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(54) **HOME PET SYSTEMS AND DEVICES**

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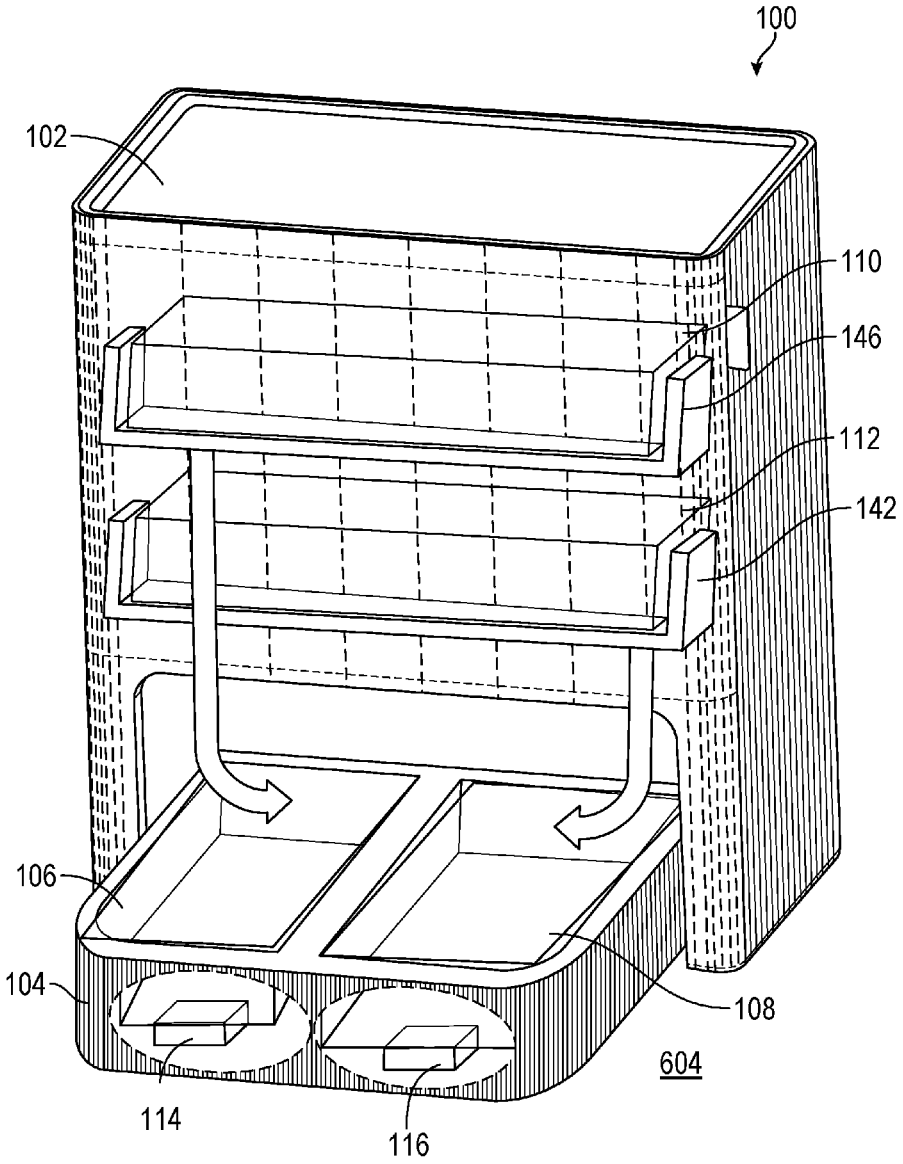
CPC ***A01K 5/0291*** (2013.01); ***A01K 1/0158*** (2013.01); ***A01K 1/035*** (2013.01)

(57) **ABSTRACT**

A pet feeding system can include a housing, a food tray connected to the housing, and a liquid tray connected to the housing. The pet feeding system can include a food dispenser connected to the housing and configured to dispense food into the food tray. The pet feeding system can include a liquid dispenser connected to the housing and configured to dispense liquid into the liquid tray. The pet feeding system can include a controller communicatively connected to the food dispenser and the liquid dispenser. The controller can operate the food dispenser to dispense the food into the food tray and can operate the liquid dispenser to dispense liquid into the liquid tray.



