US 20250257922A1

(19) **United States**

(12) **Patent Application Publication**

**Francisco**

(10) **Pub. No.: US 2025/0257922 A1**

(43) **Pub. Date: Aug. 14, 2025**

(54) **SYSTEMS AND METHODS FOR REMOTE MANAGEMENT OF ICE MACHINES**

(71) Applicant: **Lee Francisco**, Marquette, MI (US)

(72) Inventor: **Lee Francisco**, Marquette, MI (US)

(21) Appl. No.: **19/193,822**

(22) Filed: **Apr. 29, 2025**

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 18/777,061, filed on Jul. 18, 2024.

(60) Provisional application No. 63/527,418, filed on Jul. 18, 2023.

**Publication Classification**

(51) **Int. Cl.**

*F25C 5/187* (2018.01)

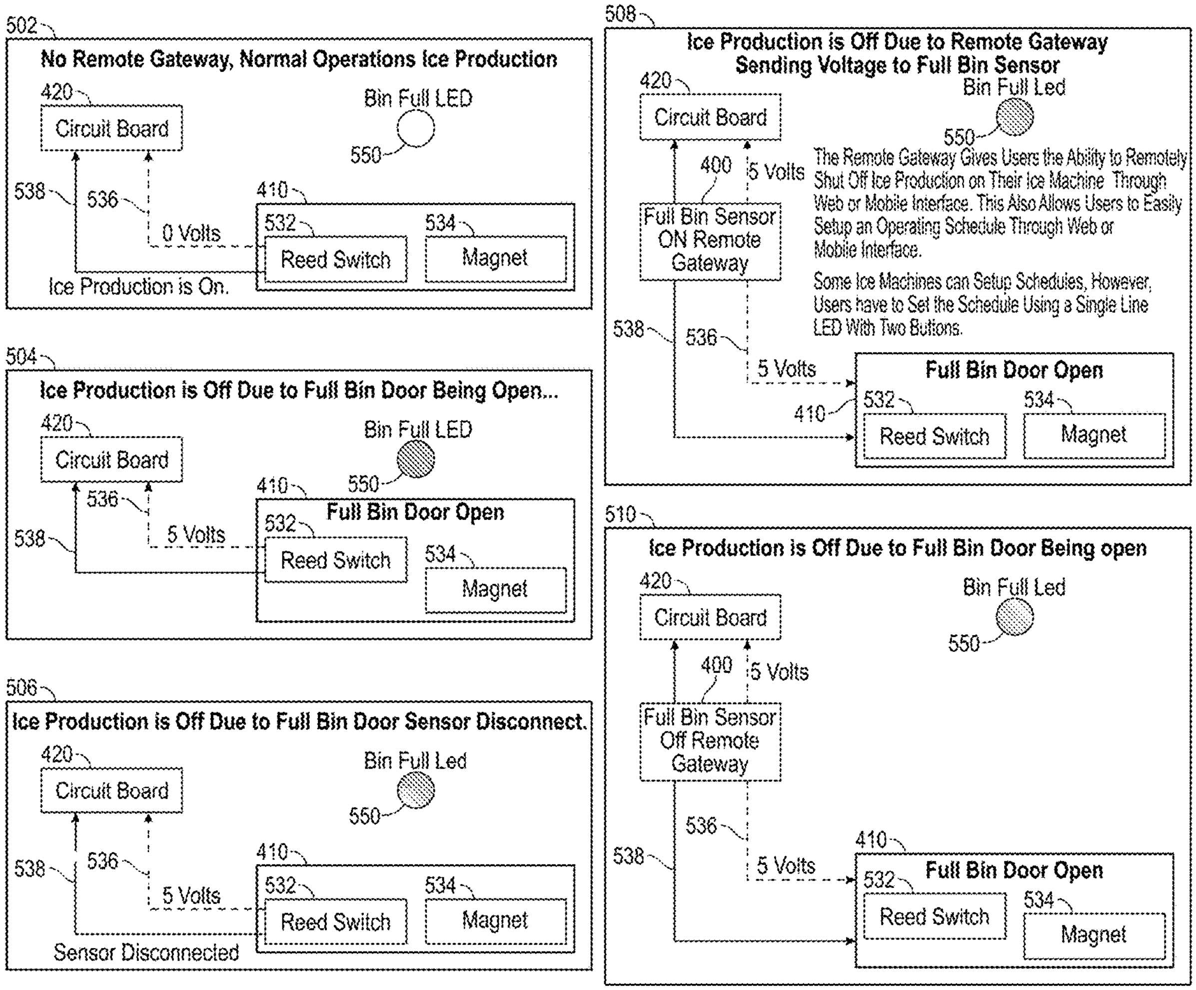
*F25C 1/00* (2006.01)

(52) **U.S. Cl.**

CPC ................ ***F25C 5/187*** (2013.01); ***F25C 1/00*** (2013.01); *F25C 2700/02* (2013.01)

(57) **ABSTRACT**

Described herein are examples of an remote gateway for controlling ice production. The remote gateway is coupled to existing sensors of the ice machine. The sensors can include a full bin sensor. The remote gateway provides commands to the ice machine controller to trigger when an ice machine is on or off, for example, when producing ice. The remote gateway may receive instructions from a management system that is remotely located from the remote gateway. The remote gateway may also receive the instructions locally.



