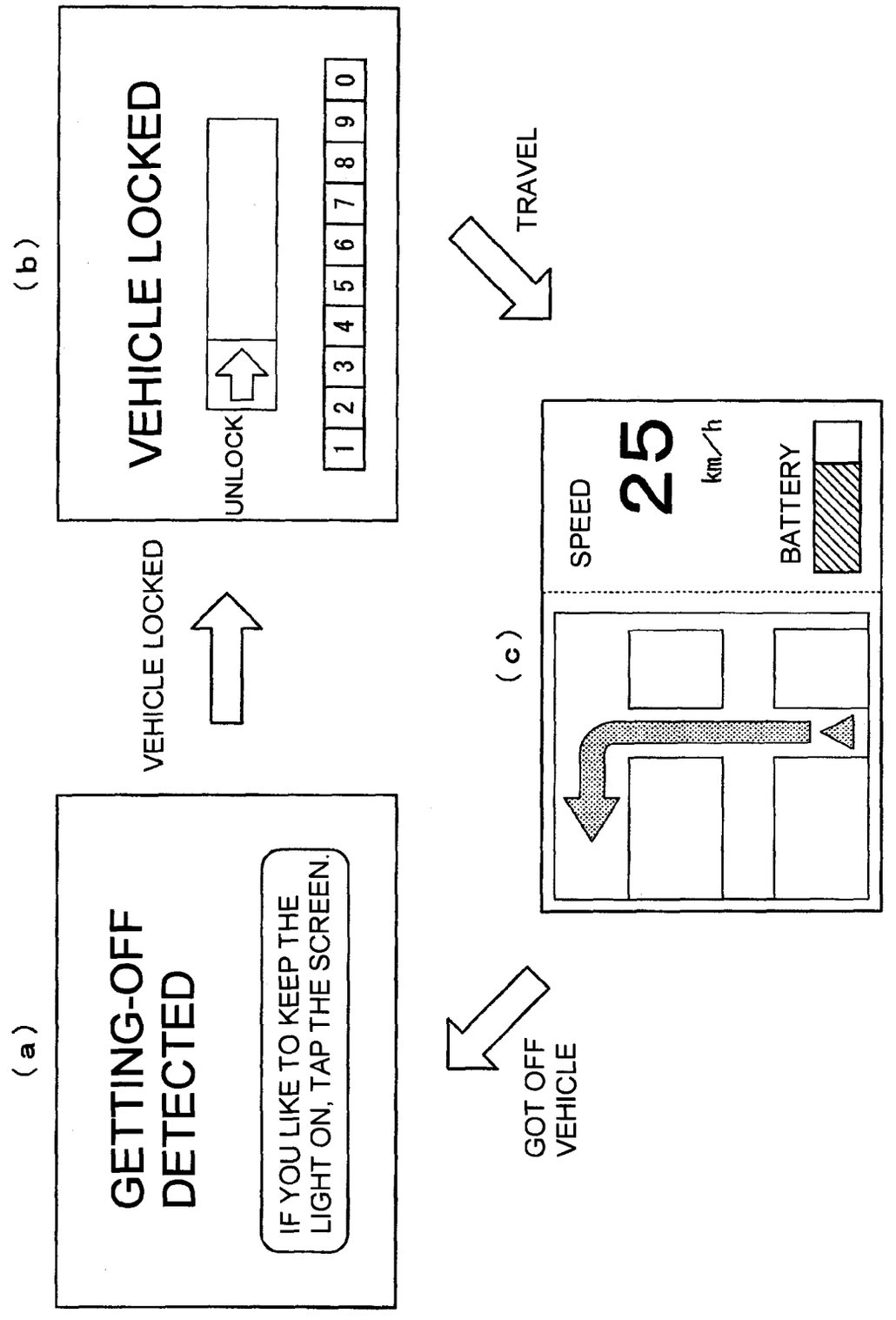

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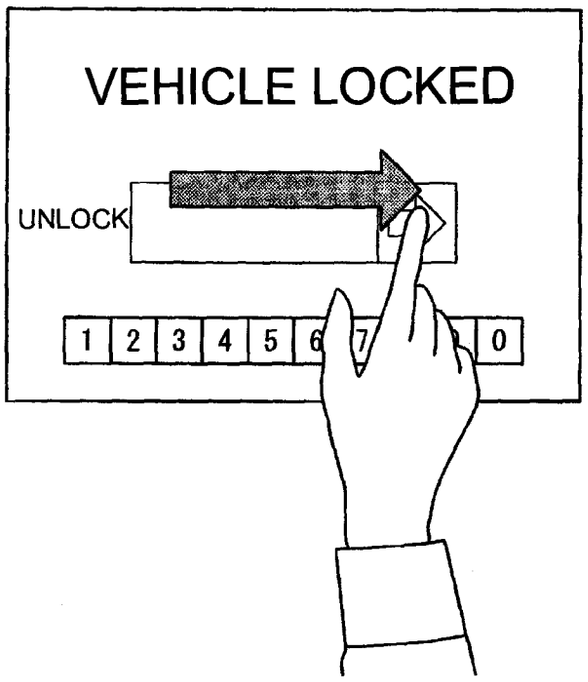
FIG. 7

(a)



(b)

