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(54) Title: SMART PARKING BARRIER

(57) Abstract: Various methods and systems are provided for smart parking barriers. In one example, among others, a smart parking barrier system includes a movable parking barrier located at one end of a parking space, a barrier drive configured to control positioning of the movable parking barrier, and a parking controller configured to initiate movement of the parking barrier, via the barrier drive. The movable parking barrier can be positioned between a first position that restricts access to the parking space and a second position that allows access to the parking space. The parking controller can initiate movement of the movable parking barrier in response to a positive identification of an individual allowed to use the parking space. The parking controller can identify the individual through, e.g., a RFID tag, a mobile device (e.g., a remote control, smartphone, tablet, etc.), an access card, biometric information, or other appropriate identifier.

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SMART PARKING BARRIER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to, and the benefit of, co-pending U.S. provisional application entitled "Smart Disable Parking" having serial no. 62/069,475, filed October 28, 2014, which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Disabled and handicapped people face many challenges, including the availability of accessible parking in public areas. In most situations, specific parking spaces are designated for use by disabled or handicapped drivers. However, even with visual markings that indicate the restricted use, non-disabled drivers make use these parking spaces without regard for other disabled drivers. People abuse the parking reserved by using fake stickers or flyers indicating authorization to use the parking spot.

SUMMARY

[0003] Embodiments of the present disclosure include systems and methods related to a smart parking barrier.

[0004] In one embodiment, among others, a smart parking barrier system comprises a movable parking barrier located at one end of a parking space, a barrier drive configured to control positioning of the movable parking barrier between the first position and the second position, and a parking controller configured to identify an individual allowed to use the parking space and, in response to a positive identification of the individual, initiate movement of the parking barrier from the first position to the second position, via the barrier drive, thereby allowing access to the parking space by the individual. The movable parking barrier can be configured to restrict access to the parking space when in a first position and allow access to the parking space when in a second position. The first position can be a raised

position of the barrier and the second position can be a lowered position of the barrier. The movable parking barrier can comprise a post (or a group of posts) that moves upward out of a surface of the parking space to restrict access to the parking space.

[0005] In one or more aspects of these embodiments, the individual can be identified based upon radio frequency (RF) communications with a RF identification (RFID) tag, where the RFID tag transmits identification information associated with the individual. The parking controller can comprise a RFID reader. The parking controller can periodically transmit an interrogation signal that initiates a response from the RFID tag. The RFID tag can be mounted on a vehicle. Movement of the parking barrier can be initiated when the individual is within a defined distance from the parking spot. The barrier drive can comprise an electrical drive that moves the movable parking barrier between the first position and the second position.

[0006] In one or more aspects of these embodiments, the individual can be identified based upon communications with a mobile device. The mobile device can be a remote control configured to transmit identification information associated with the individual to the parking controller in response to a user input. The mobile device can be a smartphone configured to transmit of identification information associated with the individual to the parking controller in response to a user input. The identification information can be transmitted to the parking controller via a network. The network can comprise a cellular network. The mobile device can comprise an application configured to initiate transmission of identification information associated with the individual to the parking controller in response to a user input.

[0007] Other systems, methods, features, and advantages of the present disclosure will be or become apparent to one with skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages be included within this description, be within the scope of the present disclosure, and be protected by the accompanying claims. In addition, all optional and preferred features and modifications of the described embodiments are usable in all aspects

of the disclosure taught herein. Furthermore, the individual features of the dependent claims, as well as all optional and preferred features and modifications of the described embodiments are combinable and interchangeable with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Many aspects of the present disclosure can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0009] FIGS. 1A and 1B illustrate an example of parking with a smart parking barrier system, in accordance with various embodiments of the present disclosure.

[0010] FIGS. 2A through 2C are block diagrams illustrating examples of a barrier control system in accordance with various embodiments of the present disclosure.

[0011] FIG. 3 is a schematic block diagram of one example of the parking controller of FIGS. 2A-2C in accordance with various embodiments of the present disclosure.

DETAILED DESCRIPTION

[0012] Disclosed herein are various embodiments of methods related to smart parking barriers. Reference will now be made in detail to the description of the embodiments as illustrated in the drawings, wherein like reference numbers indicate like parts throughout the several views.

[0013] The described smart parking barrier system provides the ability to provide automated control for access to a parking spot. For example, a smart parking barrier can be used to protect parking spots for disabled and handicapped people in shopping centers, hospitals, government complexes, city centers and/or other public parking areas. Current handicapped parking do not include barriers, since they are based upon the honesty and courtesy of others. The smart parking barrier system can assist disabled people to access

those reserved parking spots at any time, while restricting access to other non-handicapped individuals.

[0014] By providing a convenient solution that allows a disabled person to find a parking slot for his/her vehicle, the smart parking barrier can help enforce the law and stop the general population from abusing the parking spots reserved for disable people. The smart parking barrier system can improve the efficiency of the blue signs that are already used for reserved parking by putting a physical barrier across the end of the reserved parking. The smart parking barrier system can be used to allow only disabled or handicapped people to park since they will be the only ones granted access through the system. Smart parking barriers can also be utilized in other applications such as, e.g., reserved parking where individual parking spaces are assigned to specific people or vehicles for use.

[0015] FIGS. 1A and 1B illustrate the operation of the smart parking barrier system. As shown in FIG. 1A, a vehicle 103 (e.g., car, truck, motorcycle, etc.) stops in front of a restricted parking space (slot or spot) 106 including a parking barrier 109 that prevent the vehicle 103 from entering the parking space 106 without proper identification. The restricted parking space 106 can be, e.g., a handicapped parking space as indicated by signage (e.g., a blue item wheel chair painted on the pavement or a blue light with the wheel chair sign) provided on the pavement or posted adjacent to the parking spot 106. In the example of FIG. 1A, the parking barrier 109 comprises posts that extend upward out of the pavement to prevent entrance into the parking space 106 and can be retracted into the ground to allow access to the slot 106. In other embodiments, a different type of barriers (e.g., gates that retract or fold outward or downward) can be used to prevent access to the spot 106.