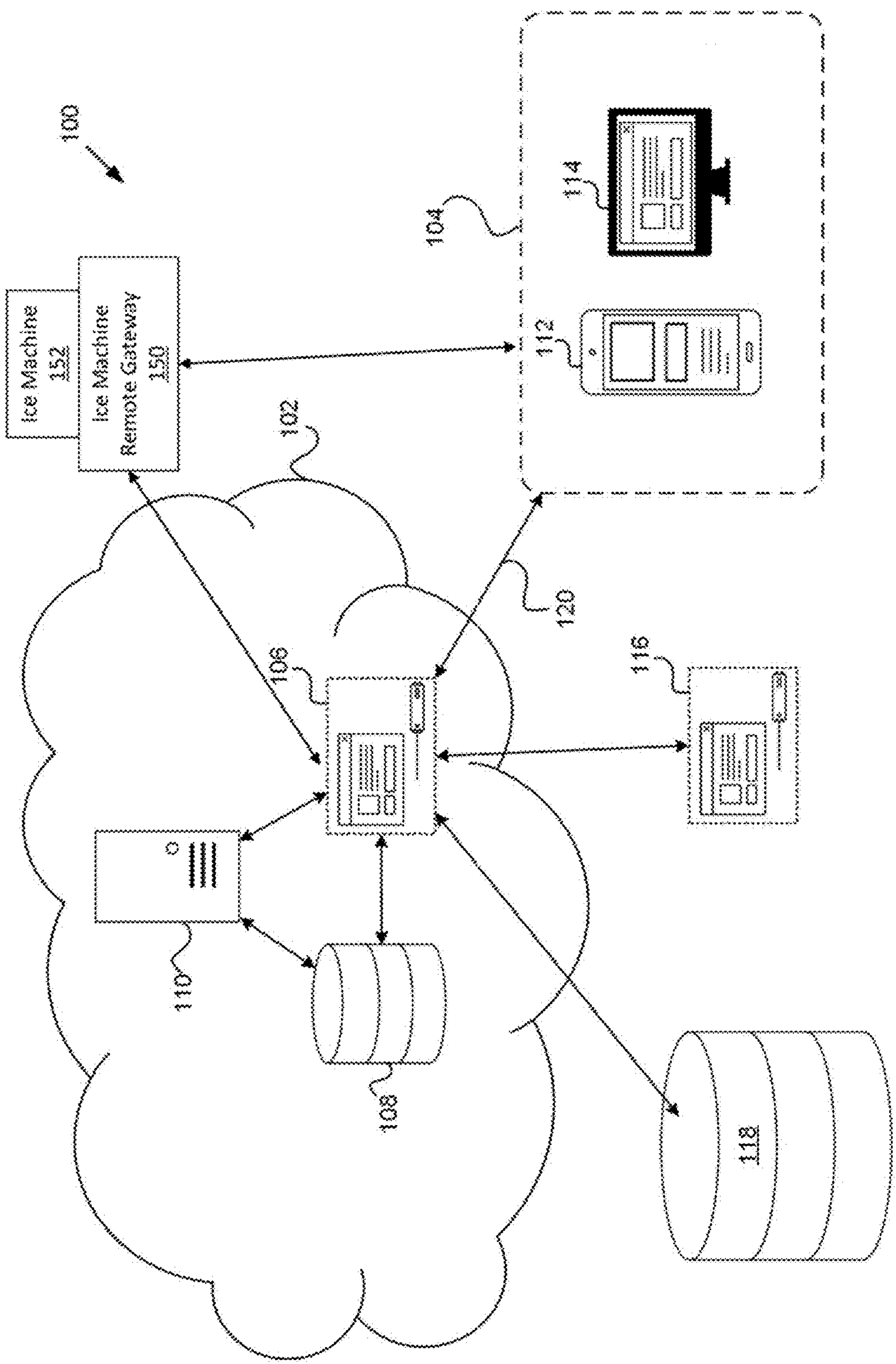

100
Ice Machine
152
Ice Machine
Remote Gateway
150
102
104
114
112
120
106
116
110
108
118

FIG. 1

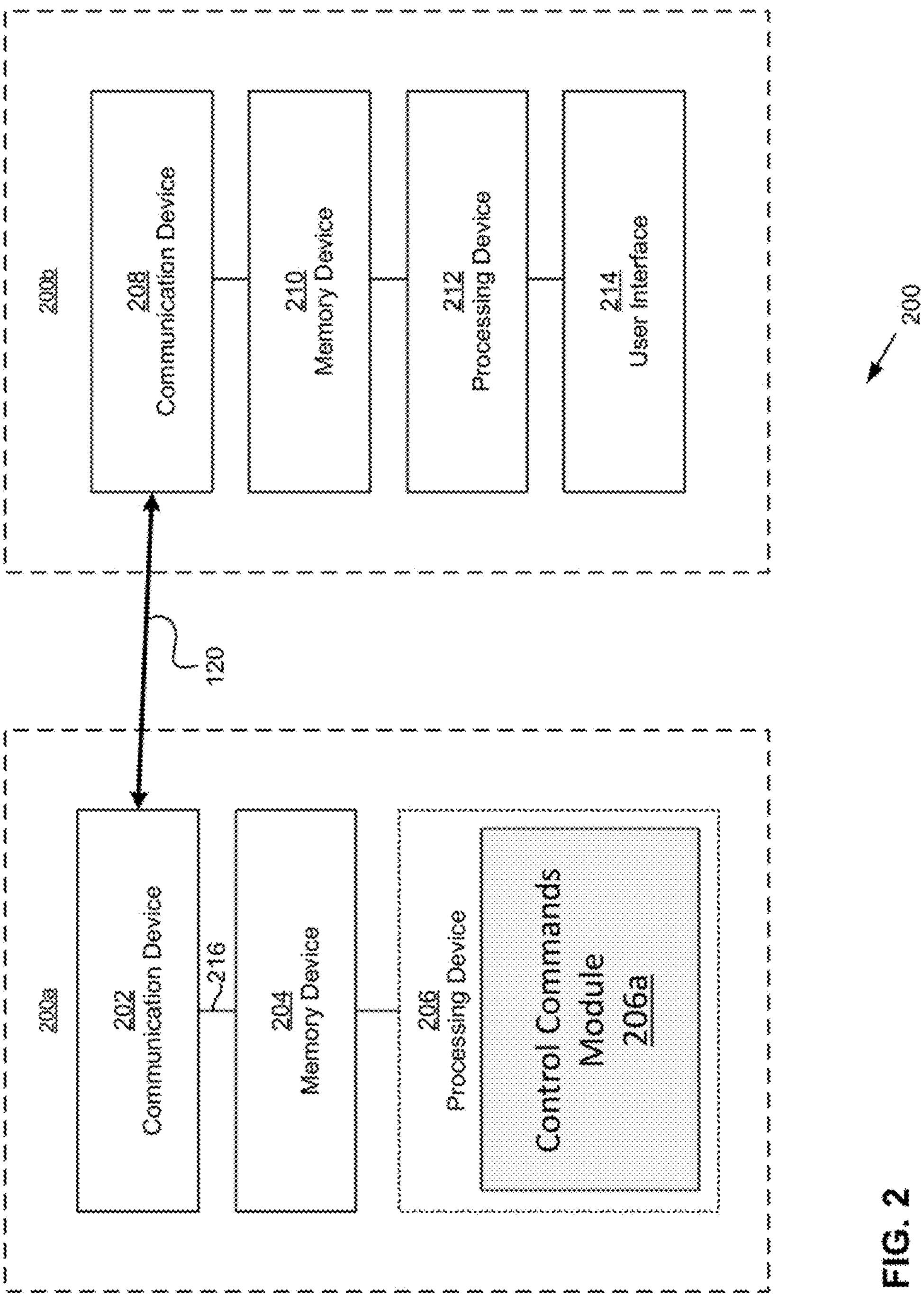

200b
208
Communication Device
210
Memory Device
212
Processing Device
214
User Interface
120
200a
202
Communication Device
216
204
Memory Device
206
Processing Device
Control Commands
Module
206a
200

FIG. 2

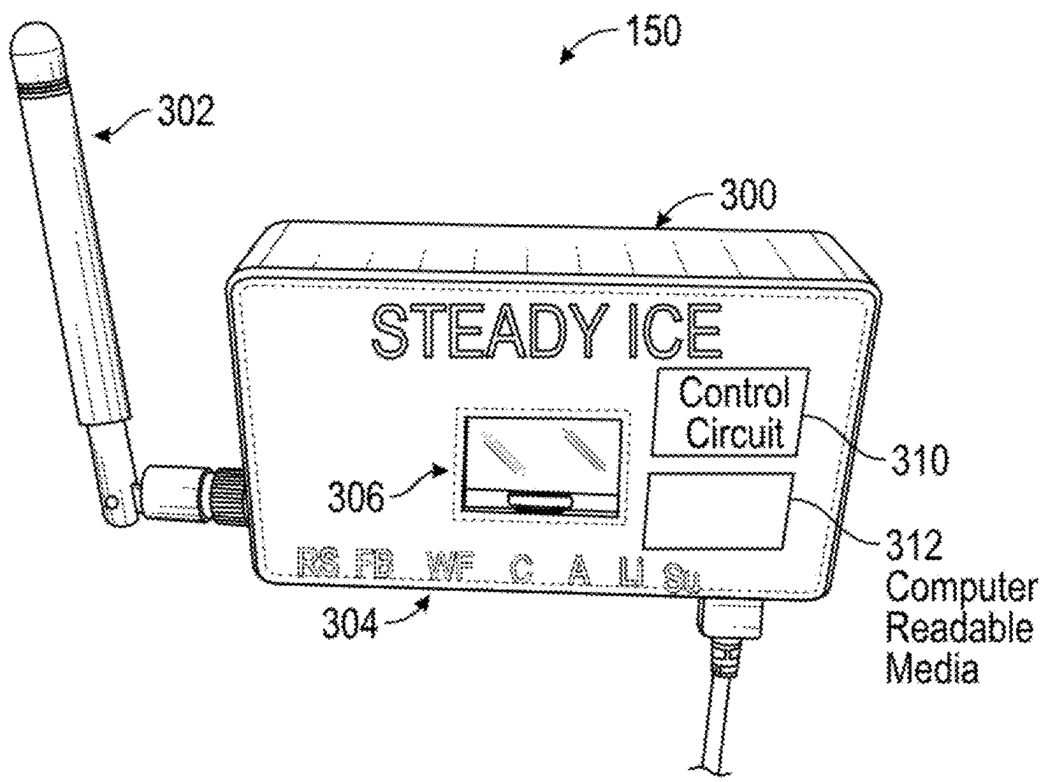

150
302
300
STEADY ICE
Control Circuit
310
306
312
Computer Readable Media
RS FB WF C A LI Su
304