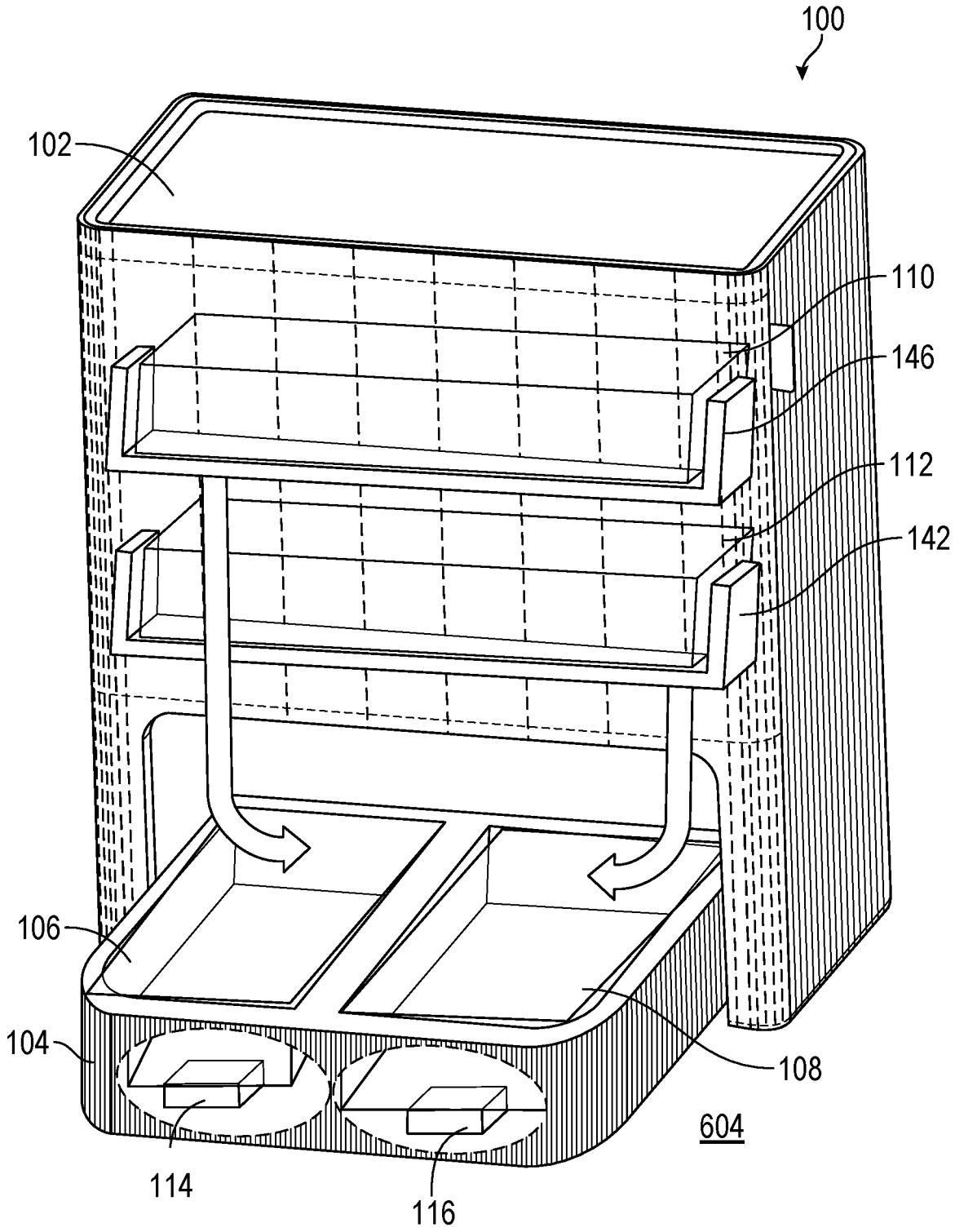


FIG. 1

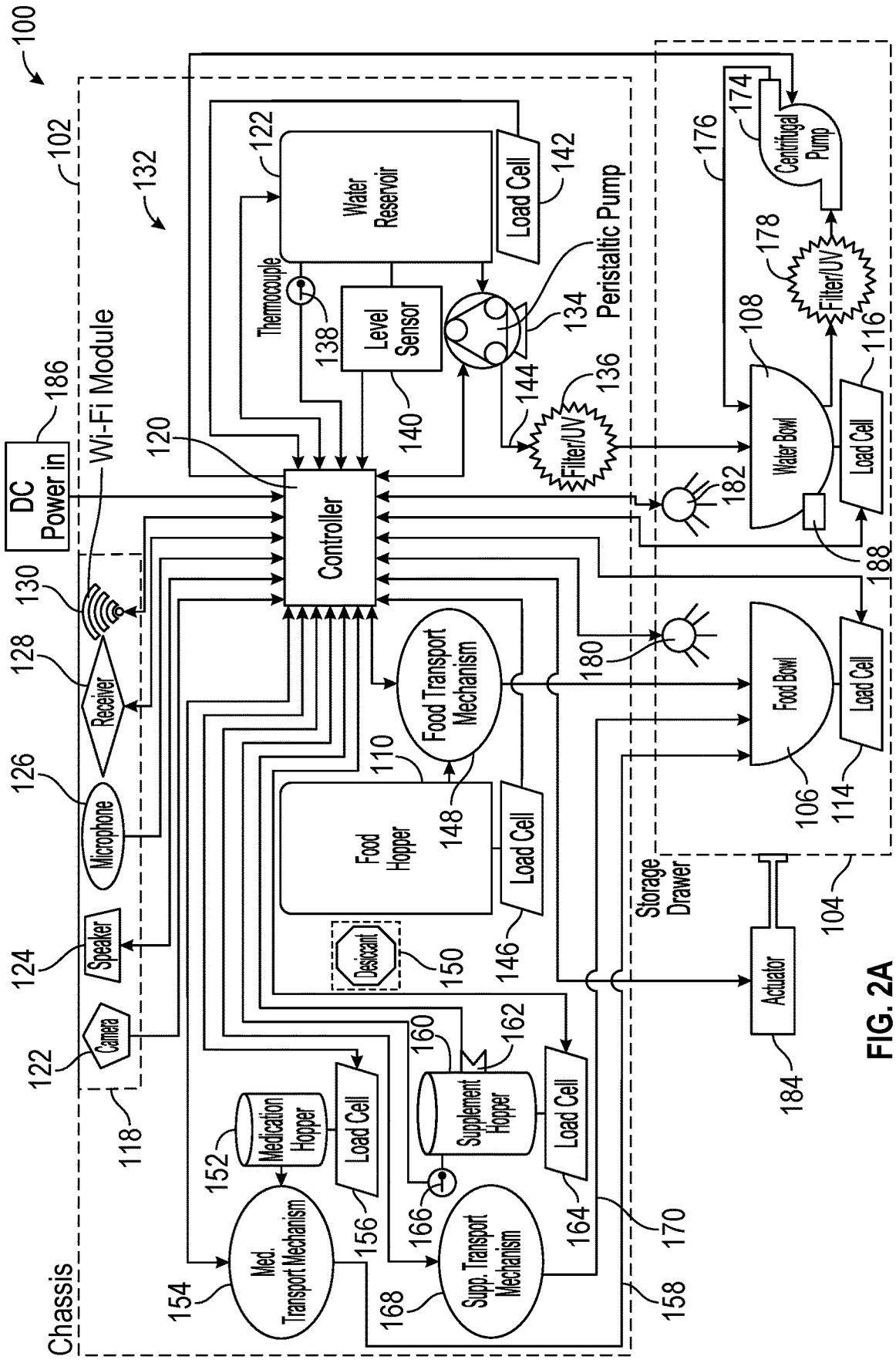

100
102
132
Chassis
DC Power in
186
Wi-Fi Module
120
Controller
122
Water Reservoir
142
Load Cell
Thermocouple
138
Level Sensor
140
134
Peristaltic Pump
144
136
Filter/UV
174
Centrifugal Pump
176
178
Filter/UV
108
Water Bowl
116
Load Cell
182
188
130
Receiver
128
126
Microphone
124
Speaker
122
Camera
118
Food Transport Mechanism
110
180
Food Bowl
106
Load Cell
114
Food Hopper
148
Load Cell
146
Desiccant
150
Storage Drawer
104
Actuator
184
152
Medication Hopper
Load Cell
156
160
162
Supplement Hopper
Load Cell
164
166
154
Med. Transport Mechanism
168
Supp. Transport Mechanism
170
158