[0016] As the vehicle 103 approaches the barrier 109 and stops in front of the parking space 106 as shown in FIG. 1A, the smart parking barrier system can attempt to determine whether the vehicle 103 is allowed to park in the restricted spot 106. The barrier 109 can be controlled based upon detecting a device installed inside the vehicle 103. For example, the smart parking barrier system can interrogate the vehicle 103 (e.g., via a radio frequency identification (RFID) tag) while it waits in front of the parking barrier 109, or the driver or

other passenger of the vehicle 103 can identify themselves as allowed to use the parking space 106. For instance, it may be controlled (e.g., manually or by voice) by a remote control device. In one embodiment, the barrier 109 can be controlled (close/open) utilizing an application on a smartphone or other mobile device. In other embodiments, access may be granted using finger print recognition, an eye print or by access card.

[0017] After determining that the vehicle 103 is authorized to enter the parking space 106, the barrier 109 can be opened (e.g., lowered as shown in FIG. 1B) to allow the vehicle 103 to move into the space 106. Once the vehicle 103 has parked in the space 106, the barrier 109 can remain down until the vehicle 103 leaves the parking space 106 or the parking barrier 109 can be closed (e.g., raised) and wait for the next instructions or information. For instance, sensors under the parking space 106 can be used to detect when the vehicle is in position and automatically close the barrier 109.

[0018] When the vehicle 103 is ready to leave, the parking barrier 109 can be opened to allow the vehicle 103 to exit from the slot 106. To open the barrier 109, the smart parking barrier system may first confirm that the vehicle 103 is allowed to be in the space 106. After exiting the spot 106, the barrier 109 can be closed to prevent non-authorized vehicles from entering. This can be confirmed, for example, by sensing that the vehicle 103 has left the slot 106 and/or by confirming that the RFID tag of the vehicle 103 is no longer in range. If a vehicle 103 is not authorized to park in the restricted parking space 106, then it can be prevented from leaving the space 106 by not opening the barrier 109. The parking barrier 109 may be opened, e.g., by a police officer or other authorized individual after the vehicle 103 is ticketed and/or to allow it to be towed away.

[0019] In one embodiment, among others, the smart parking barrier system can be implemented using low cost, battery-less, radio frequency identification (RFID) tags and RFID reader. Referring to FIG. 2A, shown is an example of the smart parking barrier system 200 that utilizes a RFID tag 203. The RFID tag can carry a specific ID number stored in the RFID chip that identifies the vehicle 103 or user of the vehicle 103 as authorized to use the restricted parking space 106 (FIG. 1A). As shown in FIG. 2A, the RFID 203 can be included

in the vehicle 103 by, e.g., storing and/or mounting the RFID 203 to a portion of the vehicle 103 or by keeping the RFID tag 203 with the driver or other passenger in the vehicle 103.

[0020] The smart parking barrier system 200 includes a controller 206 that can include an RFID reader configured to interrogate the RFID tag 203 to determine if the vehicle 103 can enter the restricted parking space 106. The controller 206 and/or RFID reader can be fixed in or adjacent to the parking slot 106. When a subscriber (e.g., handicapped) vehicle 103 approaches the parking space 106, the RFID reader sends an RF interrogation signal that powers the RFID tag 203 in the vehicle 103. The RFID tag 203 (e.g., attached to the vehicle 103) responds to the reader by transmitting its specific subscriber ID. The RFID reader can check if the transmitted subscriber ID is valid and authorized to park in the restricted parking space 106 or not. If the ID is valid, the controller 206 will open the barrier 109 (the block) for the vehicle 103 to park. In some implementations, the barrier 109 is opened when the RFID tag 203 is within a defined distance of the parking space 106 or barrier 109.

[0021] As illustrated in FIG. 2A, the RFID reader sends the interrogation signal via a transceiver 209 that, if received by the RFID tag 203, results in the identification information (e.g., the specific ID number) to be transmitted by the RFID tag 203. In some implementations, the interrogation signal can be transmitted when a vehicle 103 has been detected at the entrance (or within a defined distance) to the parking slot 106 by, e.g., a sensor embedded in or adjacent to the parking spot 106. For example, the transmission power can be set so that the RFID tag 203 responds only when it is within a defined distance of the transceiver 209. In other embodiments, the interrogation signal can be periodically transmitted (e.g., at a predefined interval) to determine if a RFID tag is present. For example, the periodic transmissions can be carried out when the restricted parking space 106 is unoccupied and suspended while the parking slot 106 is occupied. In some cases, the RFID reader can periodically communicate with the RFID tag 203 in the vehicle 103 to check how long the subscriber parked the vehicle 103 in the restricted slot 106. The

transmissions by the transceiver 209 can be directed to cover a predefined area adjacent to the parking space 106 (e.g., the area adjacent to the entrance of the slot 106).

[0022] Upon receiving the identification information via the transceiver 209, the controller 206 can determine if the identification information authorizes use of the restricted parking space 106. If the information received from the RFID tag 203 corresponds to an authorized user, the parking barrier 109 can be opened by the controller 206 via a barrier drive 212. In some implementations, the controller 206 may confirm that a response is received from the RFID tag 203 a predefined number of times before opening the barrier 109. The number of responses can be set to allow the controller 206 to discriminate between a vehicle 103 that is waiting at the entrance to the parking spot 106 from vehicles that are passing by the parking space 106. The barrier drive 212 can be an electrical and/or hydraulic drive that opens and closes (or raises and lowers) the barrier 109. For example, an electric motor can be controlled to drive the posts up and down. Once the vehicle 103 is in or out of the parking space 106, the barrier 109 can automatically close and wait for the next instruction or information.