FIG. 3

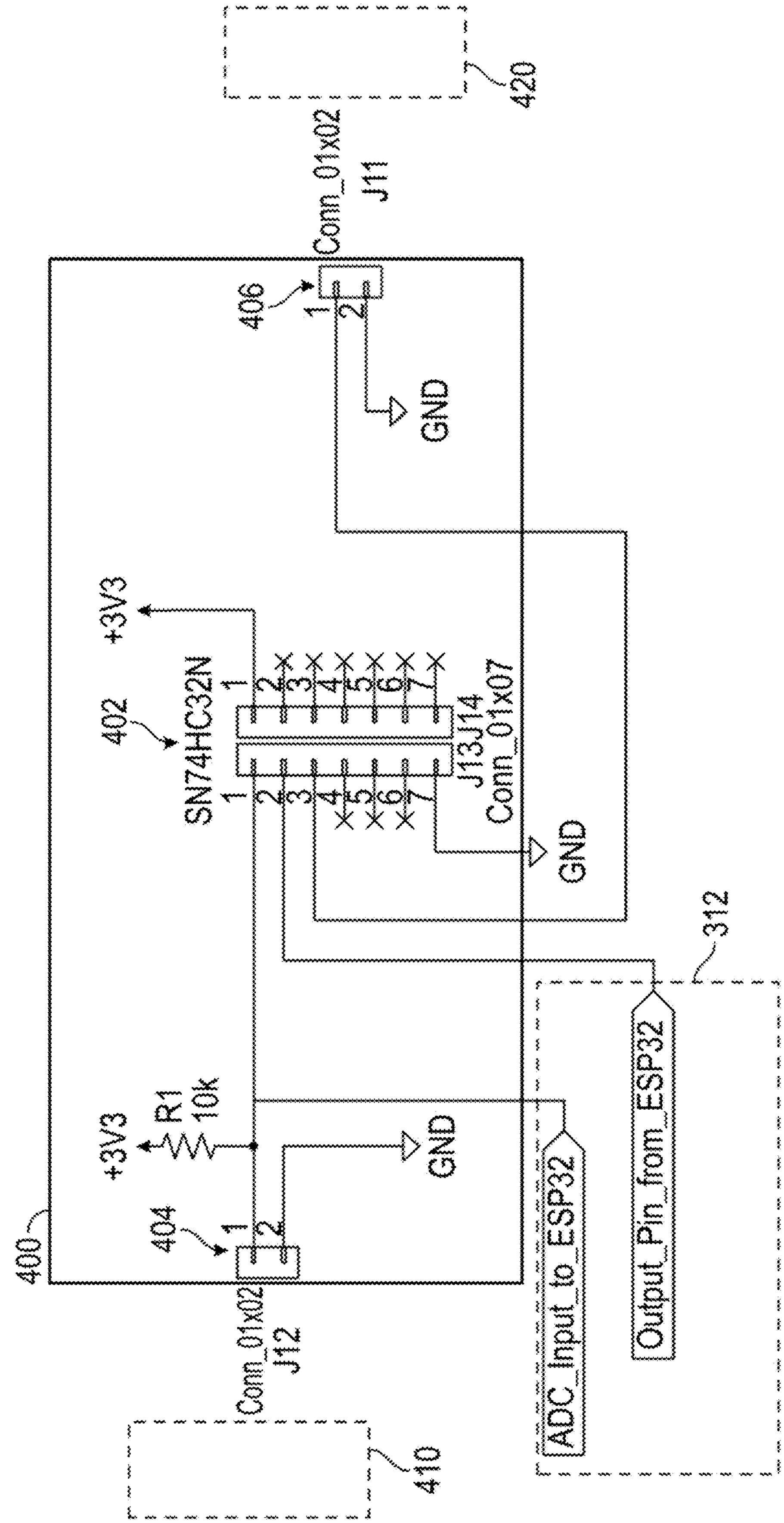

420
Conn_01x02
J11
406
GND
+3V3
402
SN74HC32N
J13J14
Conn_01x07
GND
312
Output_Pin_from_ESP32
ADC_Input_to_ESP32
R1
10k
+3V3
GND
404
400
Conn_01x02
J12
410

FIG. 4

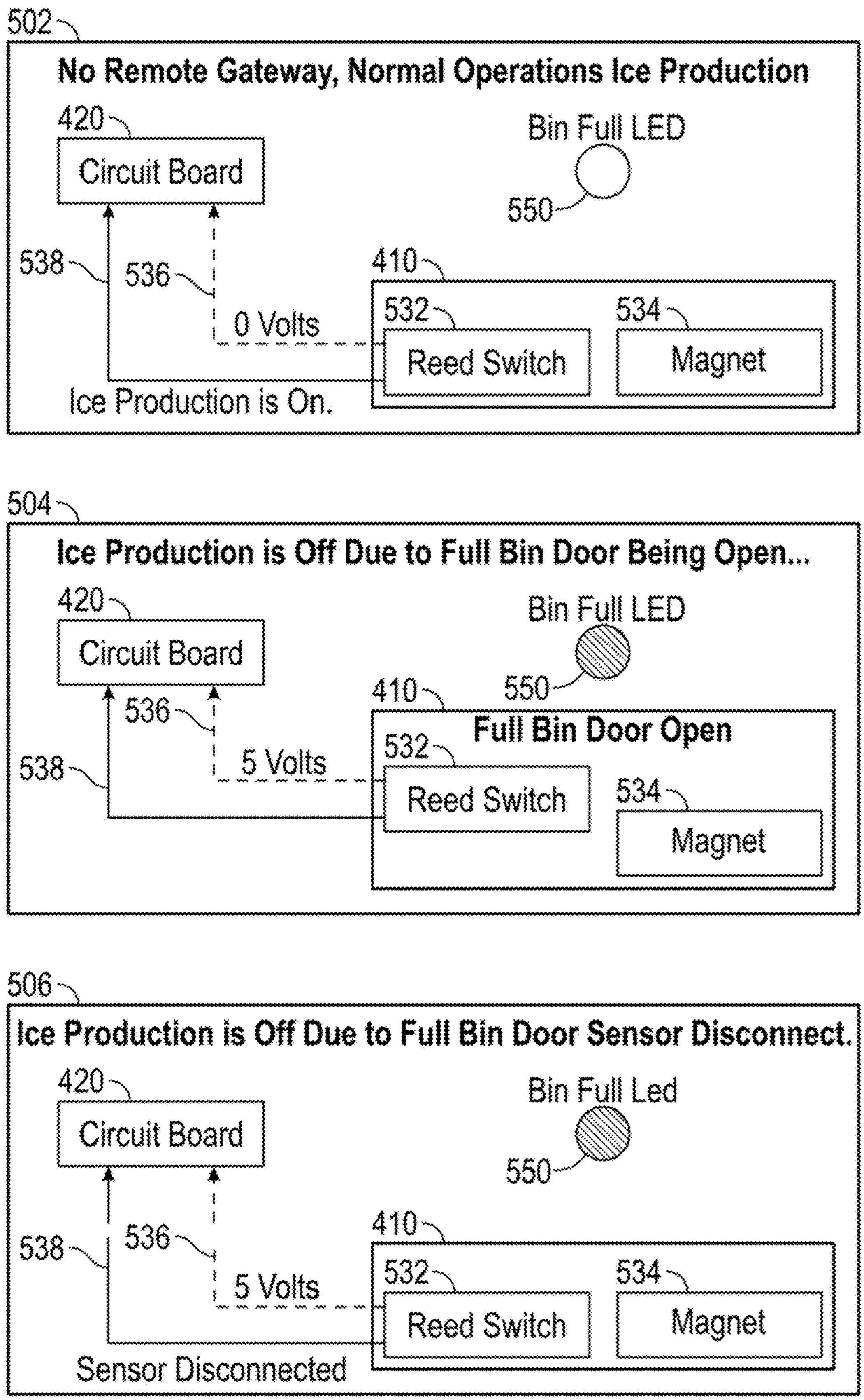

502
No Remote Gateway, Normal Operations Ice Production
420
Circuit Board
Bin Full LED
550
538
536
410
532
534
0 Volts
Reed Switch
Magnet
Ice Production is On.
504
Ice Production is Off Due to Full Bin Door Being Open...
420
Circuit Board
Bin Full LED
550
410
536
Full Bin Door Open
532
5 Volts
538
Reed Switch
534
Magnet
506
Ice Production is Off Due to Full Bin Door Sensor Disconnect.
420
Circuit Board
Bin Full Led
550
538
536
410
532
534
5 Volts
Reed Switch
Magnet
Sensor Disconnected

FIG. 5

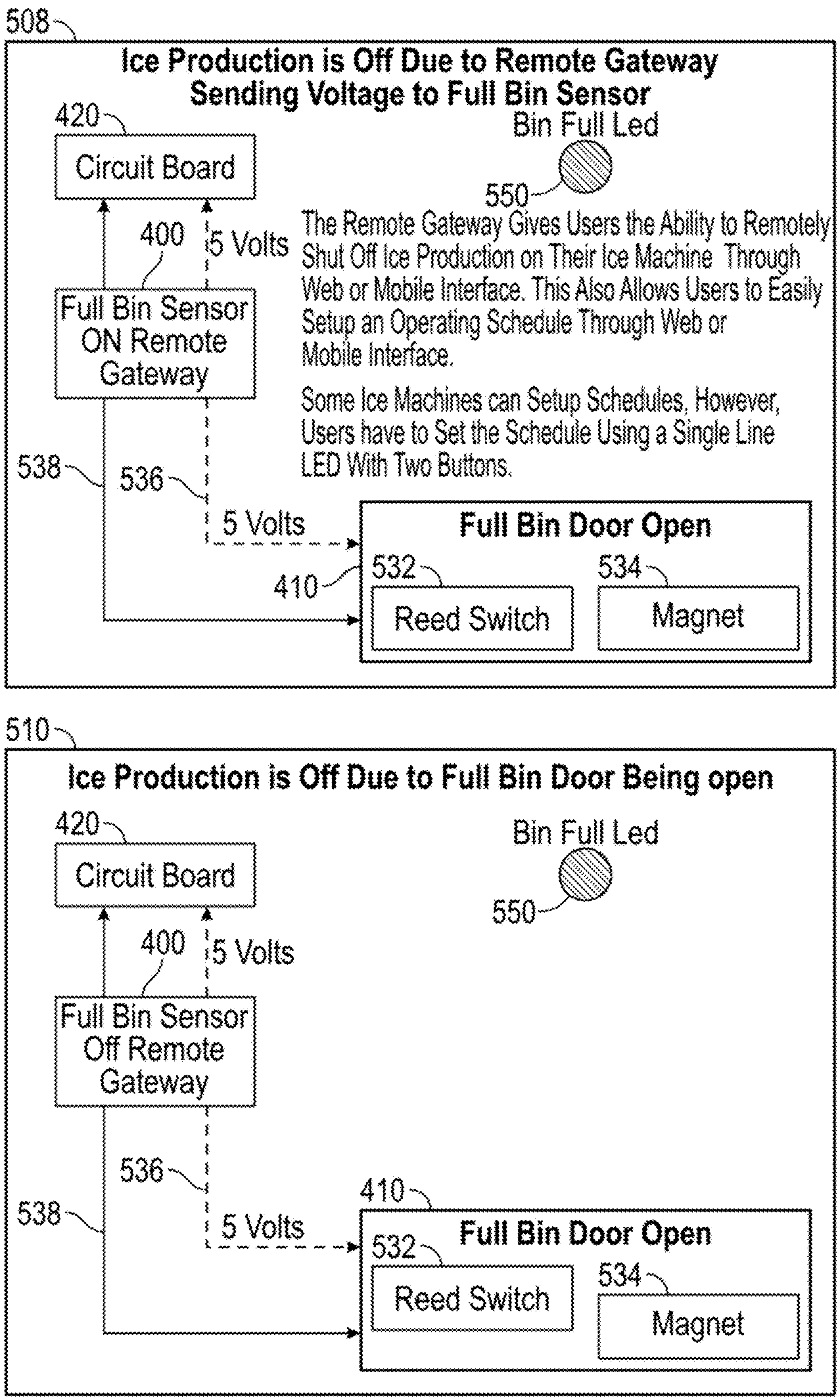



FIG. 5(Continued)