FIG. 2A

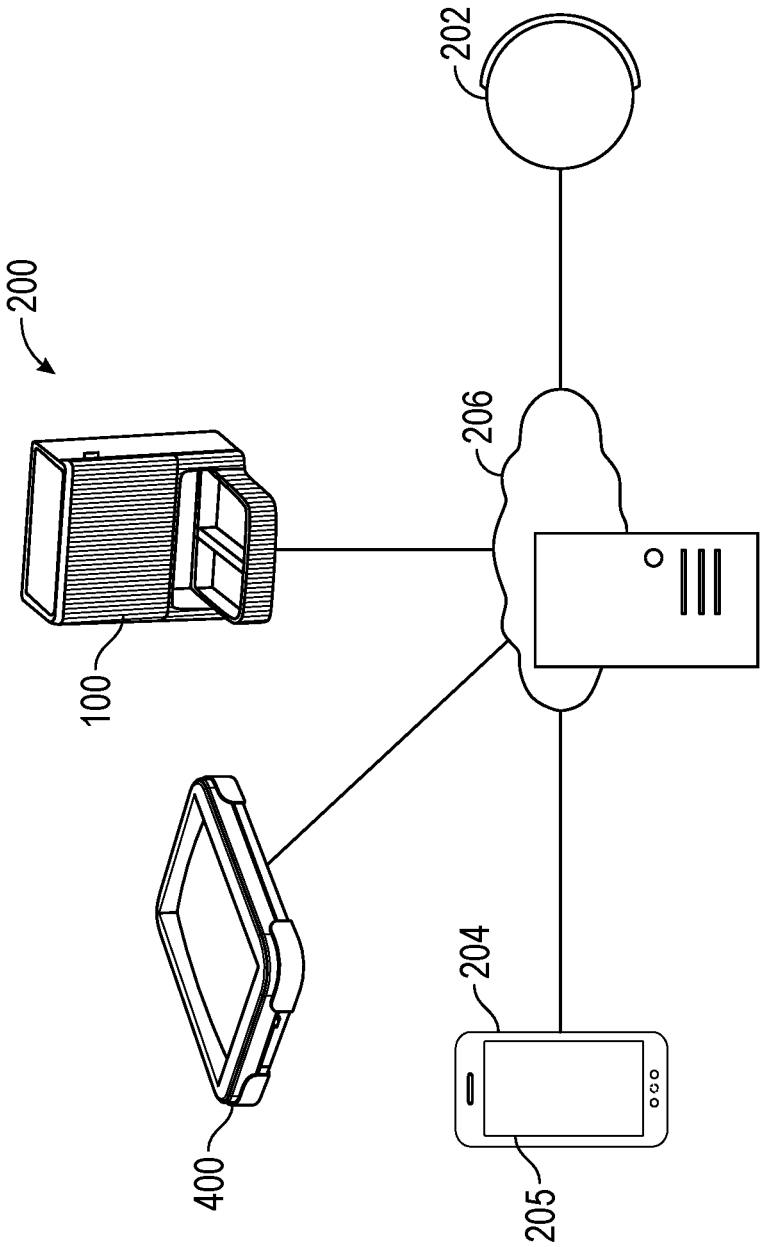


FIG. 2B

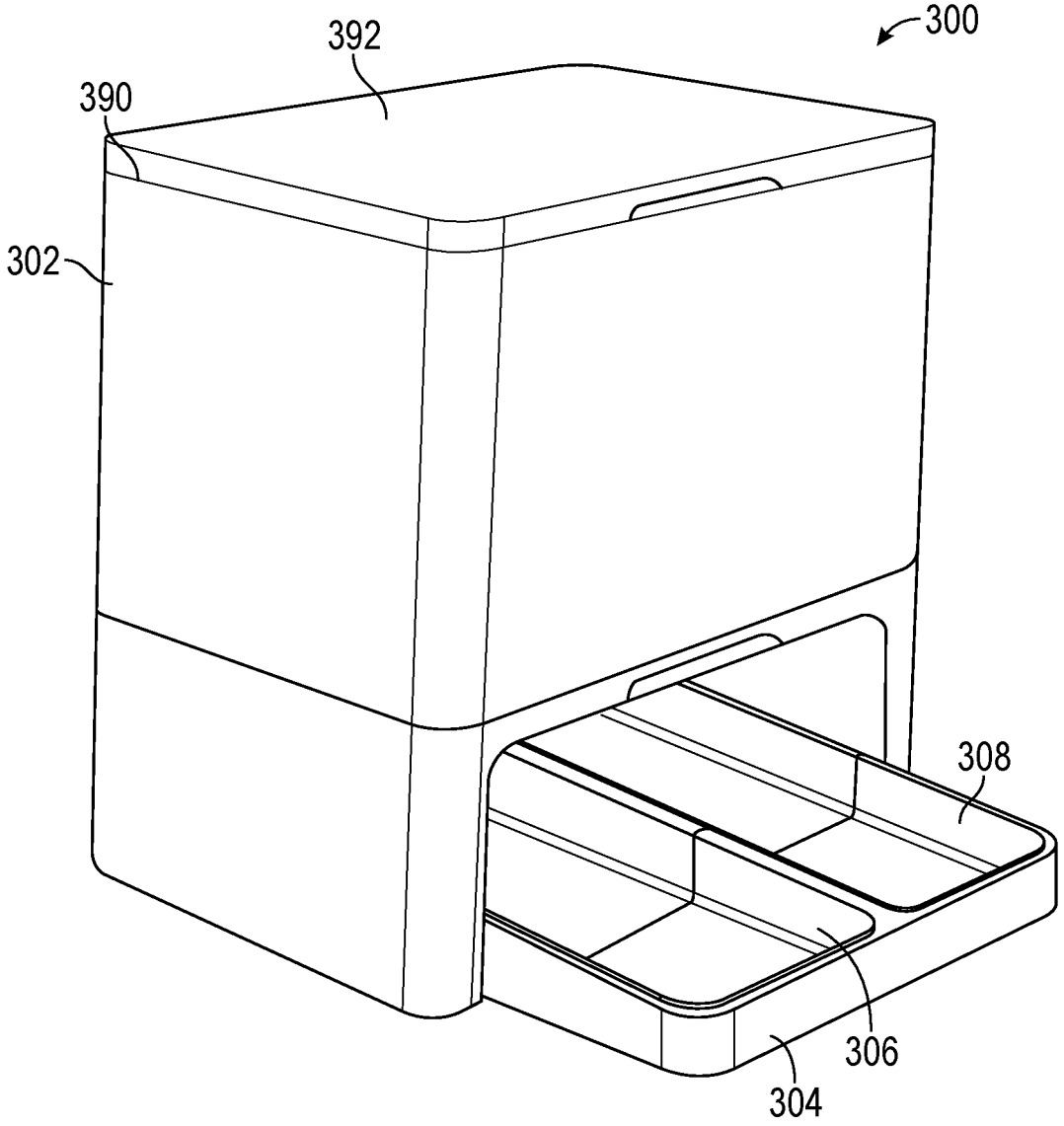


FIG. 3A

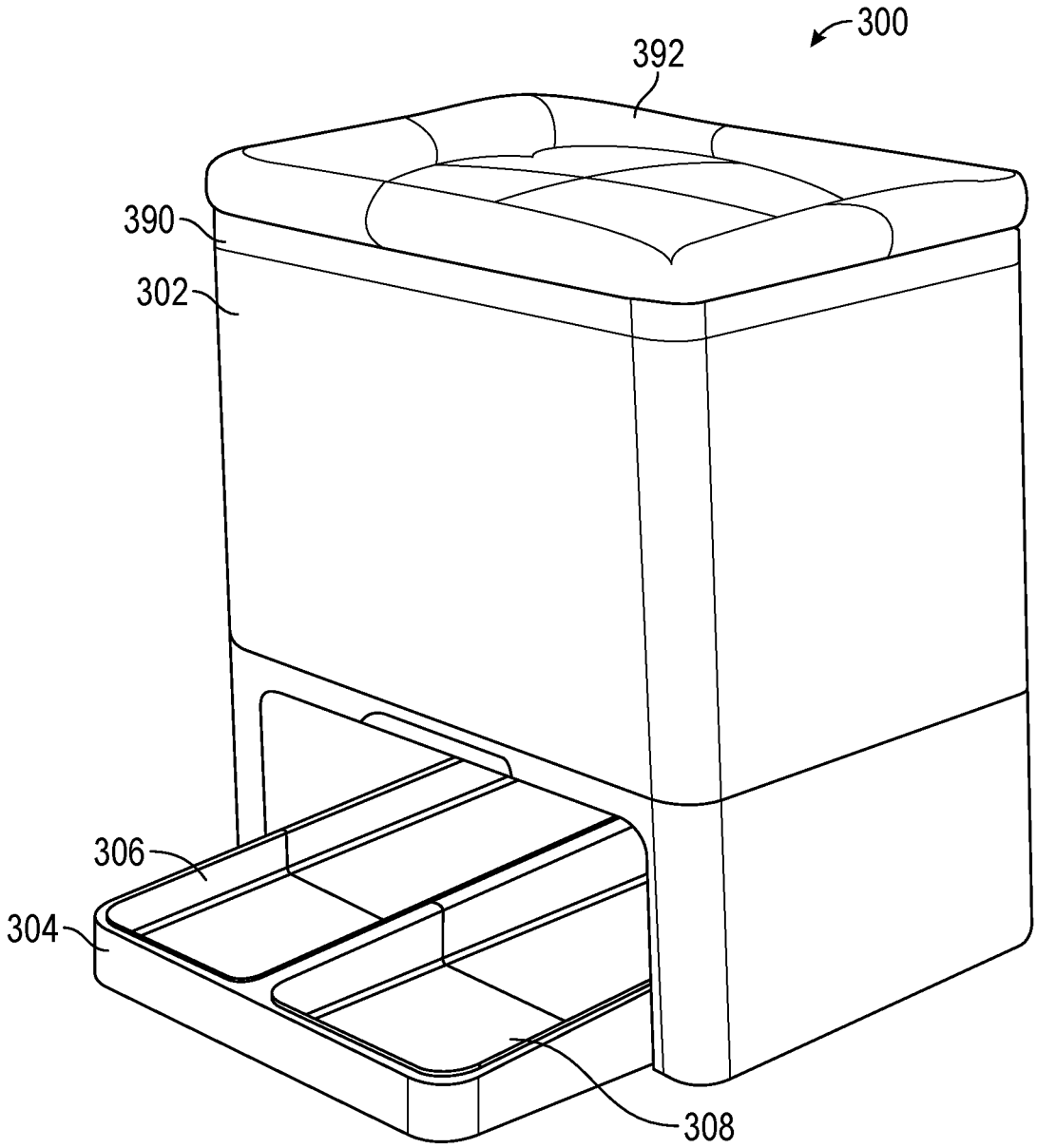