[0023] The smart parking barrier system 200 can also be controlled remotely using a mobile device such as, e.g., a remote control or an application operating on a cell phone, smartphone, tablet or other suitable device. FIG. 2B shows an example of the smart parking barrier system 200 that utilizes a mobile device 215. The parking barrier 109 can be controlled remotely by the mobile device 215 to allow authorized people to park freely in restricted parking 106 that are designated for them. For example, the mobile device 215 can communicate with the controller 206 through a wireless connection (e.g., a cellular link, WiFi link, Bluetooth® link, etc.) established via a network 218 such as, e.g., a cellular network, local area network (LAN, WLAN, etc.), the Internet, or other communication network. The controller 206 can include an interface 221 configured to communicate via the network 218.

[0024] A remote control or an application on a smartphone (or other mobile device 215) can be used to allow disabled or other authorized people to park freely in a reserved parking spot 106 designated for their use. The mobile device 215 can be used in different

organizations or areas such as city parking lots, hospitals, sport centers, shopping malls, building parking, etc. The remote control and/or application can be provided to disabled or needy people (e.g., handicapped individuals, pregnant ladies, senior people, etc.) by an authority (e.g., local city, county or state government) that has the legal power to do so.

[0025] The mobile device 215 can transmit a signal to the transceiver 209 (or receiver) of the controller 206, which contains information indicating that the user's vehicle 103 (FIG. 1) is allowed to park in the restricted space 106. The signal can be sent by the mobile device 215 in response to pressing a button or an icon on a display of a mobile device 215. For example, a remote control can include a button that initiates sending the signal to open the parking barrier 109. In some cases, the mobile device 215 can include a sensor that detects available restricted parking spaces 106. For example, the sensor can detect transmissions from the adjacent or closest spot 106. In other implementations, the mobile device 215 can send out a request or prompt and wait for responses from controllers 206 around the mobile device 215. The response can include information that identifies that specific parking spot 106. The mobile device 215 can then send a request addressed to that specific controller 206. The request(s) can be sent, by the mobile device 215, either directly to the controller(s) 206 through local RF transmissions (e.g., Bluetooth®, WiFi, etc.) or through a connection with a network 218 (e.g., cellular, WLAN, etc.).

[0026] In some embodiments, the application can be configured to utilize a GPS (global position system) of the mobile device 215 to determine the location of the mobile device 215 and identify the adjacent parking spot 106 or which restricted parking spaces 106 are in the general area. This can include a display showing the current location of the mobile device 215, locations of the restricted parking spaces 106, and/or an indication of whether the parking spots 106 are occupied or unoccupied. The mobile device 215 can then send a request to open a specific parking spot 106. The controller 206 for that parking space 106 can then confirm whether the slot 106 is occupied already, being opened for another authorized user, and/or that the requesting user is authorized to use the restricted space 106. Once the controller 206 recognizes or accepts the input from the mobile device 215,

then the barrier 109 can open or close as appropriate. Otherwise, the barrier 109 will remain closed until the controller 206 receives the correct instructions or information. A message indicating acceptance or denial may be sent back to the mobile device 215 for display.

[0027] After the vehicle 103 has parked in the space 106, the button or icon on the mobile device 215 can be used to send a signal to the controller 206 that causes the barrier 109 to be closed behind the vehicle 103. The parking barrier 109 can remain closed until the user returns. At that time, the button or icon on the mobile device 215 can be used to send a signal that opens the barrier 109. The signal can include information that can be used to confirm that the mobile device 215 is the same device used to enter the restricted parking spot 106. For instance, the controller 206 can store an ID code provided by the mobile device 215 for later identification. The barrier 109 can be closed again after the vehicle 103 exits the parking space 106. This can be done using the button or icon on the mobile device 215 and/or by sensing that the vehicle 103 has physically left the spot 106.

[0028] The smart parking barrier system 200 can also be controlled using an input sensor that can be used to determine a user's identity using items such as, e.g., an access card or fob or biometric information such as, e.g., a fingerprint, an eyeprint, or other identifying information. FIG. 2C shows an example of the smart parking barrier system 200 that utilizes an input sensor 224. The parking barrier 109 can be controlled via the input sensor 224 to allow authorized people to park freely in restricted parking 106 (FIG. 1) that are designated for them. The input sensor 224 can be an access card or fob reader, an optical scanner, a biometric scanner, or other device that can obtain identifying information. The controller 206 can include an interface 227 configured to communicate with the input sensor 224, either through a wired connection or a wireless connection (e.g., a WiFi link, Bluetooth® link, etc.).

[0029] Identification information can be entered through the input sensor 224 and used to confirm whether the individual is authorized to use the restricted parking space 106. For example, the input sensor 224 can scan an access card (either electronically or optically) to obtain the information to determine if access should be granted. Fingerprint and eyes can

also be scanned to confirm authorization to use the restricted slot 106. If the information received via the input sensor 224 corresponds to an authorized user, the parking barrier 109 can be opened by the controller 206 via the barrier drive 212, which can be an electrical and/or hydraulic drive that opens and closes (or raises and lowers) the barrier 109.

[0030] After the vehicle 103 has parked in the space 106, the input sensor 224 can be used to send a signal to the controller 206 that causes the barrier 109 to be closed behind the vehicle 103. The parking barrier 109 can remain closed until the user returns. At that time, the input sensor 224 can be used to open the barrier 109. The information obtained through the input sensor can be used to confirm that it is the same user who entered the restricted parking spot 106. For instance, the controller 206 can store an ID code provided by an access card for later identification. The barrier 109 can be closed again after the vehicle 103 exits the parking space 106. This can be done using the input sensor 224 and/or by sensing that the vehicle 103 has physically left the spot 106.

[0031] Referring next to FIG. 3, shown is one example of a parking controller 206 (FIGS. 2A-2C) that performs various functions in accordance with the various embodiments as set forth above. As shown, the parking controller 206 can include processing circuitry comprising a processor 303 and a memory 306, both of which are coupled to a local interface 309. The local interface 309 may be, for example, a data bus with an accompanying control/address bus as can be appreciated by those with ordinary skill in the art. The parking controller 206 may comprise, for example, a computing system and can be installed underneath or adjacent to the restricted parking space 106 (FIG. 1) or can be included in the parking barrier 109 at the entrance to the slot 106.

