



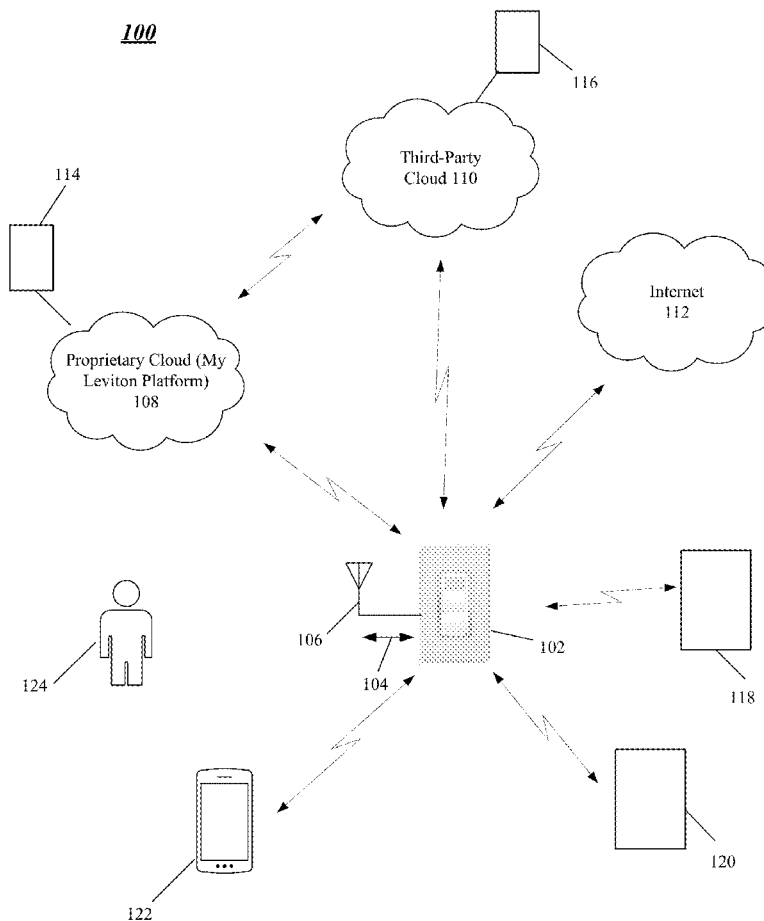
US 20190199545A1

(19) **United States**(12) **Patent Application Publication**

Ard et al.

(10) **Pub. No.: US 2019/0199545 A1**(43) **Pub. Date: Jun. 27, 2019**(54) **WIRELESS ENABLED LOAD CONTROL
DEVICE WITH VOICE CONTROLLER**(71) Applicant: **Leviton Manufacturing Co., Inc.**,
Melville, NY (US)(72) Inventors: **Aaron Ard**, New Orleans, LA (US);
James Shurte, New Orleans, LA (US);
Thomas Morgan, New Orleans, LA
(US)(73) Assignee: **Leviton Manufacturing Co., Inc.**,
Melville, NY (US)(21) Appl. No.: **15/855,475**(22) Filed: **Dec. 27, 2017****Publication Classification**(51) **Int. Cl.**
H04L 12/28 (2006.01)
H05B 37/02 (2006.01)
H04L 29/08 (2006.01)
G06F 3/16 (2006.01)(52) **U.S. Cl.**CPC **H04L 12/282** (2013.01); **H04L 12/2818**
(2013.01); **G05B 2219/2642** (2013.01); **H04L**
67/125 (2013.01); **G06F 3/167** (2013.01);
H05B 37/0227 (2013.01)(57) **ABSTRACT**

A wireless enabled load control device having integrated voice control is disclosed. The load control device may be connected to a variety of local and remote devices, including lighting devices and smart appliances, as well as various cloud service platforms. The load control device may receive a voice command from a user. The load control device may transmit the voice command to a first cloud service platform for processing to determine an instruction included in the voice command. The determined instruction may be provided to a second cloud service platform connected to the first cloud service platform. The first and second cloud service platforms may be connected to a device to be controlled based on the voice command. The cloud service platforms can adjust an operation of the device based on the determined instruction.



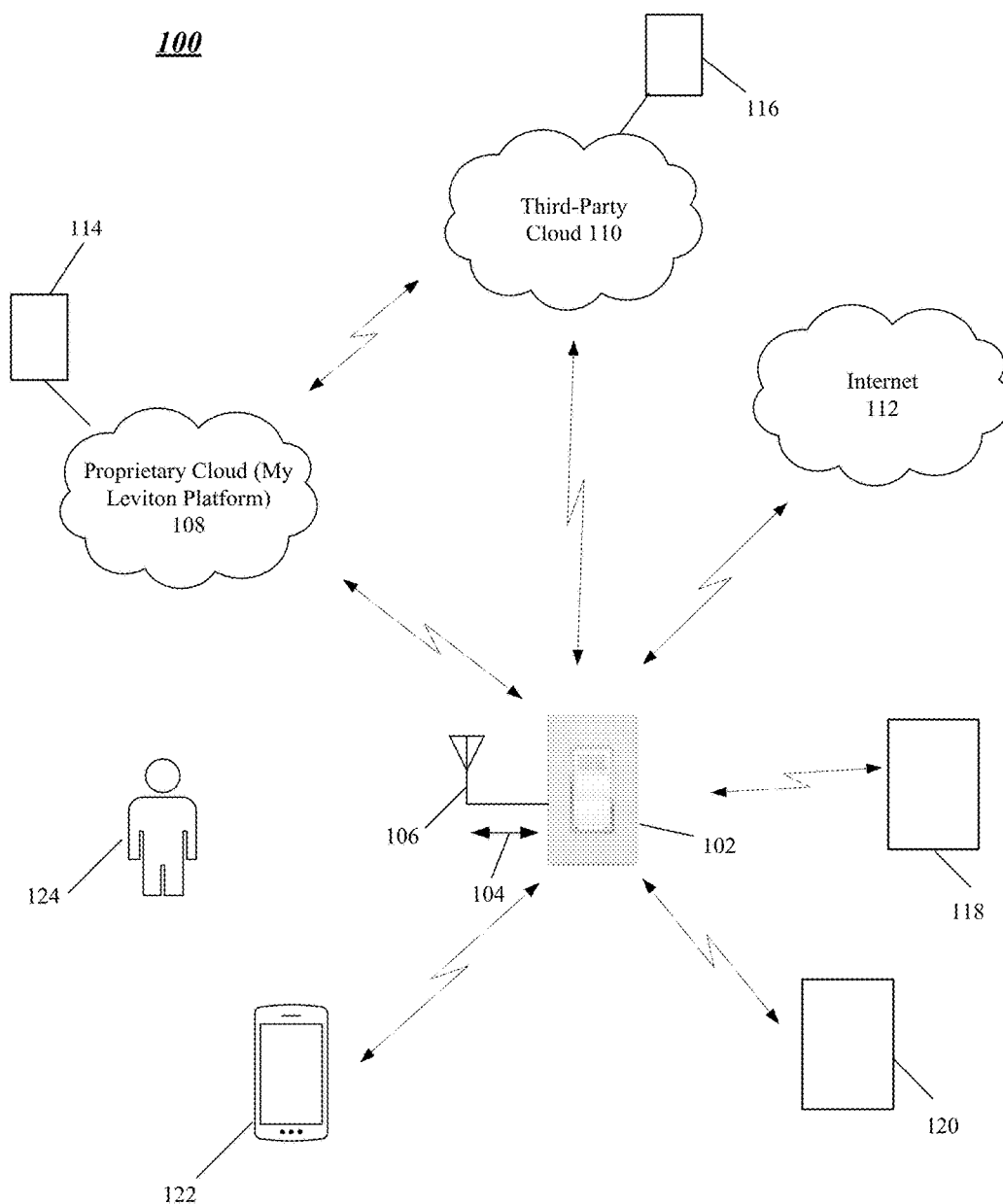
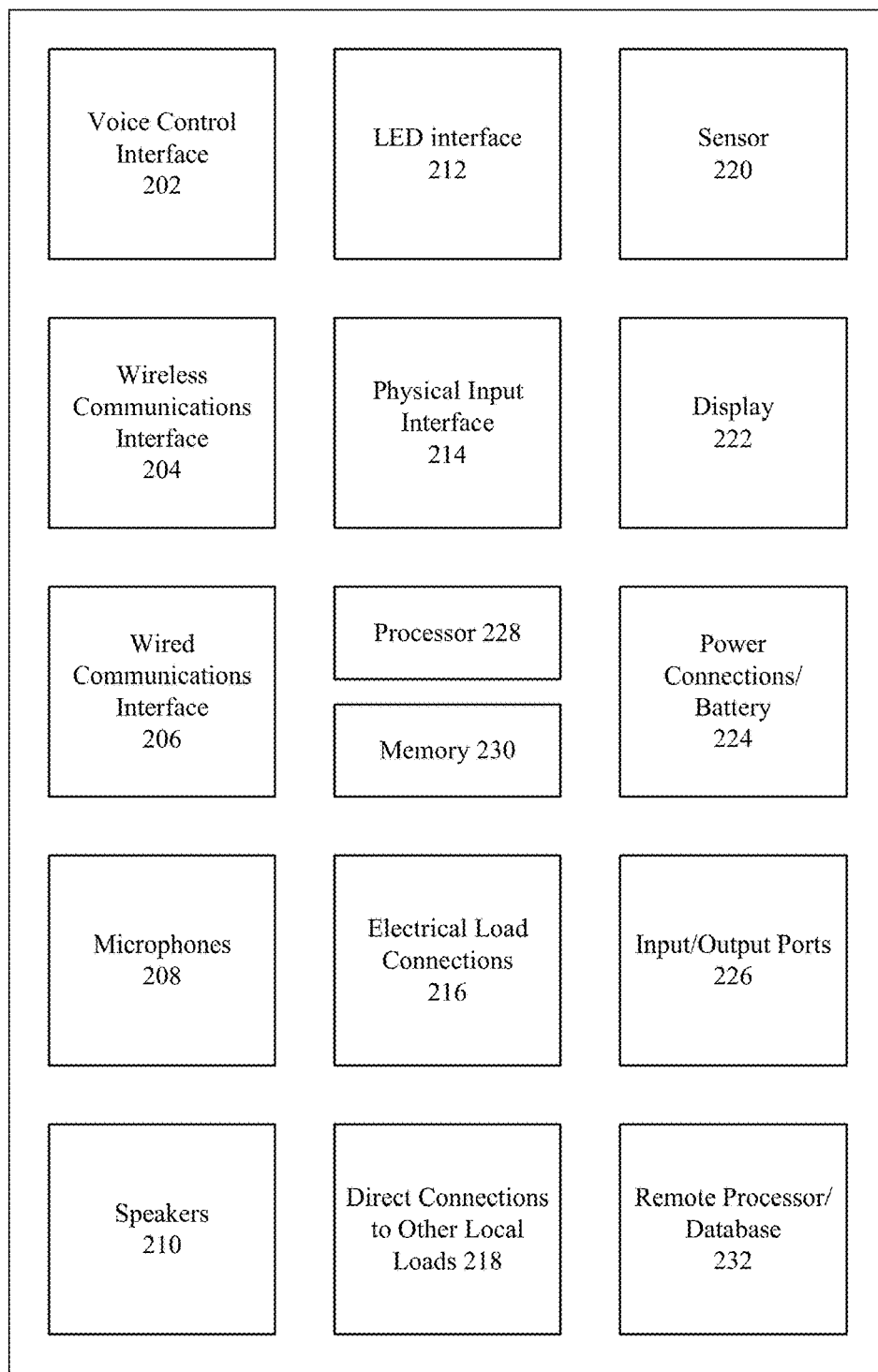