FIG. 3B

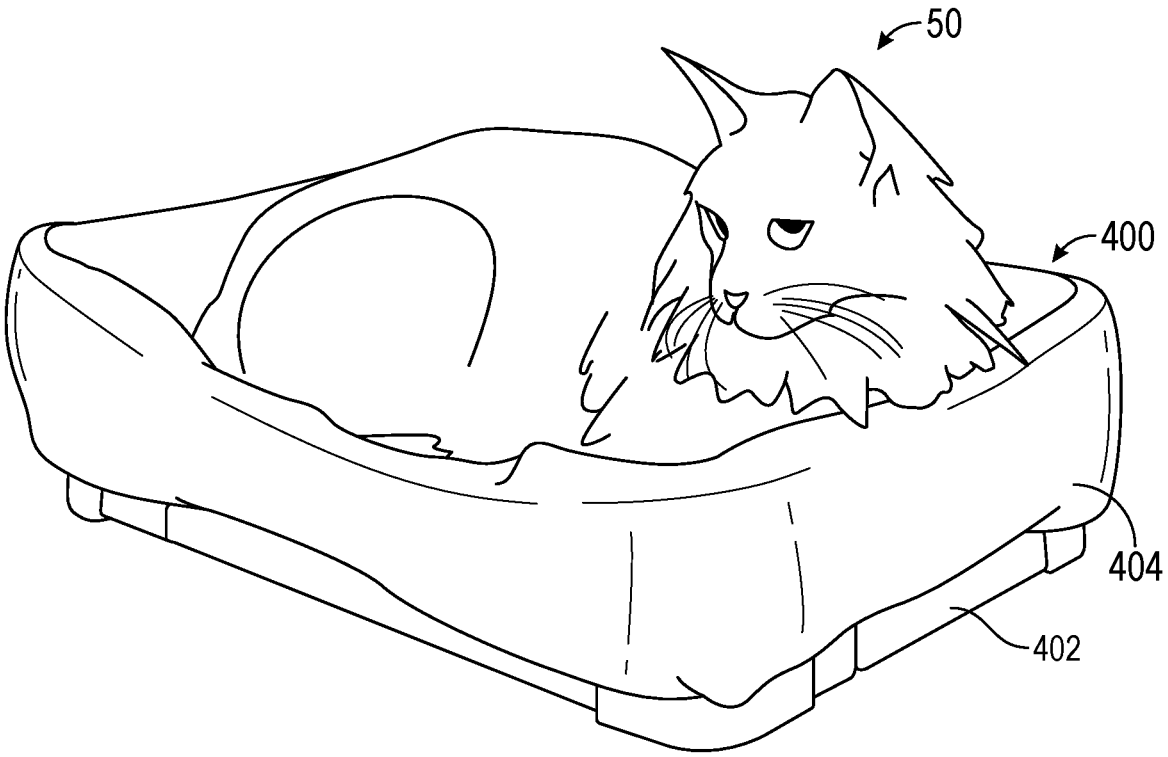


FIG. 4

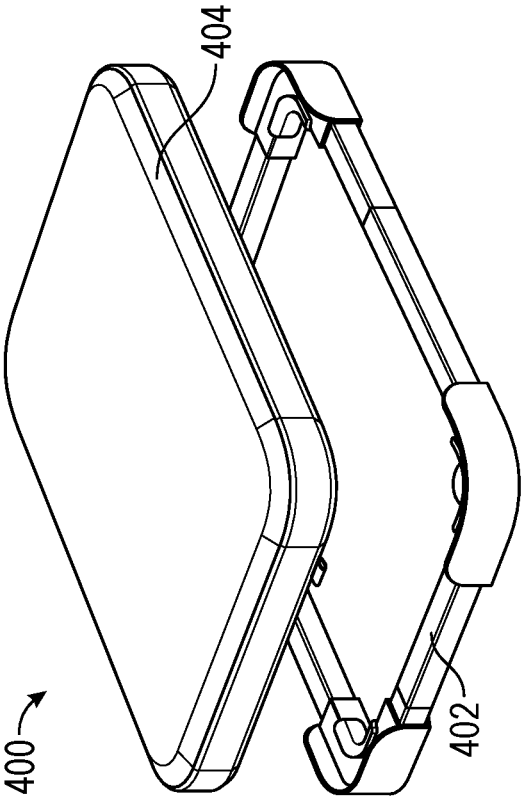


FIG. 5B

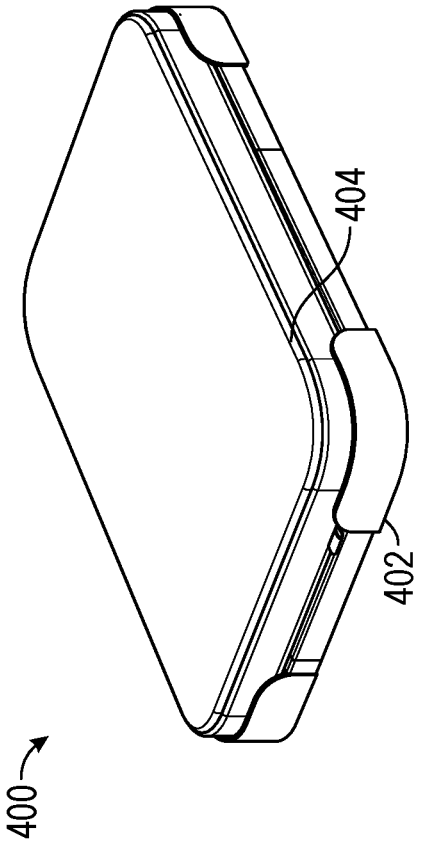