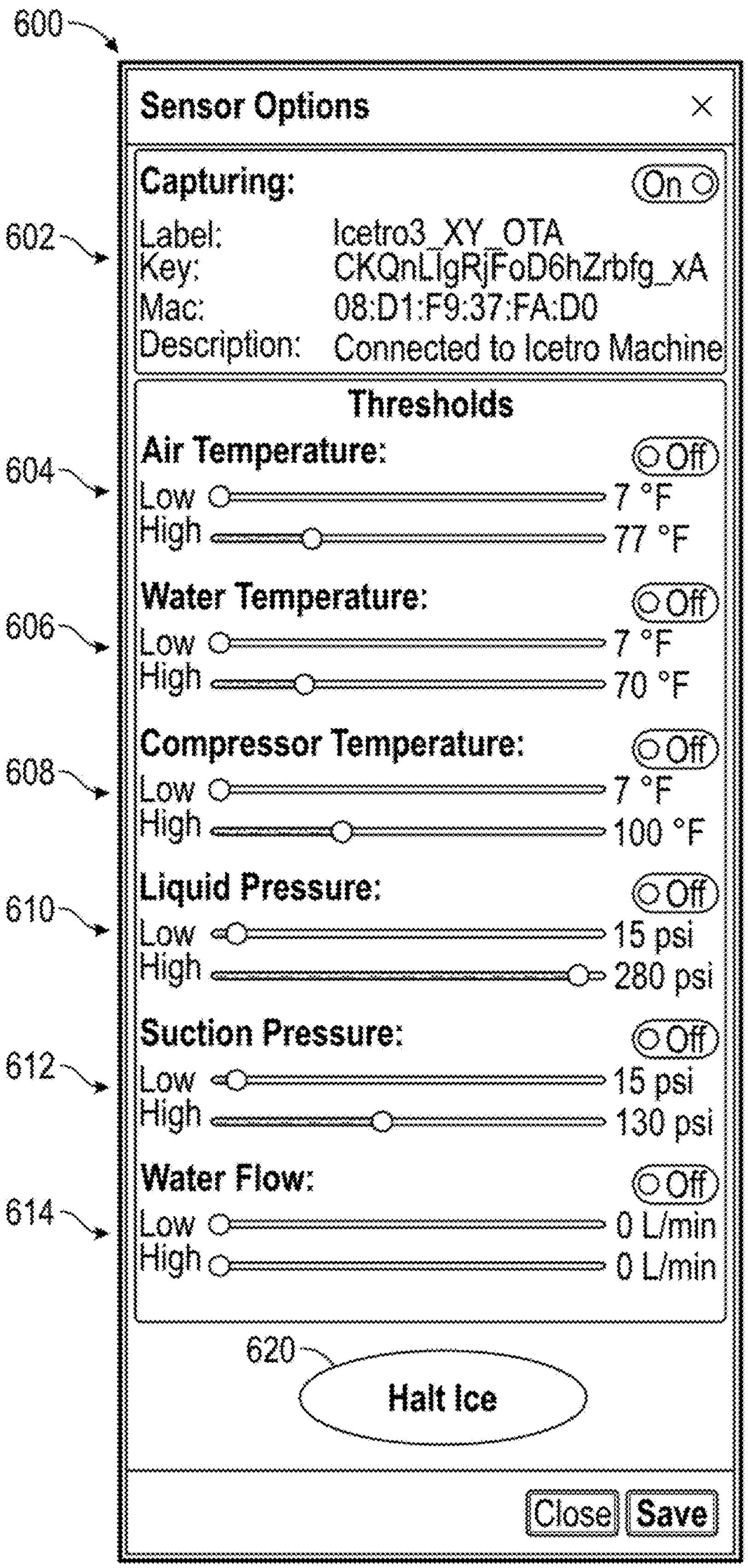

600
Sensor Options
Capturing:
On
602
Label: Icetro3_XY_OTA
Key: CKQnLIgRjFoD6hZrbfg_xA
Mac: 08:D1:F9:37:FA:D0
Description: Connected to Icetro Machine
Thresholds
604
Air Temperature:
Off
Low 7 °F
High 77 °F
606
Water Temperature:
Off
Low 7 °F
High 70 °F
608
Compressor Temperature:
Off
Low 7 °F
High 100 °F
610
Liquid Pressure:
Off
Low 15 psi
High 280 psi
612
Suction Pressure:
Off
Low 15 psi
High 130 psi
614
Water Flow:
Off
Low 0 L/min
High 0 L/min
620
Halt Ice
Close
Save

FIG. 6

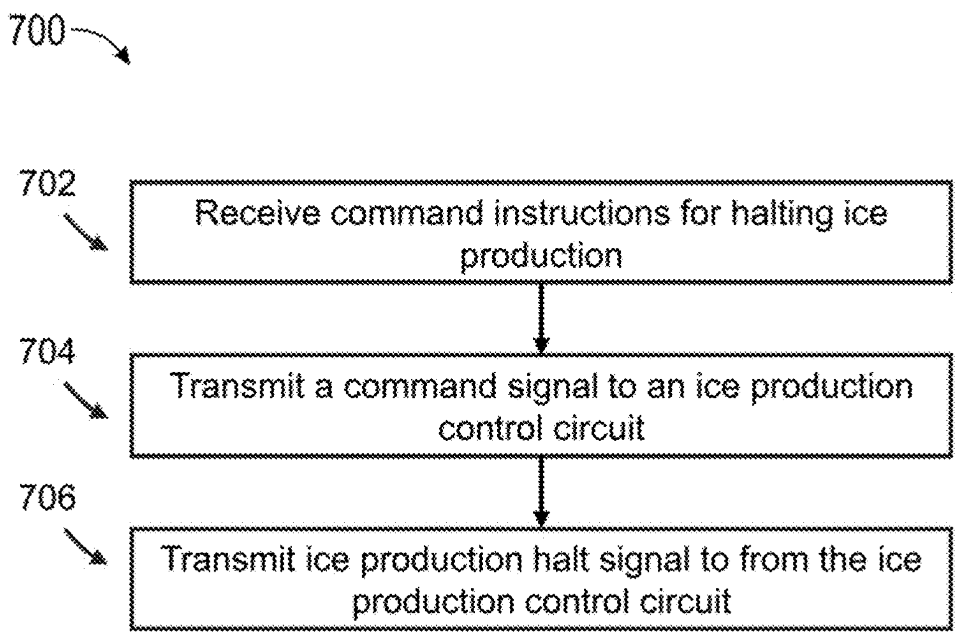

700
702
Receive command instructions for halting ice production
704
Transmit a command signal to an ice production control circuit
706
Transmit ice production halt signal to from the ice production control circuit

FIG. 7

# SYSTEMS AND METHODS FOR REMOTE MANAGEMENT OF ICE MACHINES

## CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. application Ser. No. 18/777,061 filed Jul. 18, 2024, titled "ICE MACHINE MONITORING SYSTEM AND METHODS," which claims the benefit of priority of U.S. provisional application No. 63/527,418, filed Jul. 18, 2023, titled, the entire contents of which are herein incorporated by reference.

## BACKGROUND

[0002] An ice machine is a device designed to produce ice automatically, commonly used in homes, businesses, and industrial settings. An ice machine works by freezing water in a controlled process and then, in many cases, storing the include until used in drinks, food storage, or other cooling applications. Commercial ice machines are heavy-duty appliances designed to produce large quantities of ice efficiently and consistently for businesses like restaurants, bars, hotels, hospitals, and grocery stores.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The present description will be understood more fully when viewed in conjunction with the accompanying drawings of various examples of an remote gateway. The description is not meant to limit the remote gateway to the specific examples. Rather, the specific examples depicted and described are provided for explanation and understanding of the remote gateway. Throughout the description the drawings may be referred to as drawings, figures, and/or FIGs.

[0004] FIG. **1** illustrates an remote gateway and management system, according to an embodiment.

[0005] FIG. **2** illustrates a device schematic for various devices used in the remote gateway and management system, according to an embodiment.

[0006] FIG. **3** illustrates the remote gateway, according to an embodiment.

[0007] FIG. **4** illustrates ice machine control circuitry, according to an embodiment.

[0008] FIG. **5** illustrates operational states for controlling ice production by the remote gateway, according to an embodiment.

[0009] FIG. **6** illustrates a graphical user interface for operating the remote gateway, according to an embodiment.

[0010] FIG. **7** illustrates a flow chart depicting a method of controlling ice production, according to an embodiment.

## DETAILED DESCRIPTION

[0011] An remote gateway as disclosed herein will become better understood through a review of the following detailed description in conjunction with the figures. The detailed description and figures provide merely examples of the various embodiments of the remote gateway. Many variations are contemplated for different applications and design considerations; however, for the sake of brevity and clarity, all the contemplated variations may not be individually described in the following detailed description. Those skilled in the art will understand how the disclosed examples may be varied, modified, and altered and not depart in substance from the scope of the examples described herein.