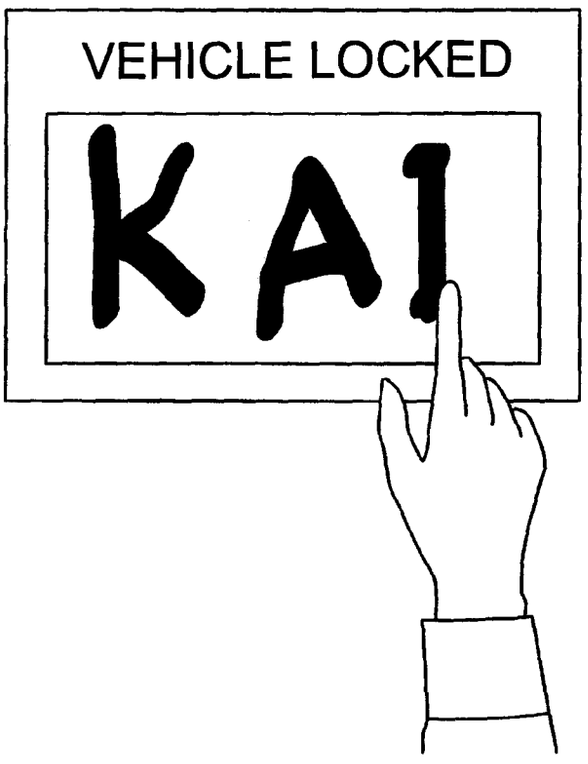


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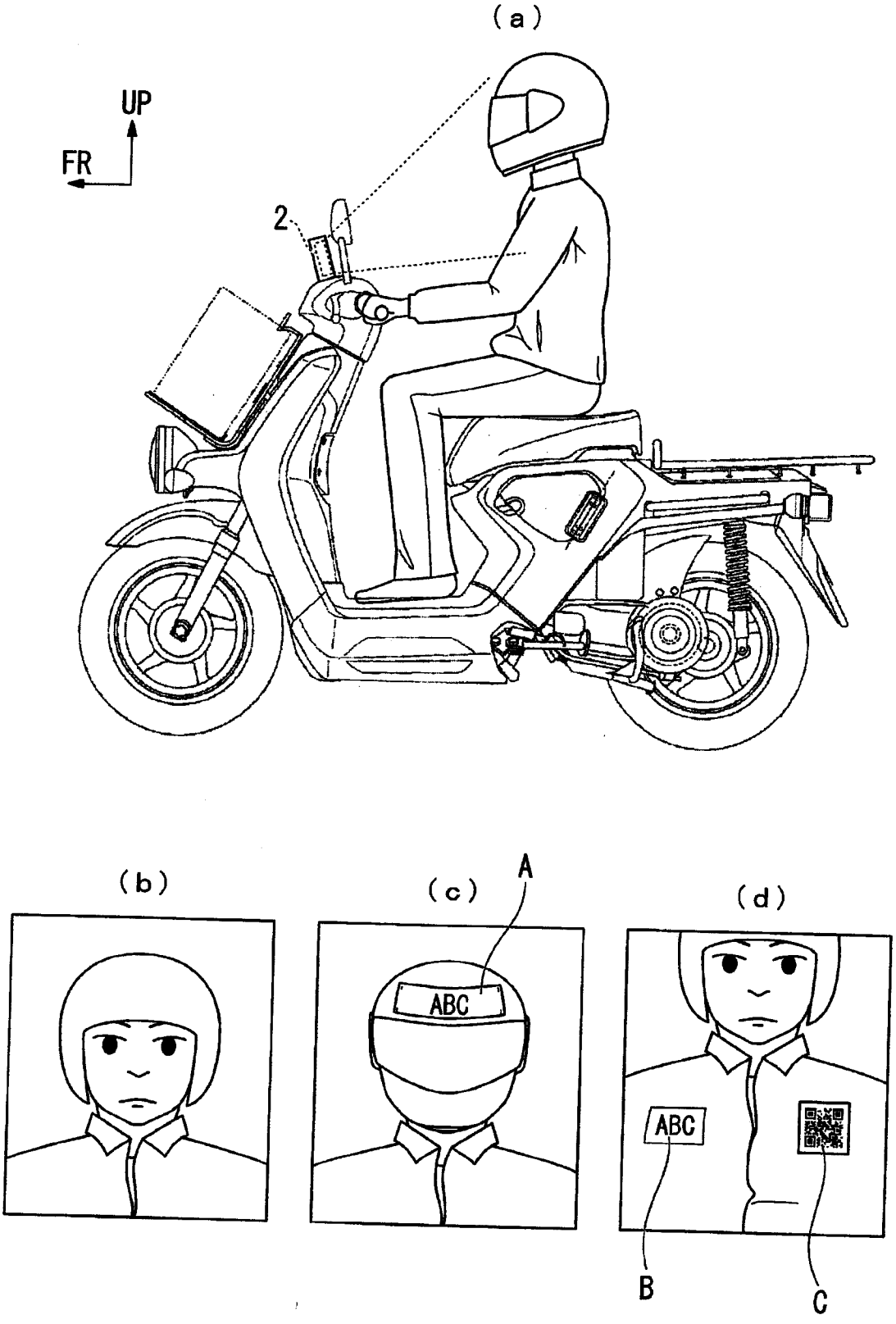
FIG. 8



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[Document Name] Specification

[Title of the Invention] VEHICLE LOCK SYSTEM

[Technical Field]

[0001]

The present invention relates to a vehicle lock system which is used at the time of getting off a vehicle temporarily.

[Background Art]

[0002]

In the past, a vehicle has been provided with a function to lock the vehicle in order to prevent a third person other than the owner from using the vehicle illegally. For example, Patent Literature 1 discloses an electronic key system which uses a communication terminal as a vehicle key. Also, Patent Literature 2 discloses a vehicle alarm system which checks an owner and a suspicious person through a camera installed in the vehicle.

[0003]

Furthermore, in recent years, the development of a saddle-ride type electric vehicle which is run by an electric motor driven by electric power supplied from a battery has progressed and the use of this saddle-ride type electric vehicle for traveling is increasing. Also, an increasing number of collection and delivery agents are using saddle-ride type electric vehicles in collection and delivery of packages.

[Citation List]

[Patent Literature]

[0004]

[Patent Literature 1] JP-A No. 2011-231567

[Patent Literature 2] JP-A No. 2005-280526

[Summary of Invention]

[Technical Problem]

[0005]

However, when stoppage time is short, the vehicle may be left unlocked. Furthermore, when a collection and delivery agent uses a vehicle, a delivery person may not lock the vehicle at each time of delivery or collection work because he/she frequently gets on and off the saddle-ride type electric vehicle and it is troublesome to lock and unlock the vehicle.

[0006]

As in this case, when a person temporarily gets off a vehicle, the vehicle is not always locked. From the viewpoint of preventing unauthorized use of a vehicle, it is necessary to lock the vehicle and it is desirable that the operation to lock and unlock the vehicle be not troublesome at the time of getting off the vehicle temporarily.

[0007]

The present invention has been made in recognition of the above problem and has an object to provide a vehicle lock system which can lock a vehicle into a state in which it cannot run, even at the time of getting off the vehicle temporarily and can easily unlock the vehicle to return it to a state in which it can run.