FIG. 5A

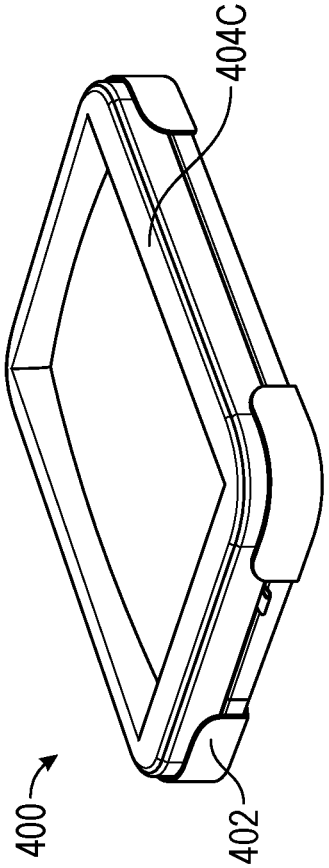


FIG. 5C

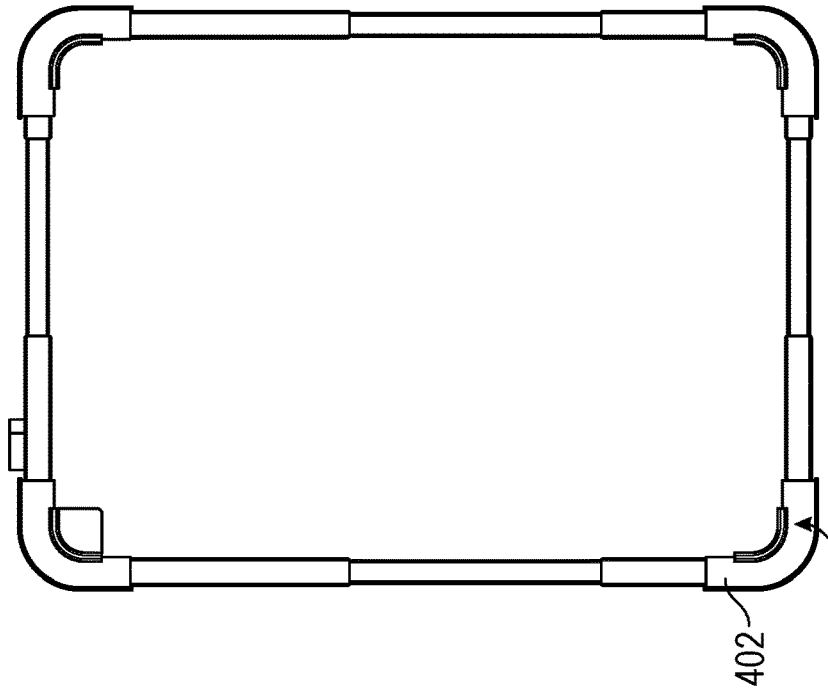


FIG. 6C

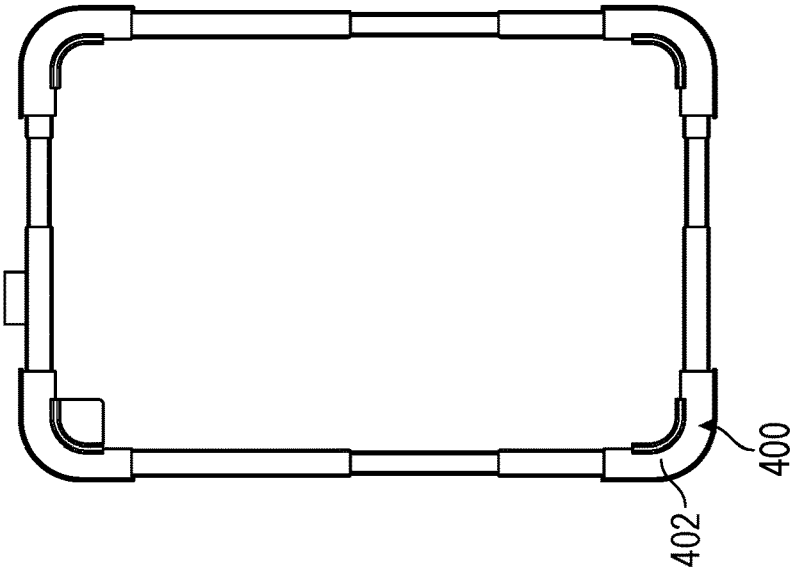