[0032] The parking controller 206 can also include a transceiver 209 (or transmitter and/or receiver) for RF communications with other devices such as a RFID tag and/or a mobile device 215 as previously discussed. For example, the controller 206 can include a RFID reader that uses the transceiver 209 to interrogate the RFID tag 203 (FIG. 2A) and receive the transmitted response including the identification information associated with the RFID tag 203. The parking controller 206 can also include an interface 221 for access to a

network 218 such as, *e.g.*, the Internet, intranets, extranets, wide area networks (WANs), local area networks (LANs), wired networks, wireless networks, networks configured for communication over a power grid, or other suitable networks, *etc.*, or any combination of two or more such networks. A mobile device 215 (FIG. 2B) can provide identification information to the parking controller 206 for verification through the network 218 or directly through the transceiver 209.

[0033] Various peripheral devices such as, for example, a display device, a keyboard, and a mouse can be coupled to the parking controller 206. In addition, other peripheral devices that can obtain identification information may be coupled to the parking controller 206 such as, for example, an input sensor 224 as described above. For example, an input sensor 224 can be communicatively coupled (through a wired or wireless connection) to an interface 227 of the parking controller 206. Identification information can be obtained by the input sensor 224 and sent to the parking controller 206 for verification. The input sensor 224 may be a biometric scanner, an optical scanner, infrared scanner, or a reader for access card, fobs or other electronic identification.

[0034] In some cases, the parking controller 206 is configured to control access to a single parking slot 106. In other embodiments, the single parking controller 206 can control access to a plurality of restricted parking spaces 106. The controller 206 can be configured to identify which restricted parking space 106 is being requested, confirm if an individual is allowed to use the restricted slot 106 and open the corresponding barrier 109. For example, the transmission power of the transceiver 209 may be set so that a response from an RFID tag 203 is only received when it is adjacent to the barrier 109 of that parking space 106. Individual transceivers 209 may be located in the different parking barriers 109 (FIGS. 2A-2C). In other implementations, a mobile device 215 can send it current location to the parking controller 206, which can use it to identify the appropriate parking space 106. In some embodiments, a proximity sensor located adjacent to the entrance to the restricted parking space 106 can indicate to the controller 206 when a vehicle 103 arrives at the parking space 106 as shown in FIG. 1A.

[0035] Stored in the memory 306 and executed by the processor 303 are various components that provide various functionality of the present disclosure. In the example shown in FIG. 3, stored in the memory 306 is an operating system 312 and a smart barrier application 315. In addition, stored in the memory 306 is identification information 318, which can be used to identify authorized users of the restricted parking spaces 106. The identification information may be associated with a corresponding input sensor 224. The identification information 318 may be stored in a database to be accessed by the smart barrier application 315 as needed. For example, the identification information 318 may comprise fingerprints or other patterns or codes as can be appreciated.

[0036] It is understood that there may be other applications that are stored in the memory 1012 and are executable by the processor 1009 as can be appreciated. Where any component discussed herein is implemented in the form of software, any one of a number of programming languages may be employed such as, for example, C, C++, C#, Objective C, Java, Java Script, Perl, PHP, Visual Basic, Python, Ruby, Delphi, Flash, or other programming languages.

[0037] The smart barrier application 315 can be executed by the processor 303 in order to determine whether an individual is authorized to use a restricted parking space 106 as described above. A number of software components can be stored in the memory 306 that are executable by the processor 303. In this respect, the term "executable" means a program file that is in a form that can ultimately be run by the processor 303. Examples of executable programs may be, for example, a compiled program that can be translated into machine code in a format that can be loaded into a random access portion of the memory 306 and run by the processor 303, or source code that may be expressed in proper format such as object code that is capable of being loaded into a of random access portion of the memory 306 and executed by the processor 303, *etc*. An executable program may be stored in any portion or component of the memory 306 including, for example, random access memory, read-only memory, a hard drive, compact disk (CD), floppy disk, or other memory components.

[0038] The parking controller 206 of certain embodiments of the present disclosure can be implemented in hardware, software, firmware, or a combination thereof. In the preferred embodiment(s), the parking controller 206 is implemented in software or firmware that is stored in a memory and that is executed by a suitable instruction execution system. If implemented in hardware, as in an alternative embodiment, the parking controller 206 can be implemented with any or a combination of the following technologies, which are all well known in the art: a discrete logic circuit(s) having logic gates for implementing logic functions upon data signals, an application specific integrated circuit (ASIC) having appropriate combinational logic gates, a programmable gate array(s) (PGA), a field programmable gate array (FPGA), *etc.*

[0039] Any logic or application described herein, including the ED/FR feedback control application 1018, that comprises software or instructions can be embodied in any non-transitory computer-readable medium for use by or in connection with an instruction execution system such as, for example, a processor 1009 in a computer system or other system. In this sense, the logic may comprise, for example, statements including instructions and declarations that can be fetched from the computer-readable medium and executed by the instruction execution system. In the context of the present disclosure, a "computer-readable medium" can be any medium that can contain, store, or maintain the logic or application described herein for use by or in connection with the instruction execution system. The computer-readable medium can comprise any one of many physical media such as, for example, electronic, magnetic, optical, electromagnetic, infrared, or semiconductor media. More specific examples of a suitable computer-readable medium would include, but are not limited to, magnetic tapes, magnetic floppy diskettes, magnetic hard drives, memory cards, solid-state drives, USB flash drives, or optical discs. Also, the computer-readable medium may be a random access memory (RAM) including, for example, static random access memory (SRAM) and dynamic random access memory (DRAM), or magnetic random access memory (MRAM). In addition, the computer-readable medium may be a read-only memory (ROM), a programmable read-only memory (PROM), an

erasable programmable read-only memory (EPROM), an electrically erasable programmable read-only memory (EEPROM), or other type of memory device.

[0040] The processor 303 may represent multiple processors and the memory 306 may represent multiple memories that operate in parallel. In such a case, the local interface 309 may be an appropriate network that facilitates communication between any two of the multiple processors, between any processor and any one of the memories, or between any two of the memories *etc*. The processor 303 may be of electrical, optical, or molecular construction, or of some other construction as can be appreciated by those with ordinary skill in the art.