[0012] Many ice machines do not have the capability to shut ice production off remotely or run by a schedule. Only a few manufacturers offer the ability to have ice machines work on a schedule. For the ice machines that do provide the option, the client must locally use buttons to scroll through schedules.

[0013] Implementations of a remote gateway disclosed herein may address some or all of the problems described above. A remote gateway controls production in a frozen product machine using existing sensors in the machine, e.g., an ice machine, an ice cream maker, an air conditioner unit, etc. The remote gateway is coupled to existing sensors of the ice machine, e.g., a full bin sensor. The ice machine gateway provides commands to the ice machine controller to trigger when an ice machine is on or off, e.g., producing ice. The remote gateway can receive instructions from a management system that is remotely located from the remote gateway. For example, the remote gateway allows users to easily suspend ice production and/or create a schedule for ice production through a remote interface, e.g., web/mobile portal.

[0014] In implementations, the remote gateway can tie into existing ice machine full bin sensors. By connecting the remote gateway in the middle of the sensor wires, the remote gateway can override the full bin sensor and send a control signal to trigger the full bin sensor. This allows the remote gateway to fully control when ice production is on or off and/or to instruct the ice machine to follow a schedule that can be downloaded to the remote gateway. The full bin sensor provides optimal override because override control is the inherent operation of the sensor and tells the ice machine when to start and stop ice production. Once the remote gateway disables the override of the full bin sensor, the ice machine operates as normal.

[0015] In implementation, the remote gateway can include a microcontroller connected via one or more communication devices, e.g., WiFi, cellular communication device, Near Field Communication, etc. The remote gateway may be connected to an array of sensors monitoring the ice machine. For the full bin sensor, a reed switch is triggered by a magnet, and a voltage is sent indicating that the bin is full. In response, the ice machine shuts down and discontinues producing ice. Once the magnet sensor is restored into position, the voltage stops, and the ice machine returns to normal operation to produce ice. The remote gateway may be coupled between the reed switch and the circuitry of the ice machine for ice production. In some implementations, the remote gateway may send voltage to cause the ice machine to move into the full bin state. In some implementations, the remote gateway may interrupt the full bin sensor, causing the full bin sensor to appear disconnected, and, in response, the ice machine ceases ice production. In some implementations, the remote gateway connects to an existing full bin sensor and uses a relay to override the existing sensor output.

[0016] FIG. **1** illustrates an remote gateway **150** and a management system **100**, according to an embodiment. The management system **100** includes internal and external data resources for managing the remote gateway **150** for controlling the operation of an ice machine **152**. The management system **100** and the remote gateway **150** allow control of the ice machine **152** without a user being physically present at the ice machine.

**[0017]** As illustrated, the remote gateway **150** may be coupled to the ice machine **152** and may communicate remotely with the management system **100**. The remote gateway **150** can be electronically coupled to the circuitry and sensors of the ice machine **152** to control the operation of the ice machine **152**. The remote gateway **150** may include one or more communications devices that allow the remote gateway **150** to receive commands from the management system **100**.

**[0018]** The management system **100** may include a cloud-based data management system **102** and a user device **104**. The cloud-based data management system **102** may include an application server **106**, a database **108**, and a data server **110**. The user device **104** may include one or more devices associated with user profiles of the management system **100**, such as a smartphone **112** and/or a personal computer **114**. For example, a user may use the user device **104** to control the operation of the ice machine **152** via the remote gateway **150**. In some embodiments, the user device **104** may directly communicate with the remote gateway **150** via one or more communication links.

**[0019]** The management system **100** may include external resources such as an external application server **116** and/or an external database **118**. The various elements of the management system **100** may communicate via various communication links **120**. An external resource may generally be considered a data resource owned and/or operated by an entity other than an entity that utilizes the cloud-based data management system **102** and/or the user device **104**.

**[0020]** The management system **100** may be web-based. The user device **104** may access the cloud-based data management system **102** via an online portal set up and/or managed by the application server **106**. The management system **100** may be implemented using a public internet. The management system **100** may be implemented using a private intranet. Elements of the management system **100**, such as the database **108** and/or the data server **110**, may be physically housed at a location remote from an entity that owns and/or operates the management system **100**. For example, various elements of the management system **100** may be physically housed at a public service provider such as a web services provider. Elements of the management system **100** may be physically housed at a private location, such as at a location occupied by the entity that owns and/or operates the management system **100**.

**[0021]** The communication links **120** may be direct or indirect. A direct link may include a link between two devices where information is communicated from one device to the other without passing through an intermediary. For example, the direct link may include a Bluetooth™ connection, a ZigbeeR connection, a Wifi Direct™ connection, a near-field communications (NFC) connection, an infrared connection, a wired universal serial bus (USB) connection, an ethernet cable connection, a fiber-optic connection, a firewire connection, a microwire connection, and so forth. In another example, the direct link may include a cable on a bus network. "Direct," when used regarding the communication links **120**, may refer to any of the aforementioned direct communication links.

**[0022]** An indirect link may include a link between two or more devices where data may pass through an intermediary, such as a router, before being received by an intended recipient of the data. For example, the indirect link may include a wireless fidelity (WiFi) connection where data is passed through a WiFi router, a cellular network connection where data is passed through a cellular network router, a wired network connection where devices are interconnected through hubs and/or routers, and so forth. The cellular network connection may be implemented according to one or more cellular network standards, including the global system for mobile communications (GSM) standard, a code division multiple access (CDMA) standard such as the universal mobile telecommunications standard, an orthogonal frequency division multiple access (OFDMA) standard such as the long-term evolution (LTE) standard, and so forth. "Indirect," when used regarding the communication links **120**, may refer to any of the aforementioned indirect communication links.

**[0023]** FIG. **2** illustrates a device schematic **200** for various devices used in the management system **100**, according to an embodiment. A server device **200*a*** may send commands to remotely control the ice machine **152** to the remote gateway **150** based on input received at the client device **200*b***.

**[0024]** The server device **200*a*** may include a communication device **202**, a memory device **204**, and a processing device **206**. The processing device **206** may include a control commands module **206*a***, where module refers to specific programming that governs how data is handled by the processing device **206**. The client device **200*b*** may include a communication device **208**, a memory device **210**, a processing device **212**, and a user interface **214**. Various hardware elements within the server device **200*a*** and/or the client device **200*b*** may be interconnected via a system bus **216**. The system bus **216** may be and/or include a control bus, a data bus, an address bus, and so forth. The communication device **202** of the server device **200*a*** may communicate with the communication device **208** of the client device **200*b***.

**[0025]** The control commands module **206*a*** may handle inputs from the client device **200*b***. The control commands module **206*a*** may cause data to be written and stored in the memory device **204** based on the inputs from the client device **200*b***. The control commands module **206*a*** may retrieve data stored in the memory device **204** and output the data to the client device **200*b*** via the communication device **202**. For example, the control commands module **206*a*** may receive instruction from the client device **200*b*** to enable or discontinue ice production in the ice machine **152**. In response, the control commands module **206*a*** may generate the appropriate command and transmit the command to the remote gateway **150**.

**[0026]** The server device **200*a*** may be representative of the cloud-based data management system **102**. The server device **200*a*** may be representative of the application server **106**. The server device **200*a*** may be representative of the data server **110**. The server device **200*a*** may be representative of the external application server **116**. The memory device **204** may be representative of the database **108** and the processing device **206** may be representative of the data server **110**. The memory device **204** may be representative of the external database **118** and the processing device **206** may be representative of the external application server **116**. For example, the database **108** and/or the external database **118** may be implemented as a block of memory in the memory device **204**. The memory device **204** may further store instructions that, when executed by the processing device **206**, perform various functions with the data stored in the database **108** and/or the external database **118**.

**[0027]** Similarly, the client device **200***b* may be representative of the user device **104**. The client device **200***b* may be representative of the smartphone **112**. The client device **200***b* may be representative of the personal computer **114**. The memory device **210** may store application instructions that, when executed by the processing device **212**, cause the client device **200***b* to perform various functions associated with the instructions, such as retrieving data, processing data, receiving input, processing input, transmitting data, and so forth.

**[0028]** As stated above, the server device **200***a* and the client device **200***b* may be representative of various devices of the management system **100**. Various of the elements of the management system **100** may include data storage and/or processing capabilities. Such capabilities may be rendered by various electronics for processing and/or storing electronic signals. One or more of the devices in the management system **100** may include a processing device. For example, the cloud-based data management system **102**, the user device **104**, the smartphone **112**, the personal computer **114**, the external application server **116**, and/or the external database **118** may include a processing device. One or more of the devices in the management system **100** may include a memory device. For example, the cloud-based data management system **102**, the user device **104**, the smartphone **112**, the personal computer **114**, the external application server **116**, and/or the external database **118** may include the memory device.

**[0029]** The processing device may have volatile and/or persistent memory. The memory device may have volatile and/or persistent memory. The processing device may have volatile memory and the memory device may have persistent memory. Memory in the processing device may be allocated dynamically according to variables, variable states, static objects, and permissions associated with objects and variables in the management system **100**. Such memory allocation may be based on instructions stored in the memory device. Memory resources at a specific device may be conserved relative to other systems that do not associate variables and other object with permission data for the specific device.