FIG. 6B

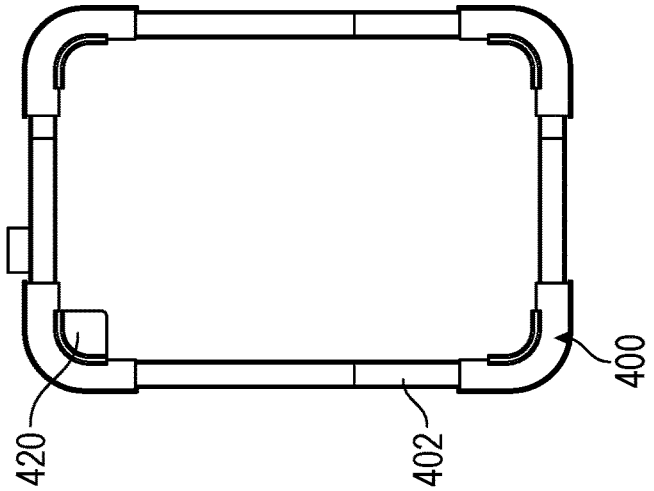


FIG. 6A

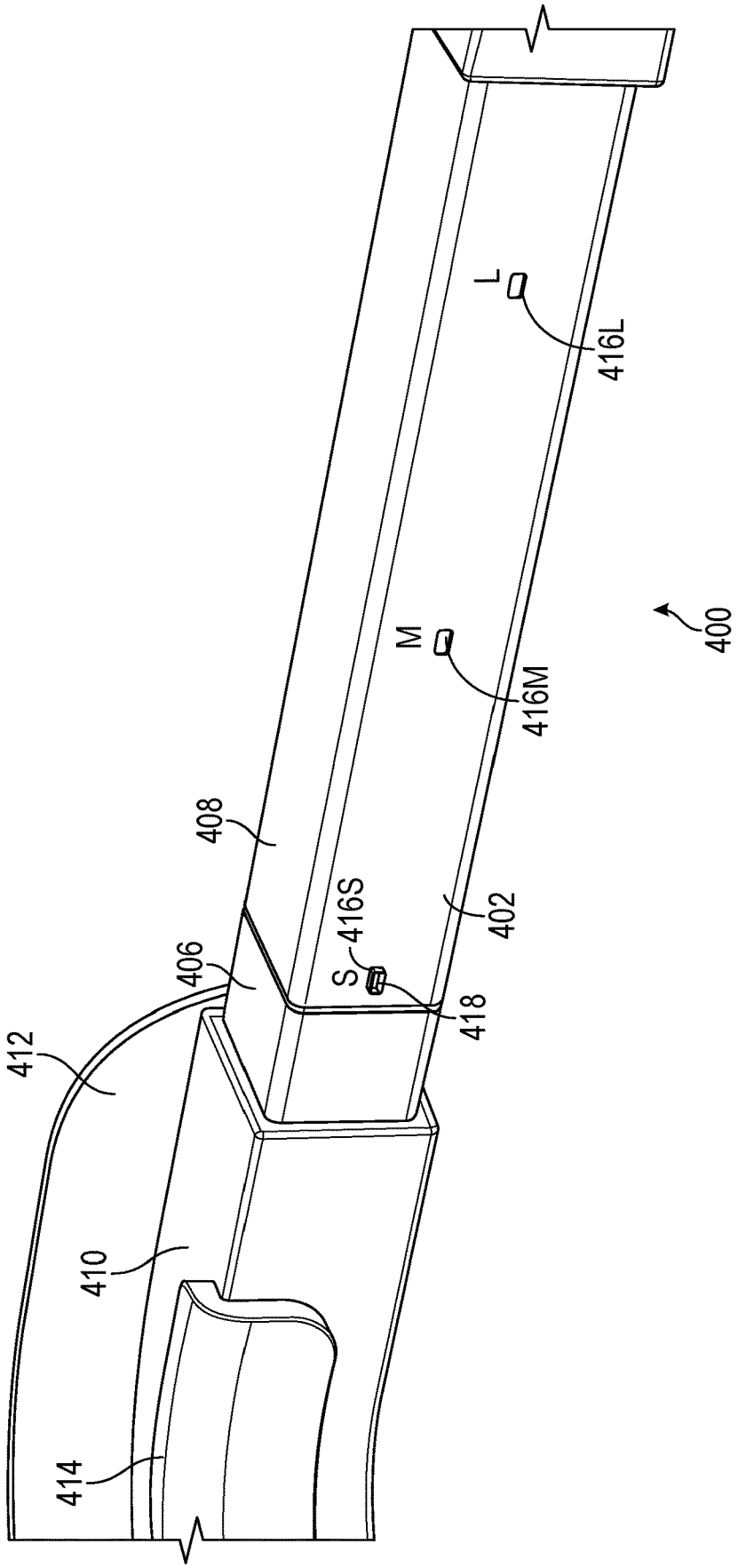


FIG. 7

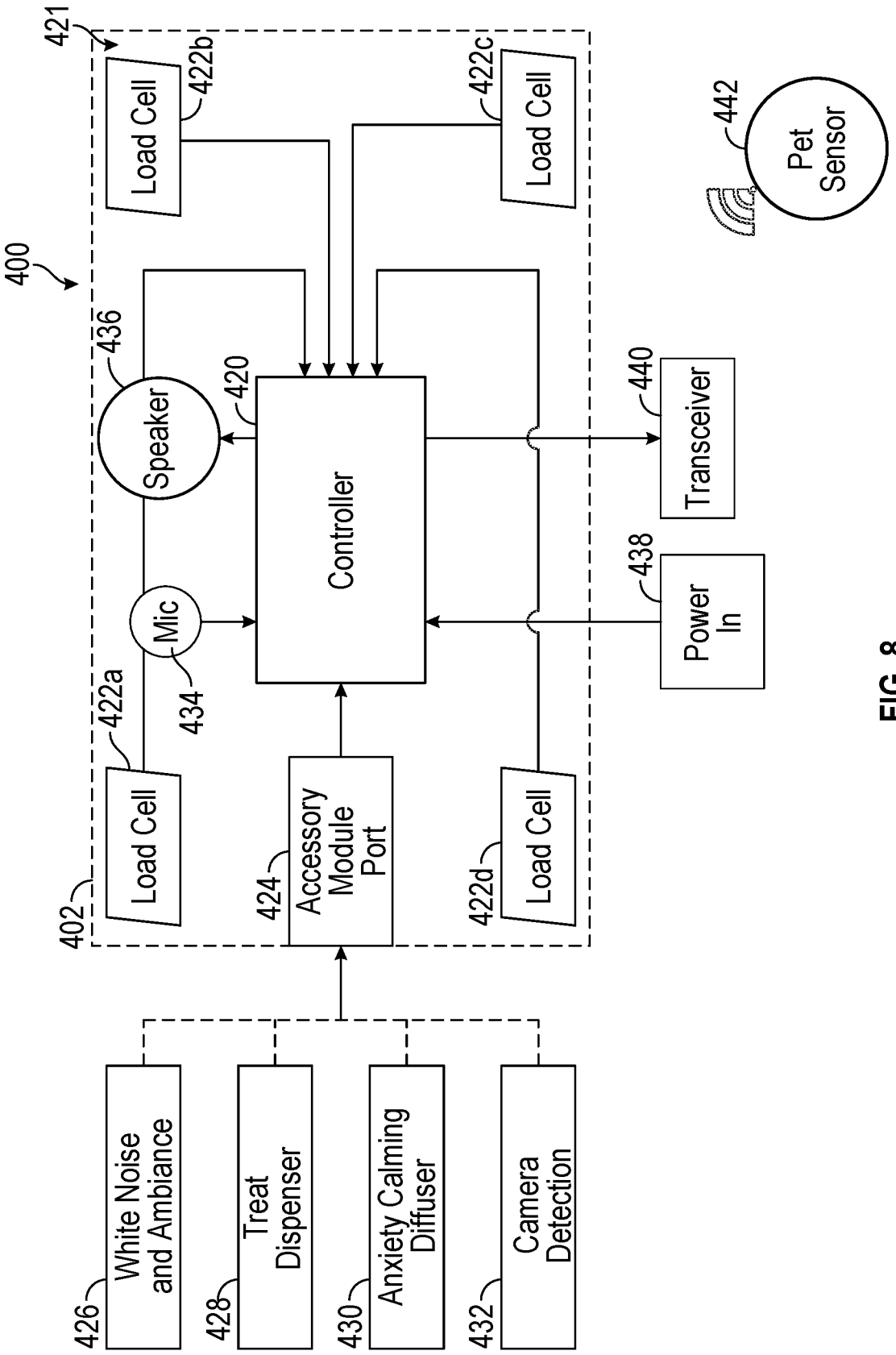