[0041] The operating system 312 is executed to control the allocation and usage of hardware resources such as the memory, processing time and peripheral devices in the parking controller 206. In this manner, the operating system 312 serves as the foundation on which applications depend as is generally known by those with ordinary skill in the art.

[0042] The smart parking barrier system 200 can allow disabled, handicapped or other authorized individuals to park in a restricted parking spot 106 since they are the only ones that are granted access by the parking controller 206 through the use of a RFID tag, mobile device 215 (e.g., remote control, smartphone, tablet, etc.), access card, or other identifiable feature. Barriers 109 can be installed in new parking or retrofitted into existing parking spaces. The smart parking barrier system 200 can be setup and/or programmed to allow for communications between the controller 206 (e.g., via the transceiver 209 or a network 218) and identification devices (e.g., RFID tag 203, mobile device 215, etc.). The parking controller 206 can be accessed by a remote terminal or monitoring system to determine the condition of the parking space 106 and/or the parking barrier 109. The remote terminal may also communicate with the controller 206 to control the positioning of the barrier 109. In some embodiments, a receiver (or transceiver) may be mounted in structures of the barrier 109 (e.g., a post of the barrier 109 in FIG. 1A) and a RFID tag can be mounted on the vehicle 103 to allow it to communicate with the parking controller 206.

[0043] It should be emphasized that the above-described embodiments of the present disclosure are merely possible examples of implementations set forth for a clear understanding of the principles of the disclosure. Many variations and modifications may be made to the above-described embodiment(s) without departing substantially from the spirit and principles of the disclosure. All such modifications and variations are intended to be included herein within the scope of this disclosure and protected by the following claims.

[0044] It should be noted that ratios, concentrations, amounts, and other numerical data may be expressed herein in a range format. It is to be understood that such a range format is used for convenience and brevity, and thus, should be interpreted in a flexible manner to include not only the numerical values explicitly recited as the limits of the range, but also to include all the individual numerical values or sub-ranges encompassed within that range as if each numerical value and sub-range is explicitly recited. To illustrate, a concentration range of "about 0.1% to about 5%" should be interpreted to include not only the explicitly recited concentration of about 0.1 wt% to about 5 wt%, but also include individual concentrations (*e.g.*, 1%, 2%, 3%, and 4%) and the sub-ranges (*e.g.*, 0.5%, 1.1%, 2.2%, 3.3%, and 4.4%) within the indicated range. The term "about" can include traditional rounding according to significant figures of numerical values. In addition, the phrase "about 'x' to 'y'" includes "about 'x' to about 'y'".

CLAIMS

Therefore, at least the following is claimed:

1. A smart parking barrier system, comprising:

a movable parking barrier located at one end of a parking space, the movable parking barrier configured to restrict access to the parking space when in a first position and allow access to the parking space when in a second position;

a barrier drive configured to control positioning of the movable parking barrier between the first position and the second position; and

a parking controller configured to:

identify an individual allowed to use the parking space; and

in response to a positive identification of the individual, initiate movement of the parking barrier from the first position to the second position, via the barrier drive, thereby allowing access to the parking space by the individual.

2. The smart parking barrier system of claim 1, wherein the first position is a raised position of the barrier and the second position is a lowered position of the barrier.

3. The smart parking barrier system of claim 2, wherein the movable parking barrier comprises a post that moves upward out of a surface of the parking space to restrict access to the parking space.

4. The smart parking barrier system of claim 1, wherein the individual is identified based upon radio frequency (RF) communications with a RF identification (RFID) tag, the RFID tag transmitting identification information associated with the individual.

5. The smart parking barrier system of claim 4, wherein the parking controller comprises a RFID reader.

6. The smart parking barrier system of claim 4, wherein the parking controller periodically transmits an interrogation signal that initiates a response from the RFID tag.

7. The smart parking barrier system of claim 6, wherein the RFID tag is mounted on a vehicle.

8. The smart parking barrier system of claim 1, wherein the individual is identified based upon communications with a mobile device.

9. The smart parking barrier system of claim 8, wherein the mobile device is a remote control configured to transmit identification information associated with the individual to the parking controller in response to a user input.

10. The smart parking barrier system of claim 8, wherein the mobile device is a smartphone configured to transmit of identification information associated with the individual to the parking controller in response to a user input.

11. The smart parking barrier system of claim 10, wherein the identification information is transmitted to the parking controller via a network.

12. The smart parking barrier system of claim 11, wherein the network comprises a cellular network.

13. The smart parking barrier system of claim 8, wherein the mobile device comprises an application configured to initiate transmission of identification information associated with the individual to the parking controller in response to a user input.

14. The smart parking barrier system of claim 1, wherein movement of the parking barrier is initiated when the individual is within a defined distance from the parking spot.

15. The smart parking barrier system of claim 1, wherein the barrier drive comprises an electrical drive that moves the movable parking barrier between the first position and the second position.