FIG. 1

102**FIG. 2**

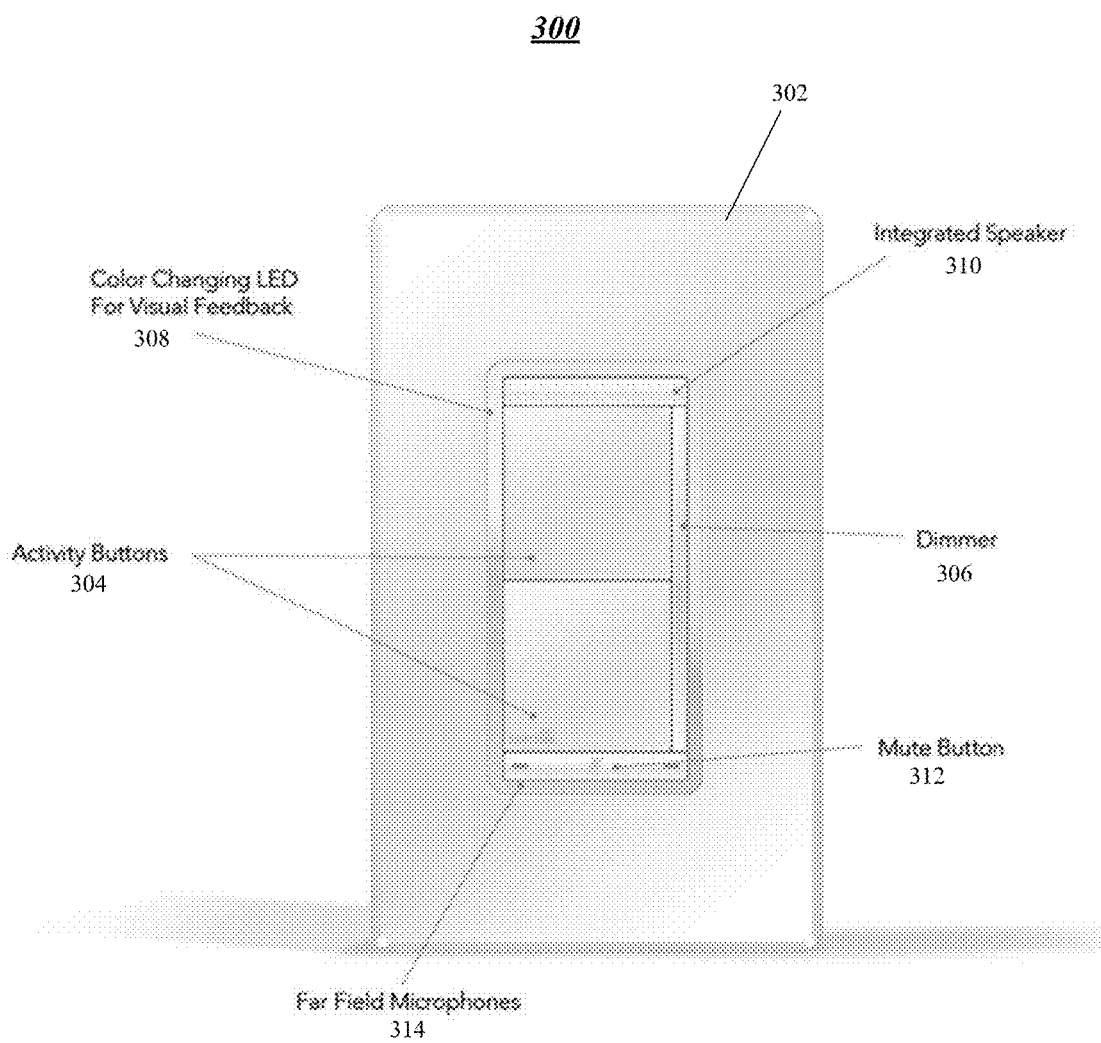


FIG. 3

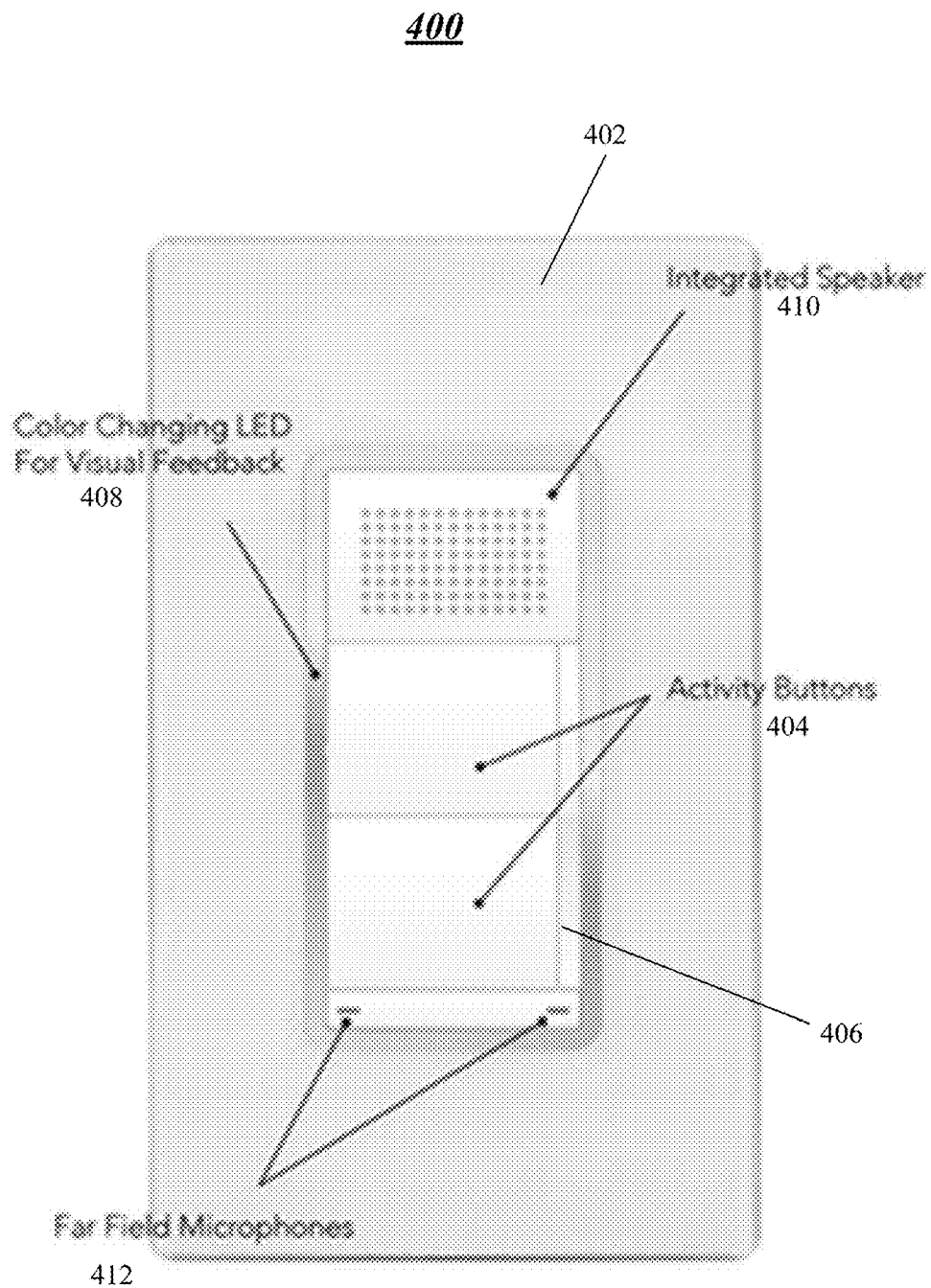


FIG. 4

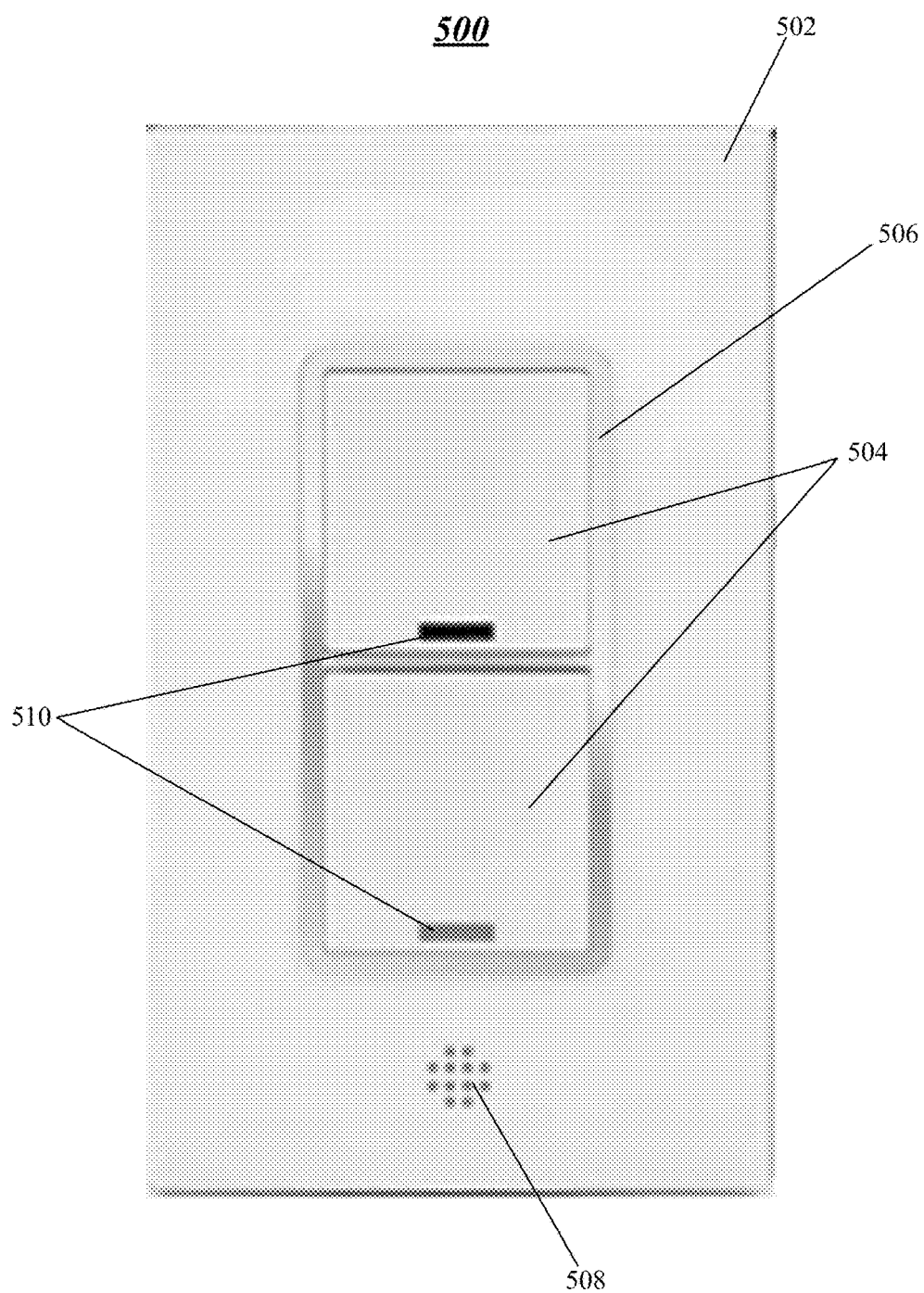


FIG. 5

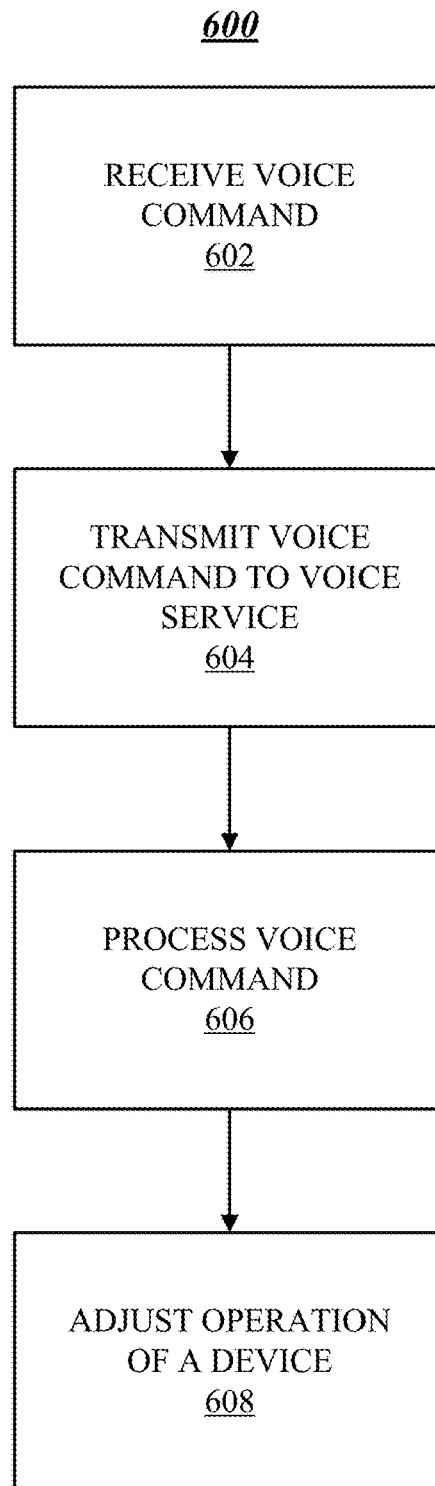


FIG. 6

WIRELESS ENABLED LOAD CONTROL DEVICE WITH VOICE CONTROLLER

FIELD OF THE DISCLOSURE

[0001] The present disclosure relates generally to a load control device and, more particularly, to a wireless enabled load control device having integrated voice control.

BACKGROUND OF THE DISCLOSURE

[0002] Conventional wireless enabled lighting devices may be controlled by a variety of devices including a virtual assistant. For example, operation of conventional wireless enabled lighting devices may be adjusted through voice commands detected by the virtual assistant. Specifically, the virtual assistant may provide access to a remote voice service that can decipher voice commands and control operation of the conventional wireless enabled lighting devices through a wireless connection such as Wi-Fi.