**[0030]** The processing device may generate an output based on an input. For example, the processing device may receive an electronic and/or digital signal. The processing device may read the signal and perform one or more tasks with the signal, such as performing various functions with data in response to input received by the processing device. The processing device may read from the memory device information needed to perform the functions. For example, the processing device may update a variable from static to dynamic based on a received input and a rule stored as data on the memory device. The processing device may send an output signal to the memory device, and the memory device may store data according to the signal output by the processing device.

**[0031]** The processing device may be and/or include a processor, a microprocessor, a computer processing unit (CPU), a graphics processing unit (GPU), a neural processing unit, a physics processing unit, a digital signal processor, an image signal processor, a synergistic processing element, a field-programmable gate array (FPGA), a sound chip, a multi-core processor, and so forth. As used herein, "processor," "processing component," "processing device," and/or "processing unit" may be used generically to refer to any or all of the aforementioned specific devices, elements, and/or features of the processing device.

**[0032]** The memory device may be and/or include a computer processing unit register, a cache memory, a magnetic disk, an optical disk, a solid-state drive, and so forth. The memory device may be configured with random access memory (RAM), read-only memory (ROM), static RAM, dynamic RAM, masked ROM, programmable ROM, erasable and programmable ROM, electrically erasable and programmable ROM, and so forth. As used herein, "memory," "memory component," "memory device," and/or "memory unit" may be used generically to refer to any or all of the aforementioned specific devices, elements, and/or features of the memory device.

**[0033]** Various of the devices in the management system **100** may include data communication capabilities. Such capabilities may be rendered by various electronics for transmitting and/or receiving electronic and/or electromagnetic signals. One or more of the devices in the management system **100** may include a communication device, e.g., the communication device **202** and/or the communication device **208**. For example, the cloud-based data management system **102**, the user device **104**, the smartphone **112**, the personal computer **114**, the application server **116**, and/or the external database **118** may include a communication device.

**[0034]** The communication device may include, for example, a networking chip, one or more antennas, and/or one or more communication ports. The communication device may generate radio frequency (RF) signals and transmit the RF signals via one or more of the antennas. The communication device may receive and/or translate the RF signals. The communication device may transceive the RF signals. The RF signals may be broadcast and/or received by the antennas.

**[0035]** The communication device may generate electronic signals and transmit the RF signals via one or more of the communication ports. The communication device may receive the RF signals from one or more of the communication ports. The electronic signals may be transmitted to and/or from a communication hardline by the communication ports. The communication device may generate optical signals and transmit the optical signals to one or more of the communication ports. The communication device may receive the optical signals and/or may generate one or more digital signals based on the optical signals. The optical signals may be transmitted to and/or received from a communication hardline by the communication port, and/or the optical signals may be transmitted and/or received across open space by the networking device.

**[0036]** The communication device may include hardware and/or software for generating and communicating signals over a direct and/or indirect network communication link. For example, the communication component may include a USB port and a USB wire, and/or an RF antenna with Bluetooth™ programming installed on a processor, such as the processing component, coupled to the antenna. In another example, the communication component may include an RF antenna and programming installed on a processor, such as the processing device, for communicating over a Wifi and/or cellular network. As used herein, "communication device" "communication component," and/or "communication unit" may be used generically herein to refer to any or all of the aforementioned elements and/or features of the communication component.

**[0037]** Various of the elements in the management system **100** may be referred to as a "server." Such elements may include a server device. The server device may include a physical server and/or a virtual server. For example, the server device may include one or more bare-metal servers. The bare-metal servers may be single-tenant servers or multiple tenant servers. In another example, the server device may include a bare metal server partitioned into two or more virtual servers. The virtual servers may include separate operating systems and/or applications from each other. In yet another example, the server device may include a virtual server distributed on a cluster of networked physical servers. The virtual servers may include an operating system and/or one or more applications installed on the virtual server and distributed across the cluster of networked physical servers. In yet another example, the server device may include more than one virtual server distributed across a cluster of networked physical servers.

**[0038]** The term server may refer to functionality of a device and/or an application operating on a device. For example, an application server may be programming instantiated in an operating system installed on a memory device and run by a processing device. The application server may include instructions for receiving, retrieving, storing, outputting, and/or processing data. A processing server may be programming instantiated in an operating system that receives data, applies rules to data, makes inferences about the data, and so forth. Servers referred to separately herein, such as an application server, a processing server, a collaboration server, a scheduling server, and so forth may be instantiated in the same operating system and/or on the same server device. Separate servers may be instantiated in the same application or in different applications.

**[0039]** Various aspects of the systems described herein may be referred to as "data." Data may be used to refer generically to modes of storing and/or conveying information. Accordingly, data may refer to textual entries in a table of a database. Data may refer to alphanumeric characters stored in a database. Data may refer to machine-readable code. Data may refer to images. Data may refer to audio. Data may refer to, more broadly, a sequence of one or more symbols. The symbols may be binary. Data may refer to a machine state that is computer-readable. Data may refer to human-readable text.

**[0040]** Various of the devices in the management system **100**, including the server device **200***a* and/or the client device **200***b*, may include a user interface for outputting information in a format perceptible by a user and receiving input from the user, e.g., the user interface **214**. The user interface may include a display screen such as a light-emitting diode (LED) display, an organic LED (OLED) display, an active-matrix OLED (AMOLED) display, a liquid crystal display (LCD), a thin-film transistor (TFT) LCD, a plasma display, a quantum dot (QLED) display, and so forth. The user interface may include an acoustic element such as a speaker, a microphone, and so forth. The user interface may include a button, a switch, a keyboard, a touch-sensitive surface, a touchscreen, a camera, a fingerprint scanner, and so forth. The touchscreen may include a resistive touchscreen, a capacitive touchscreen, and so forth.

**[0041]** FIG. **3** illustrates an example of the remote gateway **150**, according to an embodiment. The remote gateway **150** interfaces with the existing circuitry and sensor of the ice machine **152**. The remote gateway **150** allows remote control of the ice machine **152** without altering the configuration of the ice machine **152**.

**[0042]** As illustrated, the remote gateway **150** includes a housing **300** for housing a control circuit **310**, e.g., a main microprocessor/microcontroller, circuits, control box power, and communications chips, for controlling the operation of the ice machine **152** and communicating with the management system **100** and/or the user device **104**. The various ice machine sensors are electrically connected to one or more communication ports **304** thereby collecting data from the various sensors. For example, the remote gateway **150** may include a microcontroller connected via one or more communication devices, e.g., WiFi, cellular communication device, Near Field Communication, etc. The remote gateway **150** may also include an antenna **302** for transmitting signals and receiving signals for the one or more communication devices. A further description of other features of the remote gateway **150**, e.g., ice machine monitoring system, may be found in related U.S. application Ser. No. 18/777,061.

**[0043]** The remote gateway **150** may be connected to an array of sensors monitoring the ice machine **152** and the control circuit for controlling ice production in the ice machine **152**. The sensors may include a full bin sensor that determines when an ice bin, e.g., a container holding the produced ice, is full. The sensors may also monitor and capture data that helps customers, technicians, and manufacturers monitor issues and ice maker malfunctions such as incorrect: ambient air temp, incoming water temp, incoming water flow, compressor surface temp, liquid line pressure, suction line pressure, a description of which may be found in related U.S. application Ser. No. 18/777,061. The various sensors can be utilized to continuously or intermittently capture data as needed to determine malfunctions. The housing **300** may include the one or more communication ports **304** for coupling to the sensors monitoring the ice machine **152** and the circuitry for controlling ice production in the ice machine **152**.

**[0044]** In embodiments, the remote gateway **150** may be an ice production control circuit for managing ice production via the full bin sensor of the ice machine **152**. The ice production control circuit is coupled between the full bin sensor and the control circuit of the ice machine **152**. The remote gateway **150** may override the full bin sensor and send a control signal to trigger the full bin sensor. For example, the full bin sensor can be coupled to an input port of the ports **304** and the control circuity of the ice machine **152** can be coupled to an output port of the ports **304**. This allows the remote gateway **150** to fully control when ice production is on or off and/or to instruct the ice machine to follow a schedule that may be downloaded to the remote gateway **150**. In some embodiments, the remote gateway **150** may send voltage to cause the ice machine **152** to move into the full bin state. In some embodiments, the remote gateway **150** may interrupt the full bin sensor, causing the full bin sensor to appear disconnected, and, in response, the ice machine **152** ceases ice production.

[0045] The housing **300** of the remote gateway **150** may also include a user interface **306**, coupled to the control circuit **310**, for viewing the status of the remote gateway **150** and controlling operations locally. For example, the user interface **306** may be an input and output device as described above.

[0046] The remote gateway **150** may also include computer-readable storage media **312**, coupled to the control circuit **310** for storing instructions for controlling the operation of the ice machine **152**. For example, the instructions can include an ice production schedule. The ice production schedule may specify dates, times, and durations for which ice production should be halted. The ice production schedule may be preset in the remote gateway **150**. Likewise, the ice production schedule may be set by the user remotely and transmitted to the remote gateway **150** and/or may be set locally by the user. The ice production schedule may also be stored in other computer systems of the management system **100**.

[0047] FIG. **4** illustrates an example of an ice production control circuit **400** of the remote gateway **150**, according to an embodiment. The ice production control circuit **400** interfaces with the existing circuitry and full bin sensor of the ice machine **152**. The remote gateway **150** allows remote control of the ice machine **152** without altering the configuration of the ice machine **152**.