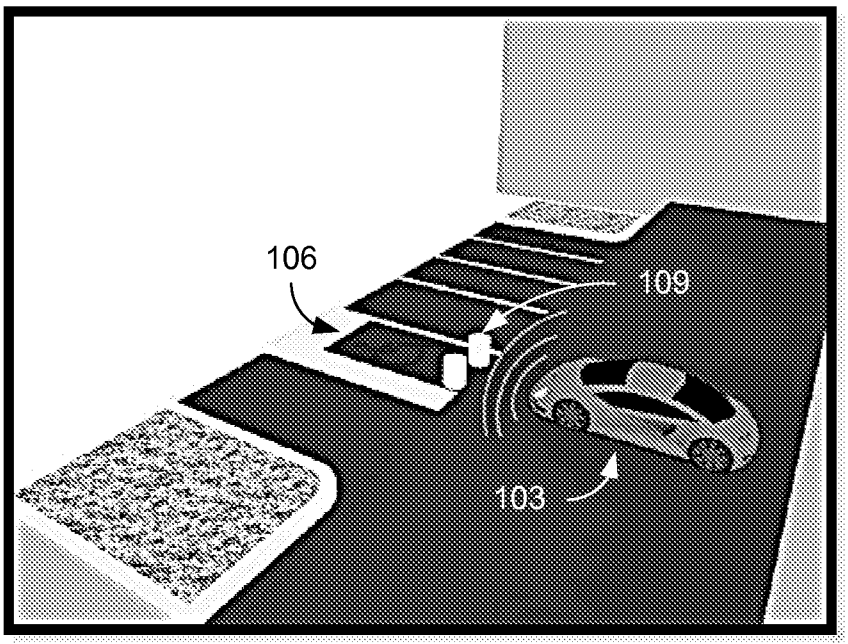

FIG. 1A

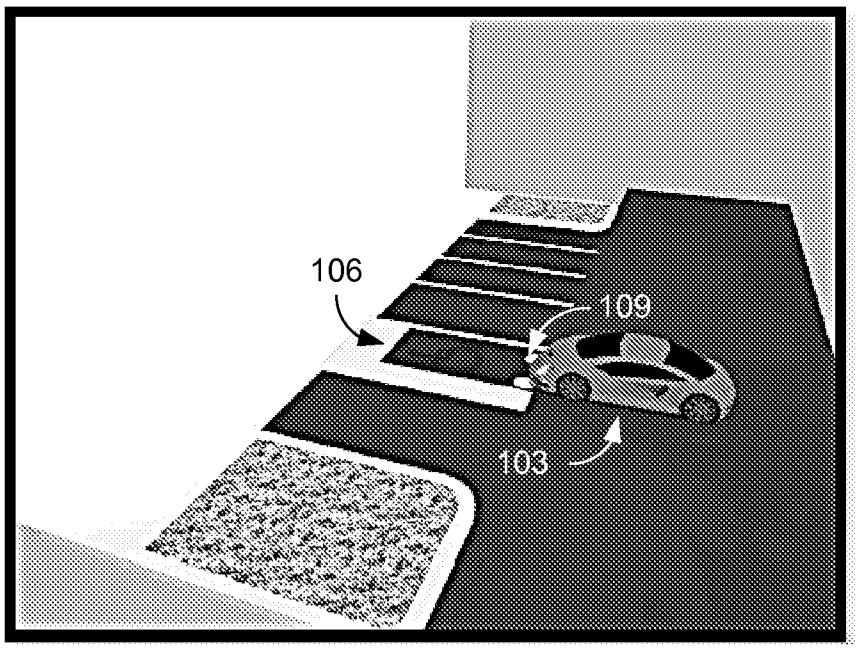

FIG. 1B

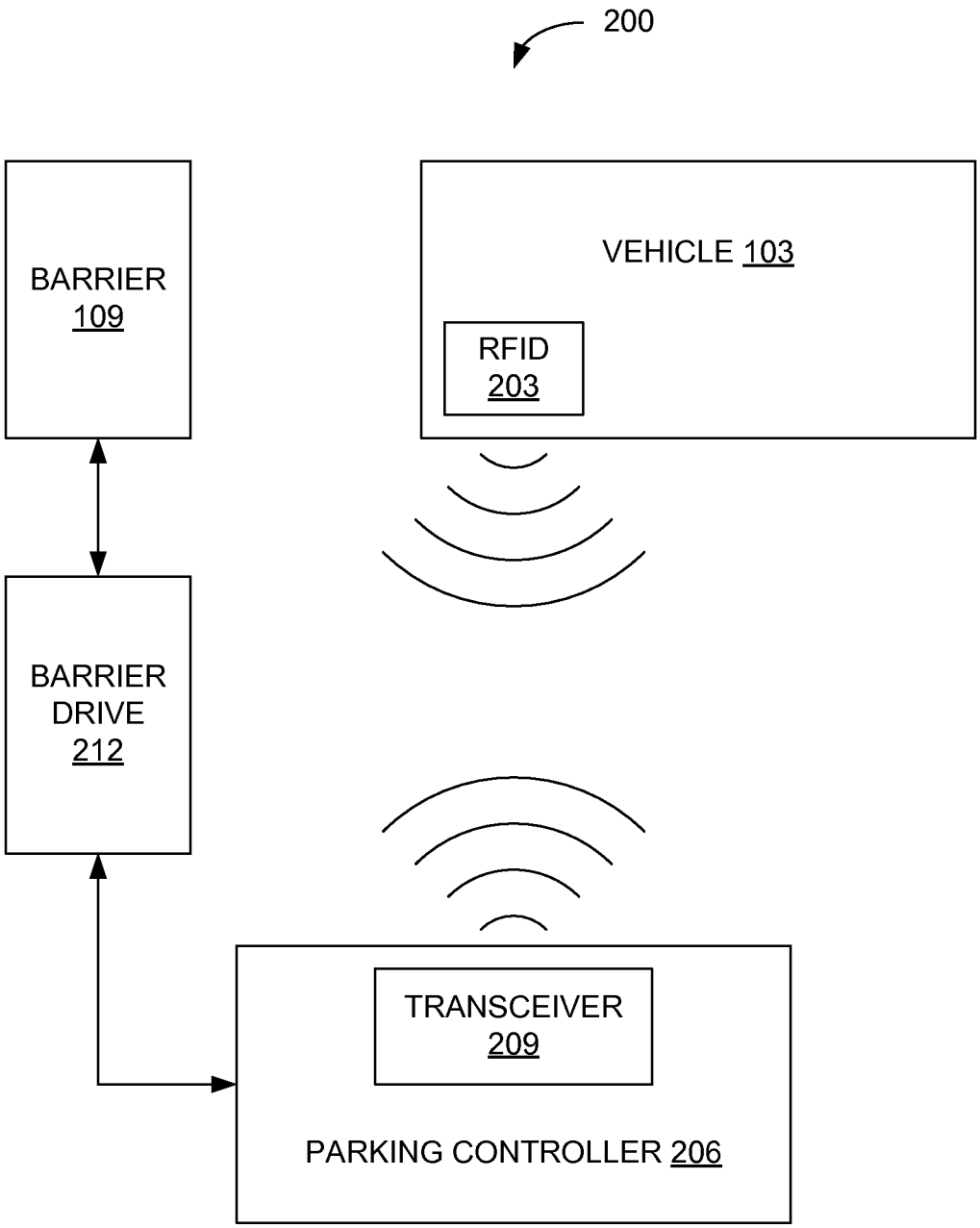
200
BARRIER
109
VEHICLE 103
RFID
203
BARRIER
DRIVE
212
TRANSCEIVER
209
PARKING CONTROLLER 206