[0003] While voice control of such conventional wireless enabled lighting devices provides flexibility, it requires a separate handheld or desktop stand-alone virtual assistant. Further, outages, software bugs, failures, etc. associated with the virtual assistant may adversely affect the functionality and use of the controllable lighting devices, thereby reducing a user's satisfaction with voice control of the lighting devices. Moreover, the separate handheld or desktop stand-alone virtual assistant may not be located in the same area or room as the user or load.

[0004] Thus, it would be desirable to provide a load control device having the ability to receive and process voice commands to control operation of a variety of devices, including lighting devices, without requiring a separate, stand-alone voice control interface conventionally provided through a virtual assistant.

[0005] In addition, it would be desirable to provide a voice-control interface that is mounted in a conventional wall box (e.g., single gang wall box of a conventional switch or receptacle).

SUMMARY OF THE INVENTION

[0006] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended as an aid in determining the scope of the claimed subject matter.

[0007] The present disclosure is directed to a wireless enabled load control device having integrated voice control. The load control device may be connected to a variety of local and remote devices, including lighting devices and smart appliances, as well as various cloud service platforms. In one embodiment, the load control device may receive a voice command from a user. The load control device may transmit the voice command to a first cloud service platform for processing to determine an instruction included in the voice command. The determined instruction may be provided to a second cloud service platform connected to a device to be controlled based on the voice command. The second cloud service platform can adjust an operation of the device based on the determined instruction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] By way of example, specific embodiments of the disclosed device will now be described, with reference to the accompanying drawings, in which:

[0009] FIG. 1 illustrates an exemplary operating environment for a load control device having integrated voice control;

[0010] FIG. 2 illustrates a block diagram of exemplary functional components of the load control device of FIG. 1;

[0011] FIG. 3 illustrates a first exemplary embodiment of the load control device depicted in FIGS. 1 and 2;

[0012] FIG. 4 illustrates a second exemplary embodiment of the load control device depicted in FIGS. 1 and 2;

[0013] FIG. 5 illustrates a third exemplary embodiment of the load control device depicted in FIGS. 1 and 2; and

[0014] FIG. 6 illustrates a logic flow associated with a load control device having integrated voice control according to an exemplary embodiment.

DETAILED DESCRIPTION

[0015] A device, system and method in accordance with the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the device, system and method are shown. The disclosed device, system and method, however, may be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the devices, system and method to those skilled in the art. In the drawings, like numbers refer to like elements throughout.

[0016] FIG. 1 illustrates an exemplary operating environment 100 for a load control device having integrated voice control 102. As illustrated, the load control device 102 may be an in-wall load control device that may be coupled to, inter alia, any type of lighting load for controlling the lighting load. The load control device 102 may be, for example, a dimmer or ON/OFF switch, either one of any design or style such as rocker, toggle, return to neutral, etc. The operating environment 100 illustrates some of the types of devices, services, platforms, and/or networking components to which the load control device 102 may be connected, either directly or indirectly. The load control device 102 and portions of the operating environment 100 may be provided within the same physical space such as, for example, a home, an office, a retail space, a warehouse, etc.

[0017] The load control device 102 enables a user—for example, through physical or voice implemented inputs—to control, inter alia, local and remote lighting or other load devices. For example, in one embodiment, the load control device 102 may be used to turn ON/OFF or dim UP/DOWN, local and remote lighting devices or systems. Control of automation activities and lighting scenes involving the local and remote lighting devices or systems may also be provided by user interaction with the load control device 102. The load control device 102 may further provide a user with access to proprietary (e.g., affiliated with the load control device 102) and/or third-party service platforms such as, for example, cloud service platforms as described further herein.

[0018] As shown in FIG. 1, the load control device 102 may include one or more wired connections 104 for cou-

pling to one or more devices. In use, the wired connection 104 may be used to supply electrical power to the connected device such as, for example, a local lighting device, system or load (used interchangeably herein without the intent to limit). Alternatively, or in addition, the wired connection 104 may be used to facilitate communication to the connected device over any known wired communication standard or protocol. Example wired connections and/or protocols may include, for example, fiber optic connections, DSL, Ethernet, cable connections, telephone line connections, etc. The load control device 102 may also include one or more wireless communication connections 106 to facilitate communication to a connected device over any known wireless communication standard or protocol. Example wireless connections and/or protocols may include, for example, Wi-Fi (e.g., any IEEE 802.11a/b/g/n network), Bluetooth, Bluetooth Low Energy, Near-Field Communication, any cellular communication standard, any infrared communication protocol, etc.

[0019] The load control device 102 may communicate wirelessly over any frequency within any licensed or unlicensed frequency band (e.g., over a 2.4 GHz operating frequency band or a 5 GHz operating frequency band). The load control device 102 may implement any known security or encryption protocol or standard such as, for example, WPA or WPA2. The load control device 102 may also communicate, either directly or indirectly, with other devices or components including, for example, those depicted in FIG. 1 (e.g., either over a wired or wireless connection) and/or may communicate with other devices or components depicted in FIG. 1 through one or more intermediate devices or components (such as, for example, a cellular base station, a Wi-Fi router, a cloud service or platform, etc.). The load control device 102 may also communicate with a wireless remote-control device such as, for example, a remote load control device (e.g., a remote switch positioned in another area or room of a home or office thus enabling multi-way control), a mobile device 122, etc.

[0020] As further shown in FIG. 1, the load control device 102 may be connected to a proprietary cloud service and/or platform 108. The proprietary cloud service and/or platform 108 may be any proprietary cloud service and/or platform associated or affiliated with the load control device 102 such as, for example, a company's proprietary cloud service (herein referred to as the "My Leviton" platform). The load control device 102 may also be connected to one or more third-party cloud services or platforms 110 (herein further referred to as a "cloud service platform") including, for example, the Amazon cloud service platform. Other third-party cloud service platforms 110 may include security systems or services (e.g., ADT, etc.) or environmental control systems (e.g., NEST, etc.). The load control device 102 may also be connected to the Internet 112.

[0021] The load control device 102 may operate to transmit and receive data from each of the My Leviton platform 108, any third-party cloud service platform 110, and the Internet 112, or any device connected thereto. As illustrated, in one embodiment, the My Leviton platform 108 may be connected to the cloud service platform 110 so that data may be transmitted between the My Leviton platform 108 and the third-party cloud service platform 110. For example, in one embodiment, data (including instructions) may be transmitted from the load control device 102 to the My Leviton platform 108 and then to the third-party cloud service

platform 110 and/or from the load control device 102 to the third-party cloud service platform 110 and then to the My Leviton platform 108 to control one or more local or remote devices.

[0022] Referring to FIG. 1, the My Leviton platform 108 may be coupled to a first remote device 114 and the third-party cloud service platform 110 may be coupled to a second remote device 116, although it is envisioned that the My Leviton Platform 108 and the third-party cloud service platform 110 may be connected to any number of devices. The first remote device 114 and the second remote device 116 may be located, for example, in a remote location from the location of the load control device 102 (e.g., separated by a relatively large physical distance so as not be considered located in the same environment as the load control device 102). Alternatively, the first and second remote devices 114, 116 may be located in the same general area or location. The first and second remote devices 114 and 116 may be any type of electronic device including any "smart" device. The first and second remote devices 114 and 116 may be identical devices or, alternatively, may be different types of devices.

[0023] Through connectivity with the My Leviton platform 108, the load control device 102 may communicate with and/or control the first remote device 114. In one embodiment, the first remote device 114 may be a remote light or lighting system. Alternatively, the first remote device 114 may be any other smart device, Wi-Fi-enabled device, Internet-of-Things (IoT) device, IFTTT device, or any other device coupled to the My Leviton platform 108. Accordingly, the load control device 102 may be used to transmit and receive data (including instructions) with the first remote device 114 and/or to control the first remote device 114. For example, in one embodiment, the load control device 102 may be used to turn ON/OFF or dim UP/DOWN the first remote device (e.g., remote light or lighting system) 114.

[0024] Similarly, through connectivity with the third-party cloud service platform 110, either directly via a connection between the load control device 102 and the third-party cloud service platform 110, or via cloud-to-cloud connectivity between, for example, the My Leviton platform 108 and the third-party cloud service platform 110, the load control device 102 may communicate with and/or control the second remote device 116. In one embodiment, the second remote device 116 may be any type of device including, for example, a smart thermostat, a smart sensor, a smart device, Wi-Fi-enabled device, IoT device, IFTTT device, or any other type of smart appliance.

