WIRELESS ACCESS CONTROL SYSTEM AND RELATED METHODS

Field of the Invention

[0001] The present invention generally relates to access control systems, and more particularly, to wireless access control systems.

Background

[0002] A passive keyless entry (PKE) system offers an increased level of convenience over a standard lock and key, for example, by providing the ability to access a secure building or device without having to find, insert, and turn a traditional key. A user may simply approach a locked PKE lock and with little if any pause, the lock grants this user access if they are carrying an authorized token.

[0003] A PKE system is currently used in an automotive application and may offer increased convenience by identifying drivers and unlocking the car as they approach. Automotive access is traditionally given by inserting a key into the lock or by pushing buttons on a traditional remote keyless entry (RKE) system. In contrast, a PKE system grants access with reduced user interaction through the use of a token carried by the driver.

[0004] Several technical challenges have been encountered during the engineering of a radio frequency (RF) PKE system, for example, for use in a residential lock. The desired basic perceived behavior of the PKE system in a residential application may be as follows: 1) the user approaches and touches the lock; 2) the lock authenticates the user with a reduced delay; 3) the lock unlocks; 4) the lock may not operate if the authorized user is outside a desired range and the lock is touched by another, unauthorized, user; 5) the lock may not operate if the authorized user is on the inside of the house, and the lock is touched on the outside by an unauthorized user; and 6) when an authorized user revokes a key from another user, it may be revoked and confirmed within a few seconds.

[0005] Indeed, as will be appreciated by those skilled in the art, with respect to the above desired basic perceived behavior of the PKE system in a residential application, primary challenges to be addressed include items 2 (speed), 4 (distance), 5 (location), and 6 (timely revocation). Accordingly, it may be desirable to improve authentication speed, proximity measurement, and power consumption, for example.

Brief Description Of The Drawings

[0006] FIG. 1 is a schematic block diagram of a wireless access system according to the present invention.

[0007] FIG. 2a is a diagram of a lock of the wireless access system as shown in FIG. 1.

[0008] FIG. 2b is a diagram of another lock embodiment as may be used in the system of FIG. 1.

[0009] FIG. 3a is a remote access device of the wireless access system as shown in FIG. 1.

[0010] FIG. 3b is a diagram of another remote access device embodiment as may be used in the system of FIG. 1.

[0011] FIG. 4 is a diagram of a home-connect plugin of the wireless access system as shown in FIG. 1.

[0012] FIG. 5 is a schematic diagram of a typical residential system layout for the wireless access system as shown in FIG. 1.

[0013] FIG. 6 is a flow chart of operation of the wireless access system as shown in FIG. 1.

Detailed Description

[0014] The present description is made with reference to the accompanying drawings, in which various embodiments are shown. However, many different embodiments may be used, and thus the description should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete. Like numbers refer to like elements throughout, and prime notation is used to indicate similar elements or steps in alternative embodiments.

[0015] Referring to FIGS. 1, 2a, and 2b, a wireless access system **10**, for example, a PKE system, includes a lock **11**. The lock **11** may be installed in a standard deadbolt hole and may be battery powered, for example. The lock **11** may be a human controlled lock, for example (FIG. 2a). The lock **11** includes an outer cylinder **12** that rotates freely around a standard key cylinder **13**. When engaged, the cylinder **13** is linked to a deadbolt **14**, thus giving the user control to extend or retract the deadbolt.

[0016] Alternatively, in another embodiment, the lock **11'** may be motor powered (FIG. 2b). When a user touches anywhere on the lock **11'**, the deadbolt **14'** is driven. Of course, the lock **11**

may be another type of lock or locking mechanism and may be installed in any access point, for example. The lock **11'** includes a controller **21** or processor and wireless communication circuitry **29** for wireless communication.

[0017] Referring now additionally to FIG. 3, the wireless access system **10** includes a remote access device **15**. The remote access device **15** is advantageously a key or token configured to control the lock **11**. In particular, the remote access device **15** may be a standard key including a remote controller **16** and remote wireless access electronics coupled thereto (FIG. 3a). Alternatively, or additionally, the remote access device **15** may be a mobile wireless communications device, such as, for example, a mobile telephone that may include the remote wireless access electronics cooperating with an application **17'** (stored in memory) (FIG. 3b). The application **17'** may be configured to provide access and control over the lock **11'**, for example. Of course, more than one remote access device **15'** may be used and may be another type of remote access wireless device, for example, a wireless FOB without the mechanical key, as will be appreciated by those skilled in the art.

[0018] Referring now additionally to FIG. 4, the wireless access system **10** also includes a home-connect plugin **30**. A typical mains power outlet **31** is shown, with the home-connect plugin **30** plugged-into it. The home-connect plugin **30** includes a home-connect controller **32** and associated wireless communication circuitry **33** cooperating therewith and configured to communicate with the lock **11**, and the remote access device **15**.

[0019] The home-connect plugin **30** also has wireless local area network (WLAN) connectivity, for example, Wi-Fi connectivity, to link it to an off-site web-based server **34**, for

example. This advantageously enables the lock **11** to receive near real time updates for adding or removing users, one-time access, extended access or specific timed access, and other connectivity related updates and functions, as will be appreciated by those skilled in the art. Additional services may be selectively provided via the Internet using the WLAN connectivity, for example. While the home-connect plugin **30** is described herein as a plugin device, it will be appreciated by those skilled in the art that the functionality of the home-connect plugin **30** may be embodied in any of a number of form factors, for example.

[0020] Referring now additionally to FIG. 5, a typical residential setup example of the wireless access system **10** is illustrated. As described above with respect to FIG. 4, the home connect plugin **30** is typically plugged-in to the mains power outlet **31**, at a location, in relatively close proximity to the lock **11**, which may be installed on the front door, for example. The remote access device **15** approaches from the outside of the home. Both the home-connect plugin **30** and lock **11** are configured to communicate with the remote access device **15** independently or simultaneously, as will be appreciated by those skilled in the art.

[0021] The home-connect plugin **30** may be configured to approximately determine the position of the remote access device **15** with a received signal strength indication (RSSI). For example, when an algorithm of the home-connect plugin **30** determines that the remote access device **15** is approaching and is within a defined range, the home-connect plugin may send a wakeup signal to the lock **11**. The home-connect plugin **30** may also configured to have an extended range capability, for example, 100 or more meters. The lock **11** has a smaller range,

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