FIG. 2A

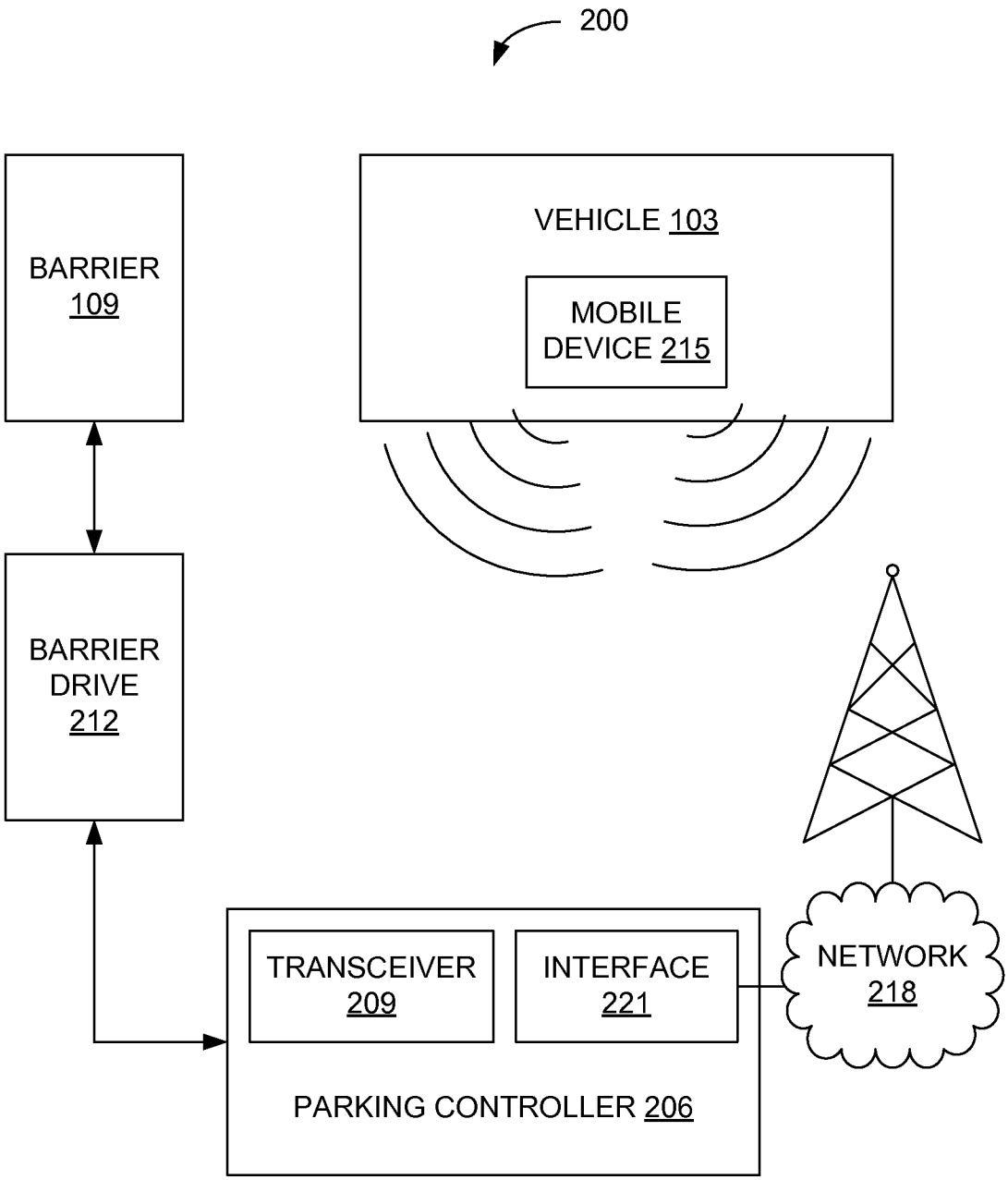
200
BARRIER 109
VEHICLE 103
MOBILE DEVICE 215
BARRIER DRIVE 212
NETWORK 218
TRANSCEIVER 209
INTERFACE 221
PARKING CONTROLLER 206