[0025] In one embodiment, the load control device 102 may be used to transmit and receive data (including instructions or control information) with the first remote device 114 through direct communications with the My Leviton platform 108. In one embodiment, the load control device 102 may be used to transmit and receive data (including instructions or control information) with the first remote device 114 through communication with the third-party cloud service platform 110 that then communicates and interacts with the My Leviton platform 108. Similarly, in one embodiment, the load control device 102 may be used to transmit and receive data (including instructions or control information) with the second remote device 116 through direct communications with the third-party cloud service platform 110. In one embodiment, the load control device 102 may be used to transmit and receive data (including instructions or control

information) with the second remote device **116** through communication with the My Leviton platform **108** that then communicates with the third-party cloud service platform **110**.

[0026] In addition, or alternatively, the load control device **102** may be connected to one or more local devices. As illustrated, the load control device **102** may be connected to first and second local devices **118**, **120**, although it is envisioned that the load control device **102** may be connected to more or less local devices. The first and second local devices **118** and **120** may be physically located within the same area or environment as the load control device **102**—for example, within the same room, home, office, retail space, or warehouse. The first and second local devices **118** and **120** may be identical devices or, alternatively, may be different types of devices. In use, the local devices **118**, **120** may be any device including, for example, Wi-Fi-enabled devices, Wi-Fi enabled lighting devices, IoT devices, smart devices, IFTTT devices, etc.

[0027] In one embodiment, the first local device **118** may be any lighting device including, for example, any light fixture, light system, LED light or lighting system, fluorescent light or lighting system, smart lighting device or system, Wi-Fi-enabled lighting device or system, Wi-Fi plug-in coupled lighting device or system, etc. In use, the load control device **102** may control the first local device (e.g., lighting device or system) **118**. For example, in one embodiment, the load control device **102** may be used to turn ON/OFF or dim UP/DOWN the first local device (e.g., local lighting device or system) **118**. The load control device **102** may control the first local device (e.g., lighting device or system) **118** through, for example, local networking communications (e.g., Wi-Fi control within a home). Alternatively, the load control device **102** may control the first local device (e.g., lighting device) **118** through the My Leviton platform **108**, through the third-party cloud service platform **110**, the Internet **112**, etc., or any combination thereof. Alternatively, the load control device **102** may be hardwired to the first local device (e.g., lighting device) **118**.

[0028] In one embodiment, the second local device **120** may be any type of smart device or IoT device including, for example, a smart thermostat or any smart appliance (e.g., any IoT-enabled device). The load control device **102** may control the second local device **120** through, for example, local networking communications (e.g., Wi-Fi control within a home). Alternatively, the load control device may control the second local device **120** through the My Leviton platform **108**, the third-party cloud service platform **110**, the Internet **112**, etc., or any combination thereof. Alternatively, the load control device **102** may be hardwired to the second local device **120**.

[0029] The load control device **102** may be connected to the first and second local devices **118** and **120** through any wired or wireless connection (e.g., one of the wired connections **104** and/or one or the wireless connections **106**). Alternatively, and/or in addition, the load control device **102** may be connected to the first and second local devices **118** and **120** through a single cloud service platform, or through connectivity between two or more cloud service platforms. The load control device **102** may transmit and receive data with the first and second local devices **118** and **120**. The load control device **102** may control operation of first and second local devices **118** and **120**. As with connectivity to the remote devices **114** and **116**, the load control device **102** can

provide connectivity for control of the local devices **118** and **120**, for example through wired or wireless connection **104**, **106**, through a single cloud service platform, or through connectivity between two or more cloud service platforms.

[0030] In one embodiment, to adjust an operation of a first local device (e.g., a local lighting device) **118**, the load control device **102** can transmit instruction information to the third-party cloud **110** for processing which then transmits the instruction information to the My Leviton platform **108** for implementation (e.g., direct adjustment of the operation of the first local device **118** based on the instruction). In this way, voice service processes can be provided by the third-party cloud **110** while implementation of the determined instruction can go through the My Leviton platform **108**.

[0031] As shown in FIG. 1, the load control device **102** may also be connected to a remote-control device **122** such as, for example, a mobile device, a remote switch, etc. The mobile device **122** may be any mobile device now known or hereafter developed including, for example, a smartphone, tablet, notebook, laptop, netbook, or other mobile computing device capable of communicating wirelessly with one or more wireless communication networks. The mobile device **122** may be used to control or interact with the load control device **102**. For example, an application (app) running on the mobile device **122** may be used to control the load control device **102** and/or any other lighting device (e.g., the first local device (lighting device or system) **118** or the first remote device (lighting device or system) **114**) through communications with the load control device **102**. The mobile device **122** may also be used to control or interact with the local or remote non-lighting devices such as the second remote device **116** and/or the second local device **120** through the load control device **102**. The load control device **102** may transmit and receive data from the mobile device **122**. Such data may include information regarding any device or service connected directly or indirectly to the load control device **102**.

[0032] In use, a user **124** may interact with the load control device **102**. The load control device **102** may include one or more user input components to facilitate interaction with the user **124**. For example, the load control device **102** may include one or more microphones for receiving voice commands, instructions, or queries from the user **124**. The load control device **102** may also include one or more actuators, such as, for example, a touch sensitive device, a touch screen or one or more buttons or other physically manipulated inputs, for receiving commands or instructions from the user **124**. In use, the load control device **102** enables the user **124** to control any of the local or remote devices connected thereto including, for example, the first and second remote devices **114**, **116**, as well as the first and second local devices **118**, **120**. In use, the user **102** may interface with remote platforms and/or services such as, for example, the My Leviton platform **108** or the third-party cloud service platform **110**, through interaction with the load control device **102**.

[0033] The load control device **102** may exchange data with each of the devices coupled thereto, either directly or indirectly through one or more of the platforms or services, thus enabling the user **124** to interact with and/or control each of these devices by issuing commands, instructions, or queries through the load control device **102**. As such, the user **124** may control any device including, for example, any

local or remote lighting device or system, connected to the load control device **102**. The user **124** may also control any other type of device including, for example, any local device (e.g., smart device, IoT device) connected to the load control device **102**. Additionally, the user **124** may control any remote lighting device connected to the load control device **102** through, for example, any proprietary or third-party cloud or service (e.g., the My Leviton platform **108** and/or the third-party cloud service platform **110**) or other communications network. The user **124** may also control any other type of remote device (e.g., smart device, IoT device) connected to the load control device **102** through, for example, any proprietary or third-party cloud or service (e.g., the My Leviton platform **108** and/or the third-party cloud service platform **110**) or other communications network. Communications with any device may be provided over one or more wired networks, one or more wireless networks, or any combination thereof.

[0034] The load control device **102** may process received commands from the user **124** locally, remotely, or in any combination thereof. In one embodiment, voice instructions can be received and initially processed by the load control device **102** (e.g., prepared for remote transmission) and then interpreted remotely (e.g., by the My Leviton platform **108** and/or the third-party cloud service platform **110**). In one embodiment, voice instructions can be received and fully processed by the load control device **102** (e.g., instructions for control of local lighting devices).

[0035] FIG. 2 illustrates an exemplary embodiment of the load control device **102**. Specifically, FIG. 2 provides a block diagram of exemplary functional components that may be incorporated into the load control device **102**. As shown, the load control device **102** may include a voice control interface **202**. The voice control interface **202** may be used by the load control device **102** to receive voice commands or instructions from the user **124** to control the load control device **102** and/or any device identified by the voice command or instruction. The voice control interface **202** may receive and determine voice commands and queries from the user **124**. In various embodiments, the voice control interface **202** may interface with a remote cloud service platform (e.g., the My Leviton platform **108** and/or the third-party cloud service platform **110**) to interpret and respond to voice controls or queries from the user **124**. In various embodiments, the voice control interface **202** may provide the capability to interpret and respond to voice controls or queries from the user **124**. For purposes of discussion, descriptions of the voice control interface **202** herein may include local and/or remote voice processing and response capabilities (e.g., processing may be provided entirely locally at the local control device **102**, processing may be provided remotely by a cloud service platform, and/or some combination thereof).

[0036] In one embodiment, the voice control interface **202** may listen for one or more “activation” words or signals. Upon hearing the activation word or signal, the voice control interface **202** will begin actively listening for a command or query and implement associated instructions. The voice control interface **202** may be a commercially-offered voice control interface such as, for example, Amazon Alexa, Google Assistant, Microsoft Cortana, or Samsung Bixby.

[0037] In various embodiments, the voice control interface **202** may be capable of distinguishing speakers—for example, the voice control interface **202** may be able to

identify and distinguish different authorized users of the load control device **102**. In various embodiments, the voice control interface **202** may determine which speaker to listen to and/or prioritize when multiple speakers are simultaneously verbally communicating with the load control device **102**. For example, the voice control interface **202** may be implemented such that it listens and follows instructions from an adult rather than a child. That is, the voice control interface **202** may be capable of determining an identity of a particular person speaking to the load control device **102**. The load control device **102** may identify and distinguish users and implement voice commands and/or respond to queries based on an established hierarchy of users.