[0048] The ice production control circuit **400** includes a relay circuit **402**, an input port **404**, and a port **406**. The input port **404** is coupled to a full bin sensor **410** of the ice machine **152**. The output port **406** is coupled to an ice production circuit **420** of the ice machine **152**. For the full bin sensor **410**, a reed switch is triggered by a magnet, and a voltage (logic high) is sent indicating that the bin is full. In response, the ice production circuit **420** controls the ice machine **152** to shut down and discontinue producing ice. Once the magnet sensor is restored into position, the voltage stops (logic low), and the ice machine **152** returns to normal operation to produce ice. The ice production control circuit **400** may be coupled between the full bin sensor **410** and the ice production circuit **420** of the ice machine **152** for ice production.

[0049] For operation, the full bin sensor via the port **404** is coupled to pin **1** of the relay circuit **402**. A control circuit **310** of the remote gateway **150** is coupled to pin **2** of the relay circuit **402**. Pin **3** of the relay circuit **402** is coupled to the ice production circuit **420** of the ice machine **152**, via the port **406**. The output of pin **3** is high if pin **1** or pin **2** (or both) are logic high. As such, if the ice bin is full, the magnet is absent, Pin **1** is logic high and the output is logic high, indicating ice production halt. If a remote command is received to stop ice production, pin **2** is driven logic high, and pin **3** is logic high, indicating ice production halt. In some embodiments, instead of sending voltage to the ice machine to turn ice production off, the remote gateway **150** may disconnect the ground wire on the full bin sensor with the relay circuit **402**.

[0050] In some embodiments, the ice production control circuit **400** may be contained within the housing **300** of the remote gateway **150**. In some embodiments, the ice production control circuit **400** may be a standalone circuit that is coupled to the remote gateway **150**.

[0051] While the ice production control circuit **400** is described above as having a relay circuit, in some embodiments, the ice production control circuit **400** may include other types of control circuitry such as logic gates, e.g., AND gate, OR gate, etc.

[0052] FIG. **5** illustrates an example of operational states for controlling ice production in the ice machine **152** via the remote gateway **150**, according to an embodiment. The remote gateway **150** controls ice production via the full bin sensor of the ice machine **152**. The remote gateway **150** allows remote control of the ice machine **152** without altering the configuration of the ice machine **152**.

[0053] As illustrated in panel **502** of FIG. **5**, the full bin sensor **420** includes a reed switch **532** and a magnet **534** that triggers the reed switch **534** to activate. The reed switch **532** is coupled to the ice production circuit **420** of the ice machine **150** by a sensor signal line **536** and an operational status line **538**. If the storage container of the ice machine **152** is not full, the magnet remains and the reed switch **532** does not send a full bin signal on signal line **536**, e.g., zero volts (logic low). The ice machine **152** continues to produce ice, and a bin full indicator **550** of the ice machine **152** does not activate.

[0054] As illustrated in panel **504**, if the storage container is full (or the door is open), the magnet **534** moves away from the reed switch **532**. In response, the reed switch **532** produces a full bin signal on the signal line **536**, e.g., a voltage (logic high), indicating that the bin is full. In response, the ice production circuit **420** controls the ice machine **152** to shut down and discontinue producing ice. The bin full indicator **550** may illuminate, indicating that the storage container is full. Once the magnet **534** is restored to position, the voltage stops (logic low), and the ice machine **152** returns to normal operation to produce ice.

[0055] As illustrated in panel **506**, ice production may also be halted if the full bin sensor **410** is disconnected from the ice production circuit **420**. The full bin sensor **410** may send a status signal on the operational status line **538**. If the operational status line **538** is interrupted and the ice production circuit **420** does not receive the status signal, the ice production circuit **420** can halt the production of ice. For example, the remote gateway **150** may disconnect the ground wire on the full bin sensor with the relay circuit **402**.

[0056] As illustrated in panels **508** and **510**, in some embodiments, the ice production control circuit **400** may send a voltage to cause the ice machine **152** to move into the full bin state. The ice production control circuit **400** may send a full bin signal in response to commands to halt ice production and/or may pass the full bin signal from the full bin sensor **410** to the ice production circuit.

[0057] In some embodiments, the remote gateway **150** may interrupt the full bin sensor **410**, causing the full bin sensor to appear disconnected, as illustrated in panel **506**, and, in response, the ice machine **152** ceases ice production. For example, the ice production control circuit **400** may generate an operational status signal that is stopped, and, in response, the ice machine **152** ceases ice production. Likewise, for example, the remote gateway **150** may disconnect the ground wire on the full bin sensor with the relay circuit **402**.

[0058] FIG. **6** illustrates an example of a graphical user interface **600** for controlling ice production in the ice machine **152** via the remote gateway **150**, according to an embodiment. The graphical user interface **600** allows a user to control the ice machine **152** without a user being physically present at the ice machine.

[0059] As illustrated, the GUI **600** can display the operating conditions of the ice machine **152** and allow the user to input control instructions. The GUI **600** can be displayed on a user device, e.g., user device **104**. The GUI **600** can interface with the remote gateway **150** directly or through the management system **100**.

[0060] For example, the GUI **602** may include an activation widget **602** that allows a user to activate remote control of the ice machine **152**. The activation widget **602** may also display information details of the ice machine **152** and the sensors of the ice machine **152**. The GUI **602** may also include environmental control widgets, e.g., a temperature control widget **604**, a water temperature control widget **606**, a compressor temperature control widget **608**, a liquid pressure control widget **610**, a suction pressure control widget **612**, and a water flow control widget **612**. The environmental control widgets allow the user to activate, monitor, and set parameters of the components of the ice machine **152**.

[0061] In embodiments, the GUI **600** may include a halt ice production widget **620**. The halt ice production widget **620** allows a user to halt ice production. By selecting the halt ice production widget **620**, command instructions are sent to the remote gateway **150** to halt ice production.

[0062] FIG. **7** illustrates a flow chart depicting a method **700** of controlling ice production, according to an embodiment. The method **700** may be embodied as, for example, but not limited to, computer instructions, which when executed, perform the method **700**. The method **700** may be implemented using one or more devices such as the remote gateway **150** and/or the management system **100**. For illustrative purposes alone, the remote gateway **150** is described as one potential actor in the following stages. The method **700**, via the remote gateway **150**, allows control of the ice machine **152** without a user being physically present at the ice machine.

[0063] In step **702**, command instructions for halting ice production are received. In embodiments, the command instructions can be generated by the remote gateway **150** and/or the devices of the management system **150**. In some embodiments, the command instructions may be a one time instruction to halt ice production. In some embodiments, the command instruction may be a ice production schedule.

[0064] In step **704**, a command signal is transmitted to an ice production control circuit. In step **706**, in response, the ice production control circuit can transmit a ice production halt signal. The ice production control circuit is coupled between the full bin sensor and the control circuit of the ice machine **152**. The remote gateway **150** may override the full bin sensor and send a control signal to trigger the full bin sensor. For example, the full bin sensor can be coupled to an input port of the ports **304** and the control circuity of the ice machine **152** can be coupled to an output port of the ports **304**. This allows the remote gateway **150** to fully control when ice production is on or off and/or to instruct the ice machine to follow a schedule that may be downloaded to the remote gateway **150**. In some embodiments, the remote gateway **150** may send voltage to cause the ice machine **152** to move into the full bin state. In some embodiments, the remote gateway **150** may interrupt the full bin sensor, causing the full bin sensor to appear disconnected, and, in response, the ice machine **152** ceases ice production.

[0065] While the above processes and devices have been described concerning an ice machine, the remote gateway **150** may be used with any type of machine or device that produces frozen products and includes sensors that monitor the production of the frozen products. For example, the remote gateway **150** may be used with an ice cream maker that produces ice cream. In this example, the remote gateway **150** may be coupled to the sensors of the ice cream maker, e.g., a bin full sensor, and halt the production of the ice cream as described above. In another example, the remote gateway **150** may be coupled to an air conditioning unit. In this example, the remote gateway may be coupled to the sensors of the air conditioning unit, e.g., operational monitoring sensors, and halt the operation of the air conditioning unit as described above.

[0066] A feature illustrated in one of the figures may be the same as or similar to a feature illustrated in another of the figures. Similarly, a feature described in connection with one of the figures may be the same as or similar to a feature described in connection with another of the figures. The same or similar features may be noted by the same or similar reference characters unless expressly described otherwise. Additionally, the description of a particular figure may refer to a feature not shown in the particular figure. The feature may be illustrated in and/or further described in connection with another figure.

[0067] Elements of processes (i.e. methods) described herein may be executed in one or more ways such as by a human, by a processing device, by mechanisms operating automatically or under human control, and so forth. Additionally, although various elements of a process may be depicted in the figures in a particular order, the elements of the process may be performed in one or more different orders without departing from the substance and spirit of the disclosure herein.

[0068] The foregoing description sets forth numerous specific details such as examples of specific systems, components, methods and so forth, in order to provide a good understanding of several implementations. It will be apparent to one skilled in the art, however, that at least some implementations may be practiced without these specific details. In other instances, well-known components or methods are not described in detail or are presented in simple block diagram format in order to avoid unnecessarily obscuring the present implementations. Thus, the specific details set forth above are merely exemplary. Particular implementations may vary from these exemplary details and still be contemplated to be within the scope of the present implementations.