[Solution to Problem]

[0008]

In order to solve the above problem, the vehicle lock system described in Claim 1 is a vehicle lock system (10) which, when a rider gets off a vehicle (1), locks the vehicle (1) into a

state in which it cannot run, and includes on-vehicle/off-vehicle decision means (140, 185) which decides whether or not the rider is riding on the vehicle (1) and outputs a result of the decision as on-vehicle/off-vehicle information, and a portable terminal (2) attached to the vehicle (1) in an attachable/detachable manner by the rider, the portable terminal (2) includes vehicle lock control means (210) which puts the vehicle (1) into a locked state in which it cannot run if the on-vehicle/off-vehicle information indicates that the rider is not riding on the vehicle and puts the vehicle (1) into an unlocked state in which it can run if the on-vehicle/off-vehicle information indicates that the rider is riding on the vehicle, unlocking means (255) which outputs operation information according to operation for putting the vehicle (1) into the unlocked state, and vehicle state display means (250) which displays a method of operating the unlocking means (255) when the vehicle (1) is controlled to be held in the locked state by the vehicle lock control means (210), in which the vehicle lock control means (210) makes a decision as to whether or not an occupant riding on the vehicle (1) is the rider of the vehicle (1) based on the operation information and puts the vehicle (1) into the unlocked state depending on a result of the decision.

The vehicles include all vehicles that a rider rides by striding over the vehicle body, including not only motorcycles but also three-wheeled vehicles (vehicles with one front wheel and two rear wheels and also vehicles with two front wheels and one rear wheel) or four-wheeled vehicles.

In the invention described in Claim 2, the vehicle state

display means (250) displays a method of entering, through the unlocking means (255), a password to put the vehicle (1) into the unlocked state and the vehicle lock control means (210) receives the password as the operation information from the unlocking means (255) and decides whether or not the occupant riding on the vehicle is the rider of the vehicle (1) according to whether or not the received password coincides with a predetermined and registered password.

In the invention described in Claim 3, the unlocking means (255) is a touch panel combined with the vehicle state display means (250), the vehicle state display means (250) displays a method of entering a password to put the vehicle (1) into the unlocked state by operating the unlocking means (255) by pressing a display screen; and the vehicle lock control means (210) receives the password as the operation information from the unlocking means (255) and decides whether or not the occupant riding on the vehicle is the rider of the vehicle (1) according to whether or not the received password coincides with a previously registered password.

In the invention described in Claim 4, the unlocking means (255) is a touch panel combined with the vehicle state display means (250), the vehicle state display means (250) displays a method of inputting operation to put the vehicle (1) into the unlocked state by operating the unlocking means (255) by sliding in one direction with a display screen held pressed, and the vehicle lock control means (210) receives information indicating the direction of sliding as the operation information from the unlocking means (255) and decides whether or not the occupant

riding on the vehicle is the rider of the vehicle (1) according to whether or not the input direction coincides with a predetermined and registered direction.

In the invention described in Claim 5, the unlocking means (255) is a touch panel combined with the vehicle state display means (250), the vehicle state display means (250) displays a method of inputting operation to put the vehicle (1) into the unlocked state by operating the unlocking means (255) by pressing a plurality of predetermined spots on a display screen in a predetermined order or sliding in a predetermined trajectory, and the vehicle lock control means (210) receives information indicating the order in which the predetermined plural spots have been pressed or information indicating the trajectory of sliding as the operation information from the unlocking means (255) and decides whether or not the occupant riding on the vehicle is the rider of the vehicle (1) according to whether or not the input order or trajectory coincides with a predetermined and registered order or trajectory.

In the invention described in Claim 6, the portable terminal (2) further includes a photographing means (271) which takes an image of an occupant of the vehicle (1) and outputs the image, and rider recognition means (270) which recognizes the rider by checking the features of the occupant included in the image against previously registered features of a user of the portable terminal (2) based on the image taken by the photographing means (271) and outputs a result of the recognition as rider recognition information, and the vehicle lock control means (210) decides whether or not the occupant is the rider of

the vehicle (1) based on the rider recognition information outputted from the rider recognition means (270).

In the invention described in Claim 7, the unlocking means (255) is a touch panel combined with the vehicle state display means (250) and the vehicle state display means (250) displays a method of starting check by the rider recognition means (270) by operating the unlocking means (255) by pressing a display screen.

In the invention described in Claim 8, the rider recognition means (270) recognizes the rider based on features of the face of, or a thing worn by, the occupant included in the image taken by the photographing means (271) as a subject of photography.

In the invention described in Claim 9, the vehicle (1) is a saddle-ride type electric vehicle (1) in which a drive mechanism (104) includes an electric motor (131) and the vehicle lock control means (210) controls the saddle-ride type electric vehicle (1) to put it into either the locked state or the unlocked state by controlling power supply control means (140) for controlling electric power supplied to the electric motor (131).

[Advantageous Effects of Invention]

[0009]

According to the invention described in Claim 1, when the rider gets off the vehicle, the vehicle is put in a locked state in which the vehicle cannot run and only when the authorized rider gets on the vehicle, the vehicle can be put in an unlocked state in which the vehicle can run so that unauthorized use of the vehicle can be prevented.

According to the inventions described in Claims 2 to 5, the vehicle can be unlocked by predetermined simple operation known only by the authorized rider.

According to the inventions described in Claims 6 to 8, the authorized rider is recognized based on the features of the rider and the authorized rider can unlock the vehicle more easily.

According to the invention described in Claim 9, the vehicle lock system in the present invention can be easily applied to a saddle-ride type electric vehicle.

[Brief Description of Drawings]

[0007]

[Fig. 1] Fig. 1 is a left side view of a saddle-ride type electric vehicle to which the vehicle lock system according to an embodiment of the present invention is applied.

[Fig. 2] Fig. 2 is a block diagram showing the general configuration of a control section which controls the travel of the saddle-ride type electric vehicle to which the vehicle lock system according to this embodiment is applied.

[Fig. 3] Fig. 3 is a block diagram showing the general system configuration of the vehicle lock system in this embodiment.

[Fig. 4] Fig. 4 is an enlarged view of the handlebar of the saddle-ride type electric vehicle to which the vehicle lock system in this embodiment is applied.

[Fig. 5] Fig. 5 is a flowchart showing the processing sequence in the vehicle lock system in this embodiment.

[Figs. 6] Figs. 6 are views showing an example of the way of showing the state of the saddle-ride type electric vehicle to which the vehicle lock system in this embodiment is applied.

[Figs. 7] Figs. 7 are views showing an example of a method of operation for unlocking the saddle-ride type electric vehicle to which the vehicle lock system in this embodiment is applied.

[Figs. 8] Figs. 8 are views showing an example of a method of processing for rider recognition in the vehicle lock system in this embodiment.