[0038] In various embodiments, the voice control interface **202** can operate to follow or listen to the speaker who voiced the most recent command or query. For example, if two speakers issue a command to the load control device **102**, then the most recently issued command will be followed and processed by the load control device **102**. For example, in an embodiment where the load control device **102** is coupled to a remote switch, multiple speakers may simultaneously communicate with the load control device **102** and remote switch, respectively, the voice control interface **202** can be configured to follow or listen to the speaker who voiced the most recent command or query.

[0039] In various embodiments, the load control device **102** can provide presence detection such that the presence of a person within a building or room can be detected (e.g., based on voice detection, motion detection, learned activity processing, etc.). Lighting control can then be based on any determined presence detection. In various embodiments, the load control device **102** can provide various levels of access control, depending upon the person interacting with the load control device **102**. For example, users of the load control device **102** can be categorized, with different categories providing relatively increased or decreased control capabilities for the load control device **102** and any device coupled thereto. In an example, an unknown or unverified user of the load control device **102** may only be able to control local lighting devices while being unable to control any remotely coupled device. In contrast, an identified and authenticated “master” user of the load control device **102** may be granted access or ability to control any device connected to the load control device **102** and can even reconfigure the load control device **102**.

[0040] The voice control interface **202** may understand and process voice control commands such that any of the other devices or services depicted in FIG. 1 may be accessed or controlled. For example, the voice control interface **202** may relay received voice commands to control local devices **118** and **120** (e.g., to turn ON/OFF lighting device **118** or adjust a setting for thermostat device **120**). As a further example, the voice control interface **202** may relay received voice commands to control remote devices **114** and **116** (e.g., to turn ON/OFF lighting device **114** or adjust a setting for thermostat device **116**). The voice control interface **202** may follow voice control commands to provide links to the My Leviton platform **108** or the third-party cloud service platform **110**.

[0041] The load control device **102** may include a wireless communications interface **204**. The wireless communications interface **204** may include the wireless communication connection **106** depicted in FIG. 1. The wireless communications interface **204** may provide interfaces for communi-

cating with any local or remote device or network through any wireless communication technology.

[0042] The load control device **102** may include a wired communications interface **206**. The wired communications interface **206** may include the wired communications connection **104** depicted in FIG. 1. The wired communications interface **206** may provide interfaces for communicating with any local or remote device or network through any wired communication technology.

[0043] The load control device **102** may include one or more microphones **208**. The microphone **208** may detect audible commands and queries from the user **124**. The microphone **208** may provide received audio information to the voice control interface **202** for processing. The load control device **102** may further include one or more speakers **210**. The speaker **210** may output audio information to the user **124**. The audio information may include synthesized voices from the voice control interface **202** and other audible information such as music or an alarm.

[0044] The load control device **102** may further include a light emitting diode (LED) interface **212**. The LED interface **212** may include one or more LEDs. The LED interface **212** may provide and adjust a visual display based on an operational state of the load control device **102** and/or any service platform, or voice service coupled thereto (e.g., to indicate processing of a command, powering up, powering off, etc.). The LED interface **212** may provide a way for communicating information to the user **124** visually by adjusting the visual state of any LEDs coupled thereto.

[0045] The load control device **102** may further include a physical input interface **214** for interfacing with one or more physical inputs that may be manipulated by the user **124**. The physical input interface **214** may include or may be coupled to a variety of inputs including a keyboard, push buttons, or slides. The physical input interface **214** may provide a way for the user **124** to communicate information to the load control device **102**, for example, to adjust operation of the load control device **102**.

[0046] The load control device **102** may also include an electrical load connection **216** providing electrical connectivity to the load controlled by the load control device **102**. Coupled loads may include any type of load such as, for example, a lighting load including, for example, an incandescent bulb, an LED bulb, a CFL bulb, an EVL, a Resistive, Halogen, Fluorescent, etc., an inductive load, ½ HP motor, etc.

[0047] The load control device **102** may include additional connections to other local loads **218**. The connections to other local loads **218** enables the load control device **102** to directly control other local loads including, for example, other local lighting devices. Accordingly, the additional connections to other local loads **218** allows the user **124** to adjust operation of other nearby lighting devices without requiring communications through other wired or wireless communication channels (e.g., through Wi-Fi or cloud based services or components).

[0048] The load control device **102** may also include a sensor **220**. The sensor **220** may be physically attached to and part of the load control device **102** (e.g., located within a housing of the load control device **102**) or may be coupled to the load control device **102** by a wired or wireless communications connection (e.g., remote to the load control device **102**). The sensor **220** may be any type of sensor including a temperature sensor, humidity sensor, light sen-

sor, motion sensor, occupancy sensor, smoke detector, gas sensor, etc. The sensor **220** may detect conditions or physical attributes of a localized space surrounding the sensor **220** and may provide an indication of the same to the load control device **102**. Received information from the sensor **220** may be used to control or adjust operation of any of the devices coupled to the load control device **102**, for example, those depicted in FIG. 1. Received information from the sensor **220** may be relayed to the user **124** (e.g., through an audible signal from the load control device **102**, through a visible signal from the load control device **102**, by providing information to an app on the mobile device **122**, etc.) or to any other device depicted in FIG. 1.

[0049] The load control device **102** may also include a display **222**. The display **222** may include a visual display that may render visual information and a display controller for controlling the rendering of any visual information. The visual information may be any graphical or textual information. The display **222** may include a touchscreen or a touch-sensitive display. Accordingly, the display **222** may provide visual information to the user **124** and/or may receive input from the user **124**. The display **222** can be part of the LED interface **212** or can be separate therefrom. In various embodiments, the display **222** and/or the LED interface **212** can include an LCD interface.

[0050] The load control device **102** may also include a power source **224**. The power source **224** may include electrical power connections and/or a battery **224**. The power source **224** may provide power to any of the constituent functional components of the load control device **102** depicted in FIG. 2. The power source **224** may be coupled to the power supply of the physical space in which the load control device **102** operates and may provide battery backup during power failures or outages.

[0051] In one embodiment, the load control device **102** may be a single gang line voltage powered device with power source connections that include the following connections: line input, load, traveler, ground, and neutral. The load control device **102** may provide hard-wired multi-way applications that may interact with a remote control (e.g., a wireless digital remote control).

[0052] The load control device **102** may also include one or more input/output ports **226**. The input/output ports **226** may include any number and type of input and/or output ports including USB, HDMI, A/V, and a speaker/headphone jack. The input/output ports **226** provide alternative manners for communicating with the constituent functional components of the load control device **102** depicted in FIG. 2 or provide alternative ways of providing outputs from any of the same.

[0053] The load control device **102** may further include a processor circuit **228** and an associated memory component **230**. The memory component **230** may store one or more programs for execution by the processor circuit **228** to implement one or more functions or features of the load control device **102** as described herein. Further, the processor circuit **228** may maintain a real-time clock for the load control device **102**. The processor circuit **228** may be implemented using any processor or logic device. The memory component **230** can be implemented using any machine-readable or computer-readable media capable of storing data, including both volatile and non-volatile memory, and may reside internal or external to the load control device **102**.

[0054] The processor circuit **230** may implement the functionalities of any of the components depicted in FIG. **2** or may control or adjust operation of any of the depicted components. Each component depicted in FIG. **2** may be coupled to the processor circuit **228** as well as any other depicted component. The depicted components may be implemented in hardware or software as appropriate, or any combination thereof.

[0055] The load control device **102** may further include one or more remote processor circuits and/or one or more remote databases **232**. In various embodiments, the remote processor and database **232** may be located within the same physical environment as the load control device **102** (e.g., coupled to the load control device **102** and located within a basement or storage area of a home or office) or may be located in a separate, physically distinct environment. The remote processor and/or database **232** can provide supplemental computing power and extended memory to enhance the performance of the load control device **102** without affecting the relatively small size and form factor of the load control device **102**.

[0056] The load control device **102** may provide one or more of the following exemplary features, functions, and capabilities based on the constituent functional components depicted in FIG. **2** in conjunction with the devices, services, network architecture, and other components depicted in the operating environment **100** of FIG. **1**.

[0057] For example, in one embodiment, the load control device **102** may include a voice control interface to integrate IoT and/or smart functionality into everyday activities. In this manner, the load control device **102** may provide a seamless and integrated architectural solution for providing voice control and/or access to, for example, local and remote devices, the My Leviton platform, the Internet, and third-party platform providers such as, for example, Amazon to provide voice control for a residence, office, retail space, etc.

[0058] Additional, and/or alternatively, the load control device **102** enables connection and/or control of directly connected local and/or remote lighting devices, or through, for example, the My Leviton platform (e.g., either directly to the My Leviton platform or through a third-party cloud service platform). The load control device may enable monitoring and control operation of local and remote lighting devices through received voice commands and/or physical inputs such as, for example, manual actuation of one or more buttons. In addition, the load control device may enable a user to trigger automation activities and lighting scenes with respect to the local or remote lighting devices.