FIG. 2B

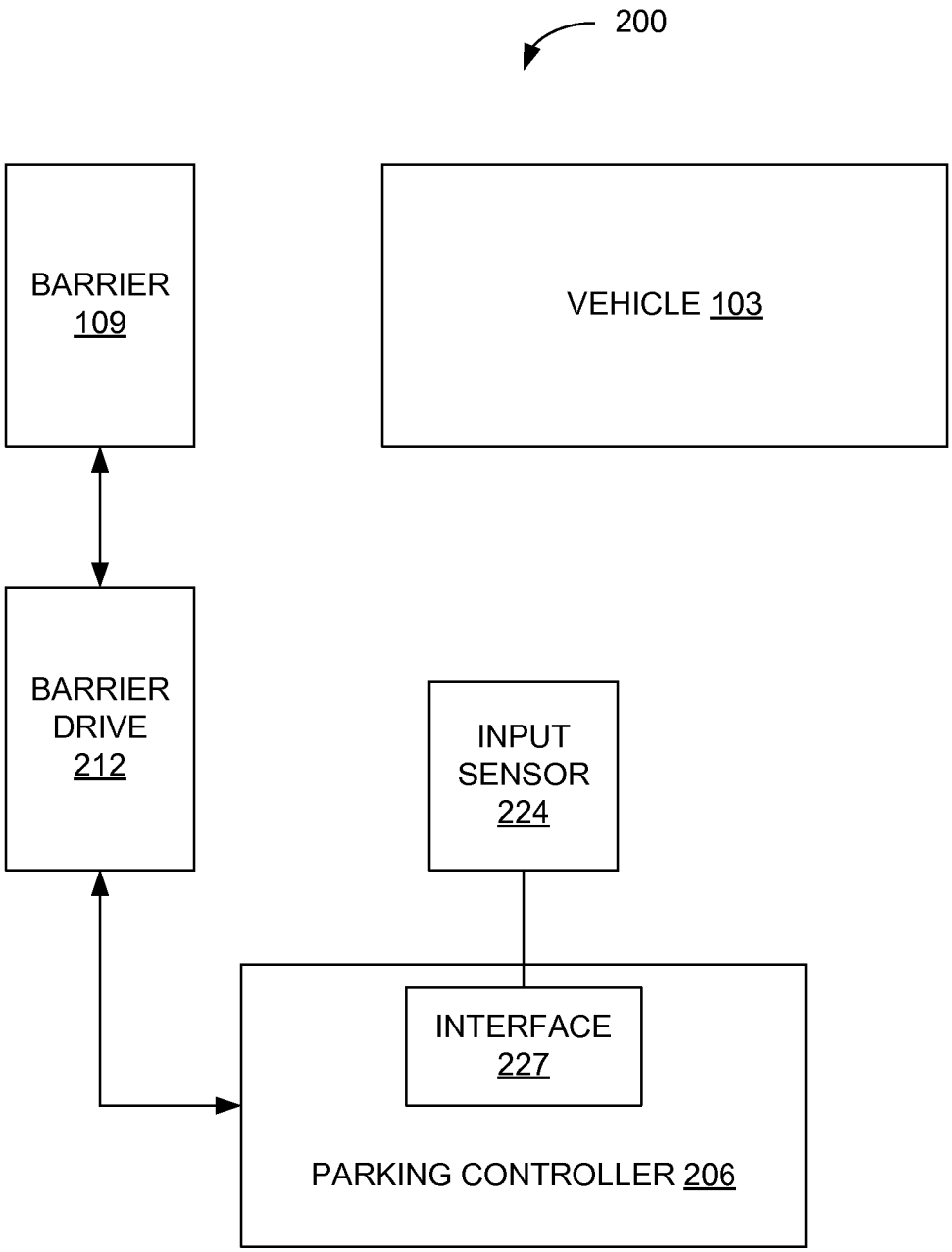
200
BARRIER
109
VEHICLE 103
BARRIER
DRIVE
212
INPUT
SENSOR
224
INTERFACE
227
PARKING CONTROLLER 206

FIG. 2C

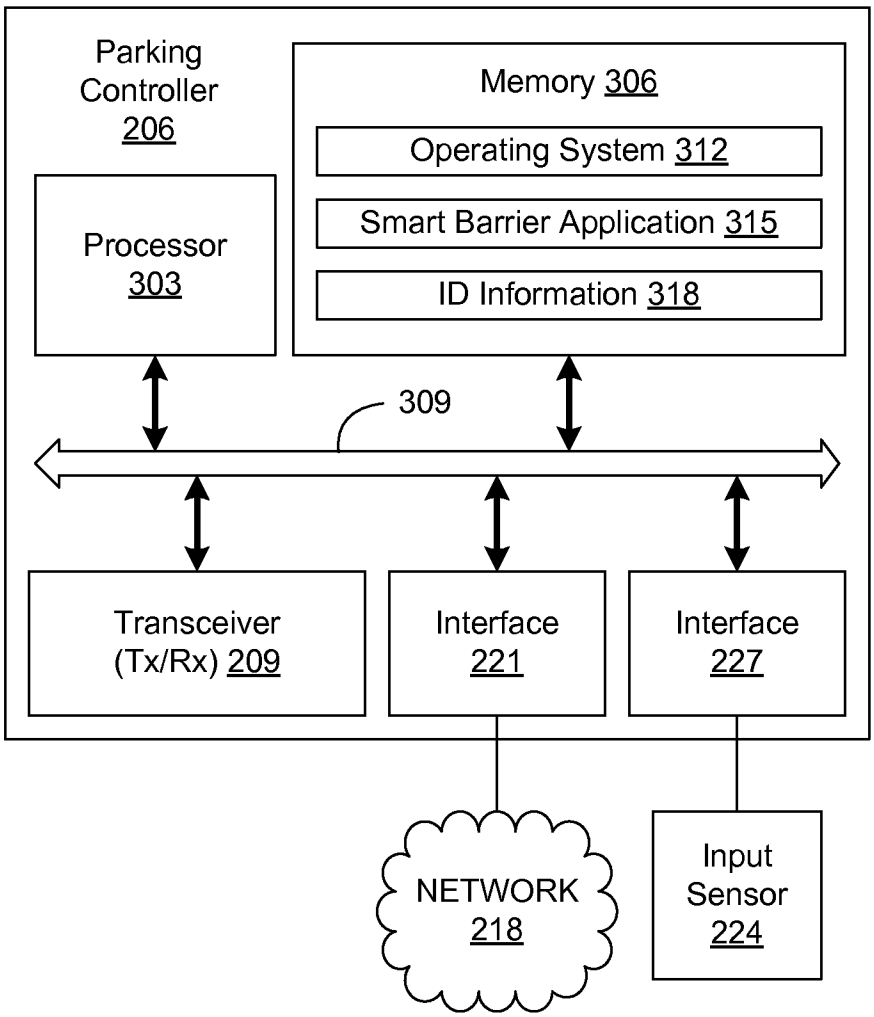
Parking Controller 206
Memory 306
Operating System 312
Smart Barrier Application 315
ID Information 318
Processor 303
309
Transceiver (Tx/Rx) 209
Interface 221
Interface 227
NETWORK 218
Input Sensor 224

FIG. 3