[Description of Embodiments]

[0011]

Next, an embodiment of the present invention will be described referring to drawings. In the description of the embodiment, it is assumed that the vehicle lock system according to the present invention is applied to a saddle-ride type electric vehicle. The drawings should be seen according to the orientations of reference signs and "left", "right", "front" and "rear" refer to directions as seen from the rider.

[0012]

Fig. 1 is a left side view of a saddle-ride type electric vehicle to which the vehicle lock system according to an embodiment of the present invention is applied. Fig. 1 shows an example of a scooter type saddle-ride type electric vehicle with a low floor (hereinafter referred to as "electric motorcycle"). The electric motorcycle 1 shown in Fig. 1 has a low floor 103 which is located between a steering handlebar 101 and a seat 102 for an occupant to sit on to enable the occupant to put his/her feet on it and covers a battery 120 from above and has a single front wheel 111 as a steering wheel and a single rear wheel 112 as a driving wheel.

[0013]

The electric motorcycle 1 runs as an electric motor 131 built in a swing arm 104 is driven by electric power supplied from the battery 120 mounted inside the low floor 103 and the torque generated when the electric motor 131 is driven is transmitted to the rear wheel 112. The travel of the electric motorcycle 1 is controlled by a control section located in an adequate place, for example, inside the swing arm 104, inside a goods housing box 105 under the seat 102, or inside left and right side covers 106.

[0014]

Fig. 2 is a block diagram showing the general configuration of the control section which controls the travel of the electric motorcycle 1 as a saddle-ride type electric vehicle to which the vehicle lock system in this embodiment is applied.

[0015]

The battery 120 generates a predetermined high voltage (for example, 48 to 72 V) by connecting a plurality of single batteries such as lithium ion batteries, nickel-hydrogen batteries, or lead batteries in series. Electric power from the battery 120 is supplied through a contactor 125 which works in conjunction with a main switch (not shown), to a PDU (Power Driver Unit) 130 which controls output of the electric motor 131 and after it is converted from DC power into three-phase AC power by the PDU 130, it is supplied to the electric motor 131 as a three-phase AC motor.

[0016]

Output voltage of the battery 120 outputted through the contactor 125 is stepped down to a low voltage (for example, 12

V) by a DC-DC converter 126 and supplied to control components such as an ECU (Electric Control Unit) 140. Also, low voltage power obtained by the DC-DC converter 126 is supplied to general electric parts 180 such as a sub-battery and a lamp which are not shown.

[0017]

The battery 120 can be charged by a charger 150 connected, for example, to a power supply of 100 VAC. The charge/discharge condition and temperature of the battery 120 are monitored by a BMU (Battery Managing Unit) 160 and the information on the monitored battery 120 is shared with the ECU 140. According to the block diagram shown in Fig. 2, the charger 150 is also a constituent element of the control section for controlling the travel of the electric motorcycle 1; however, the charger 150 may be structured to be attachable to, and detachable from, the electric motorcycle 1.

[0018]

The ECU 140 receives output request information from a throttle (accelerator) sensor 170 and the ECU 140 controls the operation of the electric motor 131 by controlling the electric power supplied to the electric motor 131 by the PDU 130 based on the received output request information. Also, the ECU 140 receives control request information from a switch (not shown) operated by the rider or a sensor (not shown) indicating the state of the electric motorcycle 1 and the ECU 140 controls operation of the electric parts 180 based on the received control request information. For example, if the rider operates a lamp switch (not shown), the ECU 140 turns on or off the lamp

according to the lamp control request information outputted from the lamp switch.

[0019]

Next, the vehicle lock system in this embodiment will be described. Fig. 3 is a block diagram showing the general system configuration of the vehicle lock system in this embodiment. The vehicle lock system 10 in this embodiment includes an electric motorcycle 1 and a portable terminal 2.

[0020]

The portable terminal 2 is a portable terminal which combines the function of a portable phone using an existing mobile communication network and the function of a portable information terminal (PDA: Personal Digital Assistant), for example, what is called a smart phone. The portable terminal 2 has various application functions which a PDA can deal with. In the explanation below, it is assumed that the portable terminal 2 has a facial recognition function based on an image taken by a camera provided in the portable terminal 2 itself.

[0021]

The portable terminal 2 controls locking and unlocking (hereinafter referred to as "unlock") of the electric motorcycle 1 depending on the information received from the ECU 140 provided in the electric motorcycle 1 which indicates whether or not the rider is riding on the motorcycle (hereinafter referred to as "on-vehicle/off-vehicle information"). Here, locking of the electric motorcycle 1 means to put the electric motorcycle 1 into a state in which it can not run even when the electric motorcycle 1 is unlocked, for example, by a main key, and unlocking means to

return the electric motorcycle 1 into a normal state in which it can run.

[0022]

As shown in Fig. 3, the portable terminal 2 includes an external connecting device 200, a vehicle lock control module 210, a display control module 250, a user interface 255, a rider recognition module 270, and a camera 271. Each of the modules provided in the portable terminal 2 is a software module which implements an application for providing the function of the vehicle lock system 10 in this embodiment to the user of the portable terminal 2, namely the rider of the electric motorcycle 1, but it is not limited thereto and may be a hardware module which implements the function of each module.

[0023]

The display control module 250 makes a screen specified by the vehicle lock control module 210 appear on the display of the portable terminal 2 itself so that the present state of the electric motorcycle 1 is shown to the rider of the electric motorcycle 1.

[0024]

The user interface 255 is an operation input section on which the user of the portable terminal 2, namely the rider of the electric motorcycle 1, can do various operations. Although the user interface 255 can be a button provided separately from the display of the portable terminal 2, in the explanation below it is assumed that it is a pressure sensor provided in the display of the portable terminal 2, namely a touch panel combined with the display. Therefore, in the explanation below, it is

assumed that the rider of the electric motorcycle 1 operates the user interface 255 by touching (tapping or flicking) the display of the portable terminal 2.

[0025]

The user interface 255 outputs information on operation of the portable terminal 2 by the rider of the electric motorcycle 1 and information on data entered into the portable terminal 2 to the vehicle lock control module 210. In the explanation below, information on operation of the portable terminal 2 by the rider and information on data entered into the portable terminal 2 are collectively referred to as "operation information."

[0026]

The camera 271 is the camera provided in the portable terminal 2 itself. The camera 271 takes a photo of the present occupant riding on the electric motorcycle 1 according to a photographing instruction entered from the rider recognition module 270 and outputs the photo image to the rider recognition module 270.