[0059] Additional, and/or alternatively, the load control device **102** may recognize and implement voice commands and/or respond to queries by linking a user to any of the components depicted in FIG. **1**.

[0060] Additional, and/or alternatively, the load control device **102** may issue commands to and/or collect data from other local devices within a common operating environment (e.g., a home, office, retail space, etc.). Additional, and/or alternatively, the load control device **102** may issue commands to and/or collect data from remote devices connected by way of a cloud based service or platform, such as, for example, a proprietary cloud service and/or platform (e.g., My Leviton), a third-party proprietary cloud connections or services (e.g., Amazon, etc.). Commands may be issued based on received voice commands. Collected data may be presented to a user by the load control device **102**.

[0061] In general, the load control device **102** may be connected to any device including, for example, any device able to communicate with the my Leviton platform, third-party proprietary cloud connections or services, Internet-enabled device, communications enabled (wireless or wired) device, smartphone, mobile device, tablet, laptop, personal computer, IFFFT device, partner IoT device (e.g., Samsung SmartThings, Nest devices, etc.), any smart Wi-Fi device, etc. Such devices include connectivity and interfaces therewith and may be provided locally or remotely based on any of the communications interfaces described herein. Connectivity to cloud service platforms may be provided through the load control device **102**.

[0062] In one embodiment, local and remote lighting devices may be controlled or adjusted based on received voice commands. For example, a query regarding the operational state of a remote lighting device may be issued by a user and detected by the integrated voice controller (e.g., voice control interface **202**) of the load control device **102** (e.g., a user may ask “Is my office light on?” to the load control device **102**). The load control device **102**, based on connectivity to the remote lighting device through, for example, a proprietary cloud platform or service (e.g., my Leviton platform—either directly or through a third-party cloud platform or service such as Amazon cloud platform), may determine the operational state of the remote lighting device. Once determined, the operational state of the remote lighting device may be provided to the user (e.g., by an audible announcement and/or visual display). Further, the load control device **102** may adjust the operational state of the remote lighting device based on received voice commands (e.g., turn OFF the remote lighting device if instructed to do so by the user). Local lighting devices may also be controlled based on direct connectivity, home networking architectures (e.g., Wi-Fi), and/or through a proprietary cloud platform or service (e.g., my Leviton platform). Accordingly, local and remote lighting devices may be controlled to turn ON/OFF or adjust dimming settings and to adjust any automation of control of the same.

[0063] Additional, and/or alternatively, the load control device **102** may be used to implement any preprogrammed activities or scenes. The activities or scenes may be activated either via voice-command or physical manipulation of an input device (e.g., button). For example, voice commands may be used to turn ON, turn OFF, or change dimming settings for any connected localized or remote lighting device. In this manner, automation activities and scenes (e.g., what lights to turn off and dim) may be set using voice commands. Some exemplary activities and/or scenes may include: turning a group of lights ON or OFF; dimming a group of lights; providing one or more lighting modes including, for example, a goodnight mode (e.g., upon activation, an automatic setting or voice-activated setting may turn certain lights ON or OFF and/or dim certain lights while also adjusting the setting of a heating, ventilation, and air conditioning (HVAC) system (e.g., via IFTTT or direct integration); providing an away mode (e.g., upon activation, an automatic setting or voice-activated setting may turn certain lights OFF and/or dim certain lights while also adjusting the setting of a HVAC system (e.g., via IFTTT or direct integration); etc. Further lighting modes can also be established and managed such as a return home mode, a

good morning mode, etc. in which certain groups of lights are controlled according to a schedule, time of day, or user activity.

[0064] Additional, and/or alternatively, by connecting the load control device **102** to one or more proprietary or third-party cloud service platforms, the load control device **102** may be able to provide a number of other services including, for example, home or office temperature/HVAC control, ability to order products or services, health and wellness monitoring and services, news and information products and services, etc.

[0065] Additional, and/or alternatively, by connecting the load control device **102** to a landline or cellular service, phone calls can be routed through the load control device **102** such that a user may establish an outgoing call or answer an incoming call.

[0066] Additional, and/or alternatively, by connecting the load control device **102** to a computing device (e.g., the mobile device **122**), the load control device **102** and any device connected to the load control device **102** either directly or indirectly can be controlled and configured via an app (e.g., the My Leviton App) residing on the computing device, including initiating or allowing automatic firmware updates (e.g., OTA updates).

[0067] Additional, and/or alternatively, the load control device **102** may be configured via, for example, the app to include the following: forward/reverse phase control; ability to set load types, fade rates, min/max levels, preset level, etc.; load control interface for ON/OFF (including ON with Fade Time and OFF with Fade Time); support downloadable dimming curves for new load types; etc. In addition, the load control device may incorporate additional functionality including, for example, enhanced management of connected devices based on behavioral learning for a particular user; enhanced speech recognition applications; and occupancy sensing using acoustic sensing/microphones.

[0068] FIG. 3 illustrates a first exemplary embodiment of a load control device having integrated voice control **300**. The load control device **300** may represent the load control device **102** as depicted in FIGS. 1 and 2. FIG. 3 illustrates physical components and features of the load control device **300**. FIG. 3 illustrates an exemplary form factor of the load control device **300**. The load control device **300** is not limited to the form factor shown in FIG. 3 as the arrangement of the constituent components of the load control device **300** may be varied in size, shape, and position as will be appreciated by a person of ordinary skill in the art.

[0069] The load control device **300** may be a single gang line voltage powered device that may fit into a standard NEMA electrical junction box. As such, the load control device **300** may include a strap for mounting the load control device to a standard NEMA electrical junction box. As shown in FIG. 3, the load control device **300** may include a wall plate **302**. The wall plate **302** may provide an outer frame for the load control device **300**. The wall plate **302** may be provided with screws or may be a screwless wall plate.

[0070] The load control device **300** may further include activity buttons **304**, a dimmer control component **306**, an LED display **308**, an integrated speaker **310**, a mute button **312**, and one or more microphones **314** (e.g., a far field microphone). The activity buttons **304** may be used to adjust operation of the load control device **300**—for example, to turn a lighting load coupled to the control device **302** ON

and OFF. The dimmer control component **306** may be used to adjust a dimming state of the lighting load coupled to the control device **302**. The activity buttons **304** and/or the dimmer control component **306** may be mechanical components and/or may be capacitive-based components that may be engaged or manipulated by a user through touch. The activity buttons **304** may be used for a variety of purposes including manually activating the integrated voice controller and power cycling/restarting the load control device **300**.

[0071] The LED display **308** may include one or more LEDs. The LED display **308** may form a border around the main components of the load control device **300**. As described herein, the LED display **308** may visually depict a state of operation or mode of the load control device **300** and/or connected voice service such as, for example, whether the load control device **300** is turned ON, the integrated voice service is working to answer a voiced query from a user, etc. Other visual information or feedback that may be provided by the LED display **308** may include: operations/modes for indicating dimming or brightness levels; load status; indicate voice controller operation states including, for example, thinking, listening, speaking, etc.; indicate a setup and/or configuration mode; indicate a muted or privacy state; indicate device connectivity status; indicate a diagnostic state such as indicating whether the device is connected to Wi-Fi; provide notifications including, for example, indicate an incoming call, an alarm, or indicate expiration of a timer; provide proprietary notifications such as, for example, My Leviton notifications including, for example, to indicate status of an activity or indicate an appliance or lighting device is turned on or drawing power for too long, etc.; providing a light or locator light such as, for example, a night light, which can be activated based on motion detection when a user enters the location of the load control device; locator or status light to indicate location of a button or engageable feature or to indicate a power state of the load control device (e.g., status light can be ON when load is turned off and OFF when load is turned ON); etc.

[0072] The integrated speaker **310** may provide audible outputs such as, for example, voiced responses from the integrated voice controller (e.g., Alexa feedback). The microphone **314** may receive audible inputs for the integrated voice controller of the load control device **300** to receive verbal commands and/or queries from the user (e.g., voice control input).

[0073] The mute button **312** may be used to provide muting and/or privacy capabilities. When activated, the load control device **102** may be programmed to cease listening for audible information. The load control device **102** may be controlled to be muted so as not to generate any audible output signal.

[0074] The load control device **300** may interface with an app (e.g., the My Leviton app) provided on a remote mobile computing device (e.g., the mobile device **122**). The load control device **300** may be set up and controlled by a user through, for example, the My Leviton app. Further, firmware updates, model number, firmware number information, etc. of the load control device **300** may be provided to the user through the My Leviton app. Other diagnostic data for the load control device **300** may be provided to the user through the My Leviton app.