[0069] Related elements in the examples and/or embodiments described herein may be identical, similar, or dissimilar in different examples. For the sake of brevity and clarity, related elements may not be redundantly explained. Instead, the use of a same, similar, and/or related element names and/or reference characters may cue the reader that an element with a given name and/or associated reference character may be similar to another related element with the same, similar, and/or related element name and/or reference character in an example explained elsewhere herein. Elements specific to a given example may be described regarding that particular example. A person having ordinary skill in the art will understand that a given element need not be the same and/or similar to the specific portrayal of a related element in any given figure or example in order to share features of the related element.

[0070] It is to be understood that the foregoing description is intended to be illustrative and not restrictive. Many other implementations will be apparent to those of skill in the art upon reading and understanding the above description. The scope of the present implementations should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

[0071] The foregoing disclosure encompasses multiple distinct examples with independent utility. While these examples have been disclosed in a particular form, the specific examples disclosed and illustrated above are not to be considered in a limiting sense as numerous variations are possible. The subject matter disclosed herein includes novel and non-obvious combinations and sub-combinations of the various elements, features, functions and/or properties disclosed above both explicitly and inherently. Where the disclosure or subsequently filed claims recite "a" element, "a first" element, or any such equivalent term, the disclosure or claims is to be understood to incorporate one or more such elements, neither requiring nor excluding two or more of such elements.

[0072] As used herein "same" means sharing all features and "similar" means sharing a substantial number of features or sharing materially important features even if a substantial number of features are not shared. As used herein "may" should be interpreted in a permissive sense and should not be interpreted in an indefinite sense. Additionally, use of "is" regarding examples, elements, and/or features should be interpreted to be definite only regarding a specific example and should not be interpreted as definite regarding every example. Furthermore, references to "the disclosure" and/or "this disclosure" refer to the entirety of the writings of this document and the entirety of the accompanying illustrations, which extends to all the writings of each subsection of this document, including the Title, Background, Brief description of the Drawings, Detailed Description, Claims, Abstract, and any other document and/or resource incorporated herein by reference.

[0073] As used herein regarding a list, "and" forms a group inclusive of all the listed elements. For example, an example described as including A, B, C, and D is an example that includes A, includes B, includes C, and also includes D. As used herein regarding a list, "or" forms a list of elements, any of which may be included. For example, an example described as including A, B, C, or D is an example that includes any of the elements A, B, C, and D. Unless otherwise stated, an example including a list of alternatively-inclusive elements does not preclude other examples that include various combinations of some or all of the alternatively-inclusive elements. An example described using a list of alternatively-inclusive elements includes at least one element of the listed elements. However, an example described using a list of alternatively-inclusive elements does not preclude another example that includes all of the listed elements. And, an example described using a list of alternatively-inclusive elements does not preclude another example that includes a combination of some of the listed elements. As used herein regarding a list, "and/or" forms a list of elements inclusive alone or in any combination. For example, an example described as including A, B, C, and/or D is an example that may include: A alone; A and B; A, B and C; A, B, C, and D; and so forth. The bounds of an "and/or" list are defined by the complete set of combinations and permutations for the list.

[0074] Where multiples of a particular element are shown in a FIG., and where it is clear that the element is duplicated throughout the FIG., only one label may be provided for the element, despite multiple instances of the element being present in the FIG. Accordingly, other instances in the FIG. of the element having identical or similar structure and/or function may not have been redundantly labeled. A person having ordinary skill in the art will recognize based on the disclosure herein redundant and/or duplicated elements of the same FIG. Despite this, redundant labeling may be included where helpful in clarifying the structure of the depicted examples.

[0075] The Applicant(s) reserves the right to submit claims directed to combinations and sub-combinations of the disclosed examples that are believed to be novel and non-obvious. Examples embodied in other combinations and sub-combinations of features, functions, elements and/or properties may be claimed through amendment of those claims or presentation of new claims in the present application or in a related application. Such amended or new claims, whether they are directed to the same example or a different example and whether they are different, broader, narrower or equal in scope to the original claims, are to be considered within the subject matter of the examples described herein.

1. A device, comprising:

a communication device coupled to a communication network, wherein the communication device receives commands from a remote user over the communication network;

a control circuit electrically coupled to the communication device, wherein the control circuit is configured to execute the remote commands from the remote user to control ice production in an ice machine;

an ice production control circuit electrically coupled between a full bin sensor and an ice production circuit, wherein:

the full bin sensor monitors ice levels in a storage container of the ice machine and sends an electrical signal to the ice production circuit when the storage container is full,

the ice production circuit the production of ice in response to the electrical signal from the full bin sensor, and

the control circuit instructs the ice machine control circuit to inject a production signal to halt ice production in response to the remote commands from the remote user.

2. The device of claim 1, wherein:

the ice production control circuit is configured to generate a first control signal that is transmitted to the ice production circuit, the first control signal is configured to indicate that the storage container of the ice machine is full regardless of a state of the electrical signal from the full bin sensor, and the ice production circuit halts ice production in response to the first control signal.

3. The device of claim 2, wherein the ice production control circuit comprises:

a first input coupled to a signal output of the full bin sensor that transmits the electrical signal from the full bin sensor;

a second input coupled to an output of the control circuit for transmitting the first control signal; and a relay coupled to the first input and the second input and comprising a first output coupled to the ice production circuit, wherein the relay outputs the production signal on the first output.

4. The device of claim 3, wherein:

the relay causes a disconnection of a ground line from the full bin sensor in response to the first control signal, wherein the ground line being disconnected causes the ice production circuit to halt ice production.

5. The device of claim 1, wherein:

the ice production control circuit is configured to generate a status control signal that is transmitted to the ice production circuit,

the status control signal is configured to indicate that the full bin sensor is non-operational regardless of an operational state of the full bin sensor, and

the ice production circuit halts ice production in response to the status control signal.

6. The device of claim 5, wherein the ice production control circuit comprises:

a first input coupled to a status output of the full bin sensor that transmits a status signal from the full bin sensor;

a second input coupled to a status control output of the control circuit; and

a logic gate coupled to the first input and the second input and comprising a first output

coupled to the ice production circuit, wherein the logic gate compares the first input and the second input and outputs the status control signal on the first output.

7. The device of claim 1, further comprising:

a local user input device coupled to the control circuit and configured to receive local commands from a local user; wherein the control circuit instructs the ice machine control circuit to inject a control signal to halt ice production in response to the local commands from the local user.

8. The device of claim 1, further comprising:

a computer readable medium storing instructions coupled to the control circuit, wherein: the instructions generate local commands, and

the control circuit instructs the ice machine control circuit to inject a control signal to halt ice production in response to the local commands.

9. The device of claim 8, wherein:

the instructions comprise an ice production schedule that specifies one or more dates and times to generate the local commands; and

the ice production schedule is received from the remote user via the communication device.

10. A device, comprising:

a first input coupled to an output of a sensor of a machine;

a second input coupled to an output of a remote gateway, wherein the remote gateway transmits signals to the second input based on production instructions from a user; and

a relay coupled to the first input and the second input and comprising a first output coupled to a production circuit of the machine, wherein the relay compares the first input and the second input and outputs a production signal on the first output to control production of a product of the machine.

11. The device of claim 10, wherein:

the machine is an ice machine; and

the relay compares the first input and the second input and outputs an ice production signal on the first output to control ice production in the ice machine.

12. The device of claim 11, wherein:

the relay causes a disconnection of a ground line from the full bin sensor in response to the first control signal, wherein the ground line being disconnected causes the ice production circuit to halt ice production.

13. The device of claim 10, wherein:

the machine is an environmental control system; and

the relay compares the first input and the second input and outputs an environmental production signal on the first output to control environmental production by the environmental control system.

14. The device of claim 10, wherein:

the production instructions are received remotely by the remote gateway, or

the production instructions are received locally by the remote gateway.

15. The device of claim 10, wherein:

the production instructions comprise an ice production schedule that specifies one or more dates and times to generate the local commands, and

the production schedule is generated by a remote user.

16. A method, comprising:

receiving, at a remote gateway from a user, command instructions for halting production of ice at an ice machine;

transmitting a control signal to an ice production control circuit, wherein an ice production control circuit is coupled between a full bin sensor of the ice machine and an ice production circuit of the ice machine; and

transmitting a production signal from the ice production control circuit to the ice production circuit of the ice machine.

17. The method of claim 16, the method further comprising:

receiving an electrical signal from the full bin sensor indicating that a storage container of the ice machine is full;

transmitting a first control signal to the ice production control circuit;

transmitting, from the ice production control circuit, the production signal to the ice production circuit of the ice machine based on a comparison of the electrical signal and the first control signal.

18. The device of claim 16, the method further comprising:

receiving a status signal from the full bin sensor indicating that the full bin sensor is operational;

transmitting a status control signal to the ice production control circuit; and

transmitting, from the ice production control circuit, an operational signal to the ice production circuit of the ice machine based on a comparison of the status signal and the status control signal.

19. The device of claim 16, the method further comprising:

receiving the command instructions for halting production of ice from the user over the communications network; and

storing the command instructions in a computer-readable medium of the remote gateway.

**20**. The device of claim **16**, the method further comprising:

receiving an ice production schedule from a user over the communications network;

storing the ice production schedule in a computer-readable medium of the remote gateway; and

generating the control signal based on a determination that a current date and time match the ice production schedule.

* * * * *