[0027]

The rider recognition module 270 performs the process of facial recognition of the occupant of the electric motorcycle 1 according to an instruction for performing the rider recognition process which is entered from the vehicle lock control module 210. Information (features) on the face of the user of the portable terminal 2, namely the owner or user (rider) of the electric motorcycle 1, is registered in the rider recognition module 270. In the facial recognition process by the rider recognition module 270, the existing facial recognition function of the portable

terminal 2 is used or processing is performed in the same way as with the existing facial recognition function. Therefore, detailed description of the facial recognition process by the rider recognition module 270 is omitted.

[0028]

In the facial recognition process by the rider recognition module 270, first a photographing instruction is outputted to the camera 271. Then, in response to the output photographing instruction, based on the image entered from the camera 271, the rider recognition module 270 checks the information (features) on the face of the occupant of the electric motorcycle 1 as the subject of photography as included in the image, against the previously registered information (features) on the face of the user of the portable terminal 2 and decides (recognizes) whether or not the present occupant photographed by the camera 271 is the user of the portable terminal 2. The rider recognition module 270 outputs information on the result of decision (recognition) (hereinafter referred to as "rider recognition information") to the vehicle lock control module 210.

[0029]

The vehicle lock control module 210 controls locking and unlocking of the electric motorcycle 1 depending on the on-vehicle/off-vehicle information entered through the external connecting device 200 from the ECU 140 of the electric motorcycle 1. If the vehicle lock control module 210 receives, from the ECU 140, on-vehicle/off-vehicle information indicating that the rider has got off, first it instructs the display control module 250 to display a screen indicating that the rider's getting off the

electric motorcycle 1 is detected (hereinafter referred to as the "getting-off detection screen"). After that, the vehicle lock control module 210 outputs an instruction for locking the electric motorcycle 1 through the external connecting device 200 to the ECU 140. Then it instructs the display control module 250 to display a screen indicating that the electric motorcycle 1 is currently locked (hereinafter referred to as the "locked-state screen").

[0030]

In addition, if the vehicle lock control module 210 receives, from the ECU 140, on-vehicle/off-vehicle information indicating that the occupant (not the rider in some case) has got on the vehicle, it performs authentication of the occupant currently riding on the vehicle by deciding whether or not the occupant riding on the vehicle is the authorized rider, namely the user of the portable terminal 2. In the authentication of the occupant riding on the vehicle by the vehicle lock control module 210, it checks operation information entered from the user interface 255 according to the occupant's operation which depends on unlocking operation and rider recognition information as the result of the rider recognition process as entered from the rider recognition module 270. Then if it is confirmed that the operation information and rider recognition information indicate the authorized rider, it is decided that the occupant riding on the vehicle is the authorized rider, namely the rider is authenticated.

[0031]

If the vehicle lock control module 210 decides that the

occupant riding on the vehicle is the authorized rider, namely the rider is authenticated, it outputs an instruction for unlocking the electric motorcycle 1 through the external connecting device 200 to the ECU 140.

[0032]

If the vehicle lock control module 210 decides that the occupant riding on the vehicle is not the authorized rider, namely the rider is not authenticated, it continues locking the electric motorcycle 1 and does not output an instruction for unlocking the electric motorcycle 1 to the ECU 140. This prevents unauthorized use of the electric motorcycle 1, for example, by a third person.

[0033]

Various kinds of operation are possible as unlocking operation which is inputted from the user interface 255. For example, one possible method is that a display for entry of a password to unlock the vehicle is made to appear on the locked-state screen and whether or not it is the authorized rider is decided according to whether the password entered by the occupant operating the user interface 255 is correct or not. Another possible method is, for example, that a display for requesting flicking operation, or sliding (flipping) in one direction with the screen held touched, is made to appear on the locked-state screen in order to unlock the vehicle and whether or not it is the authorized rider is decided according to whether or not the occupant has made flicking operation in a predetermined specific correct direction. A further possible method is, for example, that a plurality of points to be touched by the occupant are

shown on the locked-state screen and whether or not it is the authorized rider is decided according to whether or not the occupant has touched the points in a correct order or whether or not the occupant has followed the points by sliding motion in a correct trajectory. Also a further possible method is, for example, that a button for starting the facial recognition is displayed on the locked-state screen and whether or not it is the authorized rider is decided by the rider recognition process which is performed by the rider recognition module 270 after the occupant touches the button. The rider recognition process by the rider recognition module 270 can be performed not only by the above facial recognition process but also, for example, by uniform or helmet pattern recognition or based on 2D barcode such as QR code (registered trademark) or barcode information.

[0034]

The operation for unlocking the electric motorcycle 1 is not limited to the above example. Furthermore, the operation for unlocking the electric motorcycle 1 may be a combination of two or more operations and decisions. For example, whether or not it is the authorized rider may be decided by making the decision about the rider based on a password using the user interface 255 as mentioned above and concurrently performing the rider recognition process using the rider recognition module 270.

[0035]

In addition, an alarm may be given if in accordance with predetermined criteria for unauthorized use it is decided that the use is unauthorized, for example, a failure in the entry of a password into the portable terminal 2 occurs three times

successively or operation is not finished within a predetermined time. For the alarm given here, whatever method notifies those around the electric motorcycle 1 of the unauthorized use may be adopted: for example, an alarm (warning whistle) (not shown) which is sounded or a lamp which flickers. If that is the case, the mobile phone function of the portable terminal 2 which uses an existing mobile communication network may be used so that another portable terminal carried by the authorized rider, or the delivery and collection service center or store is automatically notified of the unauthorized use. Furthermore, information on the present position of the electric motorcycle 1 may be obtained, for example, from the position sensor of the GPS (Global Position System) provided in the portable terminal 2 to transmit the obtained information on the present position of the electric motorcycle 1.

[0036]

The ECU 140 outputs on-vehicle/off-vehicle information indicating whether or not an occupant (not the rider in some case) is riding on the electric motorcycle 1, through the external connecting device 100 to the portable terminal 2. The ECU 140's decision as to whether or not an occupant is riding on the electric motorcycle 1 is made based on, for example, the detection result information from a seating sensor 185 (see Fig. 1) provided in the seat 102 for detecting an occupant sitting on the seat or a stand sensor (not shown) for detecting the state of the main stand 186 (see Fig. 1) or side stand (not shown) of the electric motorcycle 1. Fig. 3 shows the configuration in which the ECU 140 makes a decision as to whether or not an occupant is

riding on the electric motorcycle 1, based on the detection result information from the seating sensor 185.