[0075] The load control device **300** may further include one or more “hot” buttons that can include any type of engageable feature that can be manipulated by a user, with

the “hot” button assigned a different input role based on a current operational state of the load control device 300. The load control device 300 may include an input for cycling power and/or turning power ON and/or OFF.

[0076] FIG. 4 illustrates a second exemplary embodiment of a load control device having integrated voice control 400. The load control device 400 may represent the load control device 102 as depicted in FIGS. 1 and 2. FIG. 4 illustrates physical components and features of the load control device 400. FIG. 4 illustrates an exemplary form factor of the load control device 400. The load control device 400 is not limited to the form factor shown in FIG. 4 as the arrangement of the constituent components of the load control device 400 may be varied in size, shape, and position as will be appreciated by a person of ordinary skill in the art. The load control device 400 can be an alternative design of the load control device 300 and can include substantially the same components and capabilities—as such, a detailed discussion of the constituent components of the load control device 400 is not provided herein but is instead made in reference to similar components described in relation to FIG. 3.

[0077] The load control device 400 may be a single gang line voltage powered device that may fit into a standard NEMA electrical junction box. As such, the load control device 400 may include a strap for mounting the load control device to a standard NEMA electrical junction box. As shown in FIG. 4, the load control device 400 may include a wall plate 402. The wall plate 402 may provide an outer frame for the load control device 400. The wall plate 402 may be provided with screws or may be a screwless wall plate. The load control device 400 may further include activity buttons 404, a dimmer control component 406, an LED display 408, an integrated speaker 410, and one or more microphones 312 (e.g., a far field microphone). The load control device 400 may further include a mute button (not depicted in FIG. 4 for simplicity).

[0078] FIG. 5 illustrates a third exemplary embodiment of a load control device having integrated voice control 500. The load control device 500 may represent the load control device 102 as depicted in FIGS. 1 and 2. FIG. 5 illustrates physical components and features of the load control device 500. FIG. 5 illustrates an exemplary form factor of the load control device 500. The load control device 500 is not limited to the form factor shown in FIG. 5 as the arrangement of the constituent components of the load control device 500 may be varied in size, shape, and position as will be appreciated by a person of ordinary skill in the art. The load control device 500 can be an alternative design of the load control device 300 and the load control device 400 and can include substantially the same components and capabilities—as such, a detailed discussion of the constituent components of the load control device 500 is not provided herein but is instead made in reference to similar components described in relation to FIGS. 3 and 4.

[0079] The load control device 500 may be a single gang line voltage powered device that may fit into a standard NEMA electrical junction box. As such, the load control device 500 may include a strap for mounting the load control device to a standard NEMA electrical junction box. As shown in FIG. 5, the load control device 500 may include a wall plate 502. The wall plate 502 may provide an outer frame for the load control device 500. The wall plate 502 may be provided with screws or may be a screwless wall

plate. The load control device 500 may further include activity buttons 504, and LED display 506, and integrated speaker 508, and indicators 510. The load control device 500 may further include a dimmer control component, a microphone, a mute button (not shown for simplicity), etc.

[0080] The indicators 510 can provide visual display for indicating a status of the load control device 500. In various embodiments, the indicators 510 can be associated with one of the two shown activity buttons 504 and can indicate a status of the activity buttons. For example, if the lower activity button 504 is engaged or has been pressed to turn a coupled load OFF, then the lower indicator 510 can be illuminated as shown in FIG. 5. The indicators 510 can also provide illumination for locating the load control device 500 in a location with low light levels.

[0081] FIG. 6 illustrates a logic flow 600 associated with a load control device having integrated voice control (e.g., load control device 102). The logic flow 600 may begin with block 602. However, the logic flow 600 may begin with a different block other than the block 602. Furthermore, the logic flow 600 is not illustrated in a particular order. A different order other than that illustrated may be used. Some or all of the communications and operations associated with the logic flow 600 may be embodied as one or more computer executable instruction. Such computer executable instructions may be stored in a storage medium, such the memory 230 and/or database 232 as depicted in FIG. 2. A computing device, such as the processor circuit 228 and/or remote processor 232 as depicted in FIG. 2, may execute the stored computer executable instructions. The logic flow 600 may represent operations performed by any of the load control devices described herein.

[0082] At block 602, the load control device can receive a voice command. The voice command can be spoken by a user in relatively close proximity to the load control device. The voice command can be detected as a voice signal by the load control device using one or more microphones.

[0083] At block 604, the load control device can transmit the received voice command to a voice service. The voice service can be part of a remote cloud-based voice service platform and can be an integrated feature of the load control device that received the voice command. The remote cloud-based voice service platform can be a proprietary or third-party voice service platform capable of receiving and decoding voice commands. The load control device can transmit the received voice command over a wired or wireless interface to the remote cloud-based voice service platform.

[0084] At block 606, the voice command can be processed. In particular, the remote cloud-based voice service platform can determine what instruction was received by the load control device at block 602. In various embodiments, the remote cloud-based voice service platform can further determine a device associated with the instruction. In various embodiments, rather than an instruction being determined, a user query can be determined.

[0085] At block 608, operation of a device can be adjusted based on the processed voice command. The device can be determined based on the decoded voice command. The device can be a local device—for example, located in relative close proximity to the load control device—or can be a remote device—for example, located in a different environment relative to the load control device. The device can be any type of device including a lighting device or a non-lighting device. The device can be a smart device, IoT

device, or any type of device capable of being controlled or managed through a communications interface. The controlled device can also include the load control device. The voice service can control operation of the device directly—for example, by being coupled directly to the remote cloud-based voice service platform. Alternatively, the voice service can control operation of the device indirectly—for example, by communicating the voice command to a third-party cloud service platform that is coupled directly to the remote cloud-based voice service platform.

[0086] In operation, in a preferred embodiment, the load control device of the present disclosure may enable a user to control any device in, for example a home. For example, in a preferred embodiment, a load control device according to the present disclosure may be located adjacent an entryway in a home. A user, upon arriving or departing the home, may issue a voice command to, for example, turn OFF all bedroom lights. Upon detection of the voice command, the load control device may transmit the voice command to a third-party cloud service platform such as, for example, Amazon's cloud service platform, which may transmit the voice command to a proprietary cloud service platform such as, for example, the My Leviton platform, which may transmit the voice command to a router located in the home to control, for example, the Wi-Fi enabled lighting devices (e.g., bedroom lights). In operation, the voice command can be processed anywhere in the system.

[0087] While certain embodiments of the disclosure have been described herein, it is not intended that the disclosure be limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be read likewise. Therefore, the above description should not be construed as limiting, but merely as exemplifications of particular embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended hereto.

We claim:

1. A system, comprising:
 - an in-wall load control device including a strap for mounting to a wall box; and
 - a voice service platform, the in-wall load control device configured to receive a voice signal from a user and to transmit the voice signal to the voice service platform, the voice service platform configured to implement an instruction contained within the received voice signal.
2. The system of claim 1, wherein the in-wall load control device is one of a dimmer switch or a toggle switch.
3. The system of claim 1, wherein the voice service platform is configured to adjust operation of a local device based on the instruction.

4. The system of claim 3, wherein the local device includes at least one lighting device.

5. The system of claim 4, wherein the lighting device is a Wi-Fi-enabled lighting device.

6. The system of claim 3, wherein the local device is an electrical receptacle.

7. The system of claim 3, wherein the local device is an appliance other than a lighting device.

8. The system of claim 7, wherein the appliance is a wireless enabled appliance.

9. The system of claim 3, wherein the voice service platform is configured to adjust operation of the local device directly.

10. The system of claim 3, wherein the voice service platform is configured to adjust operation of the local device indirectly by communicating the instruction to a third-party cloud services platform that is coupled to the local device.

11. The system of claim 3, wherein the in-wall load control device is a load control device and the voice service platform is a proprietary cloud service platform.

12. The system of claim 3, wherein the voice service platform is a third-party voice service platform.

13. An in-wall load control device having integrated voice control, comprising:

a strap for mounting to a wall box;

a processor; and

a memory coupled to the processor, the processor configured to implement a voice control interface for receiving voice commands from a user and transmitting the voice commands to a remote voice service platform.

14. The in-wall load control device of claim 13, wherein the remote voice service platform is configured to adjust operation of the load control device based on the received voice command.

15. The in-wall load control device of claim 13, wherein the remote voice service platform is configured to adjust operation of a local lighting device based on the received voice command.

16. The in-wall load control device of claim 15, wherein the local lighting device is a Wi-Fi-enabled lighting device.

17. The in-wall load control device of claim 13, wherein the remote voice service platform is configured to adjust operation of a local device based on the received voice command.

18. The in-wall load control device of claim 13, further comprising an LED display.

19. The in-wall load control device of claim 18, wherein the LED display is configured to adjust a visual output based on an operational state of the load control device.

* * * * *