[0037]

The decision as to whether or not an occupant is riding on the electric motorcycle 1 may be made based on a combination of detection results from plural sensors. For example, if the decision as to whether or not an occupant is riding on the electric motorcycle 1 is made based on a combination of results from the seating sensor 185 and stand sensor, the ECU 140 makes a decision as follows. If the stand sensor detects that the stand is up and the seating sensor 185 detects that an occupant is riding on the vehicle, the ECU 140 decides that an occupant is riding on the electric motorcycle 1. If the stand sensor detects that the stand is down and the seating sensor 185 detects that an occupant is off the vehicle, the ECU 140 decides that the rider has got off the electric motorcycle 1.

[0038]

The way the ECU 140 decides whether or not an occupant is riding on the electric motorcycle 1 is not limited to the above example and whatever method can decide whether or not an occupant is riding on the electric motorcycle 1 may be adopted. In addition, what makes the decision is not limited to the ECU 140. For example, the portable terminal 2 can also decide whether or not an occupant is riding on the electric motorcycle 1, by making the camera 271 of the portable terminal 2 take a photo of a subject located within the distance of the seat 102 and making the rider recognition module 270 perform the facial recognition process in a predetermined cycle when the electric motorcycle 1

is locked.

[0039]

The ECU 140 actually locks or unlocks the electric motorcycle 1 in response to an instruction for locking and unlocking the electric motorcycle 1 which is entered from the portable terminal 2 through the external connecting device 100. The ECU 140 actually locks the electric motorcycle 1 in response to an instruction entered from the portable terminal 2 for locking the electric motorcycle 1, for example, by stopping power supply to the electric motor 131 through the PDU 130. Along with this, it may be designed to turn off the electric parts 180 except those required to control unlocking, for example, turn off the lamp. This can reduce consumption of electric power stored in the battery 120 of the electric motorcycle 1 and contribute to increase in the mileage of the electric motorcycle 1.

[0040]

It may happen that while the electric motorcycle 1 is actually locked by the vehicle lock system 10 in this embodiment, the electric motorcycle 1 is unlocked, for example, by the main key. Therefore, it is also necessary to prevent removal of the main key from the electric motorcycle 1 when the electric motorcycle 1 is locked actually. For example, in the case of a cylinder key, while in an unlocked state, rotation of the cylinder should be prohibited so that the main key cannot be turned to the position where it can be pulled out. An alternative approach is, for example, to abolish the main key and use the detection of an occupant on the electric motorcycle 1 and the decision of rider recognition instead of the main key.

[0041]

Also, in response to an instruction entered from the portable terminal 2 for unlocking the electric motorcycle 1, for example, the ECU 140 restores power supply to the electric motor 131 through the PDU 130 and returns operation of the electric parts 180 to a normal state in which the electric motorcycle 1 can run.

[0042]

The method of locking and unlocking the electric motorcycle 1 actually in response to an instruction entered from the portable terminal 2 for locking and unlocking the electric motorcycle 1 is not limited to the above example and whatever method can prevent unauthorized use of the electric motorcycle 1 by a third person may be adopted.

[0043]

Here, an example of connection between the ECU 140 of the electric motorcycle 1 and the portable terminal 2 is explained. Fig. 4 is an enlarged view of the handlebar of the electric motorcycle 1 as a saddle-ride type electric vehicle to which the vehicle lock system 10 in this embodiment is applied. The portable terminal 2 is attached in a predetermined position of the handlebar of the electric motorcycle 1 in an attachable/detachable manner as shown in Fig. 4 and the ECU 140 and the portable terminal 2 are connected, for example, by transmitting a signal from the ECU 140 to the connector of the portable terminal 2. Consequently, the external connecting device 100 and the external connecting device 200 in the block diagram shown in Fig. 3 are connected. The portable terminal 2 is

structured to be attachable and detachable only by the user of the portable terminal 2, namely the rider of the electric motorcycle 1. Alternatively, for example, the structure may be designed to mechanically lock the vehicle or electrically unlock it by entry of a password into the portable terminal 2, though detailed description of the structure and the method of attachment and detachment is omitted here.

[0044]

Next, the processing sequence in the vehicle lock system 10 in this embodiment will be described. Fig. 5 is a flowchart showing the processing sequence in the vehicle lock system 10 in this embodiment.

[0045]

First, the process of locking the electric motorcycle 1 is explained. This flow is started when the seating sensor 185 detects that no occupant is seated. First, at Step S100, the ECU 140 detects that the electric motorcycle 1 has stopped. At Step S100, stop of the electric motorcycle 1 is detected based on information on vehicle speed V of the electric motorcycle 1. If the vehicle speed V of the electric motorcycle 1 is "0" and stop of the electric motorcycle 1 is detected (Yes at Step S100), at Step S110 the ECU 140 detects whether or not the rider has gotten off the electric motorcycle 1. At Step S110, the rider's getting off the electric motorcycle 1 is detected according to whether or not the side stand or main stand 186 of the electric motorcycle 1 is ON. At Step S110, if the rider has not gotten off (No at Step S110), the ECU 140 repeats the detection at Step S110 as to whether or not the rider has gotten off. If it is detected at

Step S110 that the rider has gotten off (Yes at Step S110), the ECU 140 outputs on-vehicle/off-vehicle information indicating the rider's getting off, to the portable terminal 2.

[0046]

As the vehicle lock control module 210 of the portable terminal 2 receives on-vehicle/off-vehicle information indicating the rider's getting off from the ECU 140, at Step S120 it first outputs an instruction for displaying a getting-off detection screen to the display control module 250. Consequently, the getting-off detection screen appears on the portable terminal 2 to show the rider of the electric motorcycle 1 that the electric motorcycle 1 is going to be locked. Then, the vehicle lock control module 210 outputs an instruction for locking the electric motorcycle 1 to the ECU 140. Consequently the ECU 140 actually locks the electric motorcycle 1. Then, the vehicle lock control module 210 outputs an instruction for displaying a locked-state screen to the display control module 250. Consequently, the locked-state screen appears on the portable terminal 2 to show the rider of the electric motorcycle 1 that the electric motorcycle 1 is locked.

[0047]

Next, the process of unlocking the electric motorcycle 1 is explained. This flow is started when the main switch of the electric motorcycle 1 is ON and the side stand or main stand 186 becomes OFF which means that it is retracted into the vehicle body. When the electric motorcycle 1 is locked by the vehicle lock system 10, first at Step S200 the ECU 140 detects whether or not an occupant (not the rider in some case) has gotten on the

vehicle. At Step S200, whether or not an occupant has gotten on the vehicle is detected according to whether or not the seating sensor 185 detects that an occupant is seated. If no occupant has gotten on the vehicle at Step S200 (No at Step S200), the ECU 140 outputs on-vehicle/off-vehicle information indicating that no occupant is riding on the vehicle, namely the on-vehicle/off-vehicle information indicating the rider's getting off as outputted at Step S110, to the portable terminal 2 and repeats the detection at Step S200 as to whether or not the occupant has gotten on. Then the vehicle lock control module 210 continues output of the instruction for locking the electric motorcycle 1 to the ECU 140 at Step S120 and output of the instruction for displaying the locked-state screen to the display control module 250. Consequently, the locked state of the electric motorcycle 1 and the display of the locked-state screen on the portable terminal 2 are continued.

[0048]

If it is detected at Step S200 that an occupant has gotten on (Yes at Step S200), the ECU 140 outputs on-vehicle/off-vehicle information indicating the occupant's getting on, to the portable terminal 2.

[0049]

As the vehicle lock control module 210 of the portable terminal 2 receives on-vehicle/off-vehicle information indicating the occupant's getting on from the ECU 140, at Step S210 it performs authentication of the occupant currently riding on the vehicle. Then the vehicle lock control module 210 decides whether or not the rider currently riding on the vehicle is authenticated

at step S220.

[0050]

If the rider currently riding on the vehicle is not authenticated at Step S220 (No at Step S220), the sequence goes back to Step S200 and the vehicle lock control module 210 continues output of the instruction for locking the electric motorcycle 1 to the ECU 140 at Step S120 and output of the instruction for displaying the locked-state screen to the display control module 250. Consequently, the locked state of the electric motorcycle 1 and the display of the locked-state screen on the portable terminal 2 are continued.

[0051]

If the rider currently riding on the vehicle is authenticated at Step S220 (Yes at Step S220), at Step S230 the vehicle lock control module 210 outputs an instruction for unlocking the electric motorcycle 1 to the ECU 140. Consequently the ECU 140 actually unlocks the electric motorcycle 1 and returns it into the normal state in which the electric motorcycle 1 can run.

[0052]

Here, an explanation is given of an example that the present state of the electric motorcycle 1 is shown on the display of the portable terminal 2 attached to the electric motorcycle 1. Figs. 6 are views showing an example of the way of showing the state of the electric motorcycle 1 as a saddle-ride type electric vehicle to which the vehicle lock system in this embodiment is applied. In the example of the way of showing it as illustrated in Figs. 6, in addition to the getting-off detection

screen and the locked-state screen, the running state of the electric motorcycle 1 is displayed as superposed on the navigation function of the portable terminal 2 as a running-state screen.

[0053]

Fig. 6(a) shows an example of the getting-off detection screen which appears when the rider's getting off the electric motorcycle 1 is detected. In the example of the getting-off detection screen shown in Fig. 6(a), a message confirming whether or not the lamp should be turned off is displayed when the electric motorcycle 1 is locked along with a message telling that the rider's getting off is detected. If the rider of the electric motorcycle 1 decides not to turn off the lamp and taps the screen with a finger, the user interface 255 outputs operation information indicating that tapping has been done, to the vehicle lock control module 210. Consequently, the vehicle lock control module 210 outputs an instruction for locking the electric motorcycle 1 without turning off the lamp, to the ECU 140.

[0054]

Fig. 6(b) shows an example of the locked-state screen which appears when the electric motorcycle 1 is locked. After the getting-off detection screen shown in Fig. 6(a), the electric motorcycle 1 is actually locked and then the display of the portable terminal 2 changes to the locked-state screen shown in Fig. 6(b). In the example of the locked-state screen shown in Fig. 6(b), numeric buttons for entering a password into the portable terminal 2 in order to unlock the electric motorcycle 1 are shown along with a message indicating that the electric motorcycle 1 is

currently locked. When the rider of the electric motorcycle 1 is going to unlock the electric motorcycle 1, he/she enters the password into the portable terminal 2 by input operation such as tapping the numeric buttons shown on the screen. The user interface 255 outputs operation information representing the pressed numerals to the vehicle lock control module 210. Consequently the vehicle lock control module 210 performs authentication of the occupant currently riding on the vehicle by deciding whether or not the operation information entered from the user interface 255, namely the entered password, is correct. Then, if the occupant currently riding on the vehicle is authenticated as the authorized rider, the vehicle lock control module 210 outputs an instruction for unlocking the electric motorcycle 1 to the ECU 140.

[0055]

Fig. 6(c) shows an example of the running-state screen which appears when the electric motorcycle 1 is running. In the example of the running-state screen shown in Fig. 6(c), a route guide based on the navigation function of the portable terminal 2 and the information on the speed of the electric motorcycle 1 and information on the residual quantity of electric power stored in the battery 120 of the electric motorcycle 1 which can be obtained from the ECU 140 are displayed.

[0056]

The way of displaying the state of the electric motorcycle 1 on the portable terminal 2 is not limited to the way shown in Figs. 6 and the present state of the electric motorcycle 1 can be shown to the rider of the electric motorcycle 1 in various ways.

The method of unlocking the electric motorcycle 1 is not limited to the method shown in Fig. 6(b) and it can be unlocked in various ways. Figs. 7 are views showing an example of an operation method for unlocking the electric motorcycle 1 as a saddle-ride type electric vehicle to which the vehicle lock system in this embodiment is applied. Fig. 7(a) shows an example of a case that the rider of the electric motorcycle 1 unlocks the electric motorcycle 1 by flicking a specified part of the screen and Fig. 7(b) shows an example of a case that the rider of the electric motorcycle 1 unlocks the electric motorcycle 1 by writing in a specified field of the screen by hand.

[0057]

As mentioned above, according to a form for embodying the present invention, when the rider's getting off a saddle-ride type electric vehicle is detected, the saddle-ride type electric vehicle is locked into a state in which it cannot run. Consequently, even when the rider temporarily gets off the saddle-ride type electric vehicle, the saddle-ride type electric vehicle is automatically locked without operation such as locking, for example, with the main key.

[0058]

Furthermore, according to a form for embodying the present invention, the saddle-ride type electric vehicle is unlocked by operating the portable terminal attached to the saddle-ride type electric vehicle in a locked state so that the saddle-ride type electric vehicle is returned to a state in which it can run. Consequently, an authorized rider can easily unlock the vehicle. If a third person who is not an authorized rider operates the

portable terminal, the saddle-ride type electric vehicle is not unlocked and remains locked. This prevents unauthorized use of the saddle-ride type electric vehicle by a third person. Furthermore, according to the form for embodying the present invention, if it is decided that the use is unauthorized, an alarm may be given.

[0059]

For the above reason, the form for embodying the present invention can provide a vehicle lock system which the user of the saddle-ride type electric vehicle can use with a sense of security.

[0060]

In this embodiment, a case that a portable terminal such as a smart phone is used as means for showing the state of the electric motorcycle 1 has been explained; however, the means for showing the state of the electric motorcycle 1 is not limited to the form for embodying the present invention. For example, another portable terminal for exclusive use may be provided. Furthermore, when a collection and delivery agent uses the electric motorcycle 1 for collection and delivery of packages, the delivery person as the rider of the electric motorcycle 1 can make the portable terminal for managing the collection of packages display the state of the electric motorcycle 1.

[0061]

Also in this embodiment, a case that the rider recognition module 270 performs the process of facial recognition of the occupant riding on the electric motorcycle 1 has been explained. However, the rider of the saddle-ride type electric vehicle is

expected to wear a helmet. Therefore, if the facial recognition process cannot be performed easily because the occupant currently riding on the vehicle wears a helmet, it is also possible to authenticate the rider, for example, by the features of the pattern on the helmet, etc. Also, if a collection and delivery agent uses the electric motorcycle 1 for the collection and delivery of packages, the rider can also be authenticated by the features of the collection and delivery agent's uniform which the delivery person wears.

[0062]

Here a concrete example of the rider recognition process for the rider recognition module 270 to recognize the delivery person is explained. Figs. 8 are views showing an example of a processing method for rider recognition in the vehicle lock system in this embodiment. As shown in Fig. 8(a), the rider recognition module 270 performs the rider recognition process based on an image of the occupant currently riding on the electric motorcycle 1 which is taken by the camera 271.

[0063]

If the camera 271 takes an image as shown in Fig. 8(b), the rider recognition module 270 can perform the facial recognition process for the occupant of the electric motorcycle 1 based on the input image. However, if the camera 271 takes an image as shown in Fig. 8(c), the rider recognition module 270 cannot perform the facial recognition process based on the input image. In this case, the occupant of the electric motorcycle 1 can be recognized by knowing whether or not it is the helmet for a delivery person to wear, based on the collection and delivery

agent's logo mark attached to area A of the helmet included in the image of Fig. 8(c).

[0064]

If the camera 271 takes an image as shown in Fig. 8(d), the rider recognition module 270 can recognize the occupant of the electric motorcycle 1 not only by the facial recognition process based on an input image but also by the features of the collection and delivery agent's uniform worn by the delivery person (for example, the logo mark in area B of Fig. 8(d) or the two-dimensional barcode in area C).

[0065]

In this embodiment, as for the connection between the ECU 140 of the electric motorcycle 1 and the portable terminal 2, an example of wired connection using a connector has been given; however, the method of connection between the ECU 140 and the portable terminal 2 is not limited to the form for embodying the present invention. For example, the system can be designed so that the ECU 140 and the portable terminal 2 are connected by a short distance wireless communication such as Bluetooth (registered trademark) or wireless LAN such as WiFi (registered trademark). Also, the system can be designed so that communication is made during contactless charging using, for example, WPC-standard electromagnetic induction.

[0066]

In this embodiment, a case that the vehicle lock system according to the present invention is applied to a scooter type saddle-ride type electric vehicle with a low floor (electric motorcycle 1) has been explained. However, the vehicle to which

the vehicle lock system according to the present invention can be applied is not limited to the electric motorcycle 1 described in this embodiment. For example, saddle-ride type electric vehicles include all vehicles that a rider rides by striding over the vehicle body, and the saddle-ride type electric vehicles to which the vehicle lock system in the form for embodying the present invention can be applied include not only motorcycles but also three-wheeled vehicles (vehicles with one front wheel and two rear wheels and also vehicles with two front wheels and one rear wheel) or four-wheeled vehicles. In this case, a decision concerning stop of the saddle-ride type electric vehicle or a rider's getting off the saddle-ride type electric vehicle can be made by detecting the state of the parking brake.

[0067]

In this embodiment, a case that the vehicle lock system 10 is applied to the electric motorcycle 1 which runs by driving the electric motor 131 has been explained; however, the vehicles to which the vehicle lock system in the form for embodying the present invention can be applied are not limited to vehicles which have the same configuration as the electric motorcycle 1 described in this embodiment. For example, it can also be applied to motorcycles which run as driven by an engine with an idling stop function which stops when the vehicle stops, three-wheeled vehicles (vehicles with one front wheel and two rear wheels and also vehicles with two front wheels and one rear wheel) and four-wheeled vehicles. Furthermore, the vehicle lock system according to the present invention can be applied to so-called hybrid vehicles which also have an internal combustion engine.

[0068]

Also in this embodiment, a case that a smart phone is used as the portable terminal 2 has been explained; however, the portable terminal in the vehicle lock system in the form for embodying the present invention is not limited to a smart phone as used in this embodiment. For example, a so-called tablet terminal which generally has a larger touch panel than a smart phone may be used as the portable terminal in the vehicle lock system.

[0069]

The embodiment of the present invention has been so far described referring to drawings; however, the concrete configuration is not limited to this embodiment and includes various modifications without departing from the gist of the invention.

[Reference Signs List]

[0070]

1... Electric motorcycle (vehicle, saddle-ride type electric vehicle)

104... Swing arm (drive mechanism)

120... Battery

130... PDU

131... Electric motor

140... ECU (on-vehicle/off-vehicle decision means, power supply control means)

160... BMU

180... Electric parts

185... Seating sensor (on-vehicle/off-vehicle decision means)

186... Main stand

10... Vehicle lock system

2... Portable terminal

210... Vehicle lock control module (vehicle lock control means)

250... Display control module (vehicle state display means)

255... User interface (unlocking means)

270... Rider recognition module (rider recognition means)

271... Camera (photographing means)