400
402
421
Load Cell
422a
422b
422c
422d
Speaker
436
Mic
434
Controller
420
Accessory Module Port
424
Transceiver
440
Power In
438
Pet Sensor
442
White Noise and Ambiance
426
Treat Dispenser
428
Anxiety Calming Diffuser
430
Camera Detection
432

FIG. 8

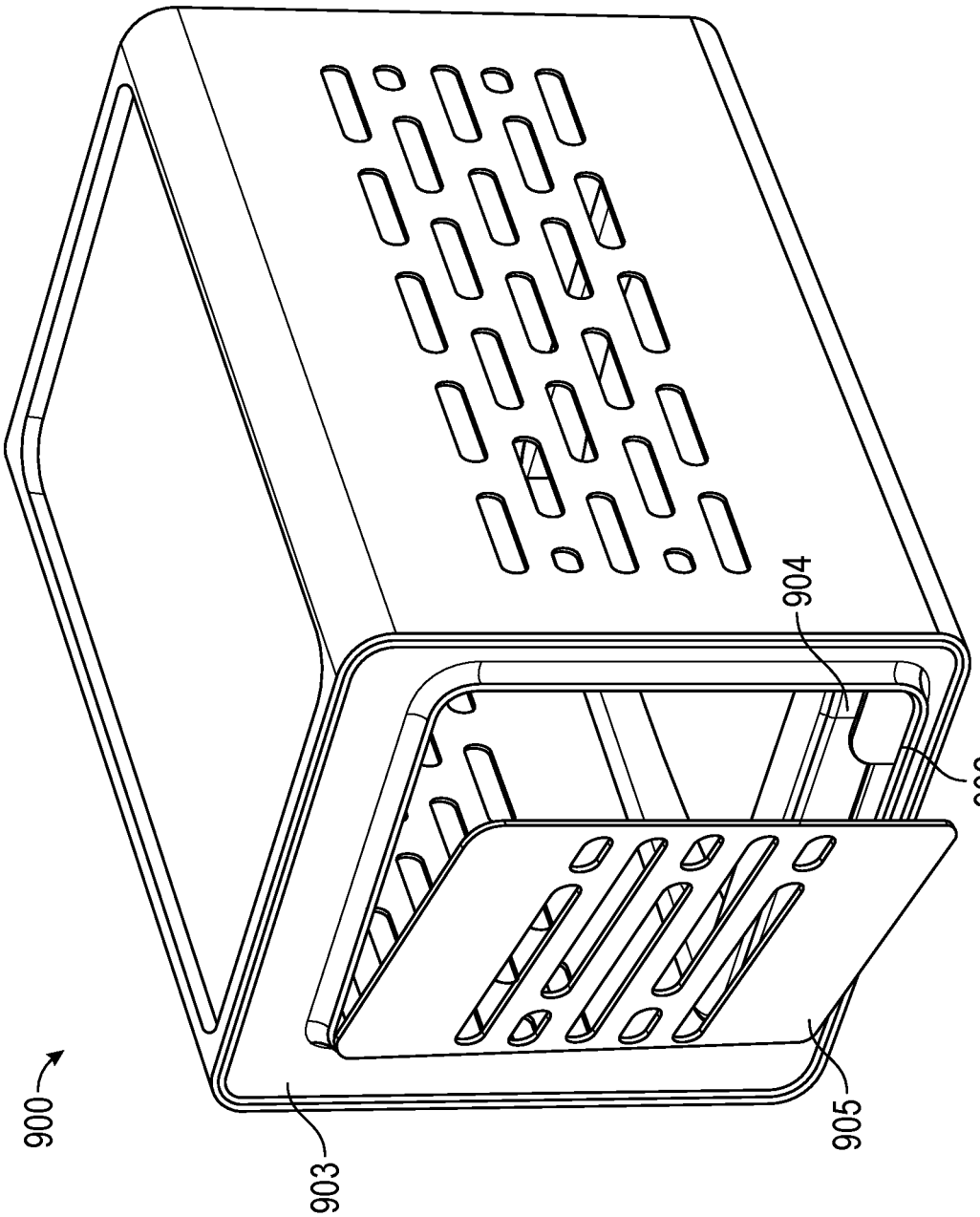


FIG. 9

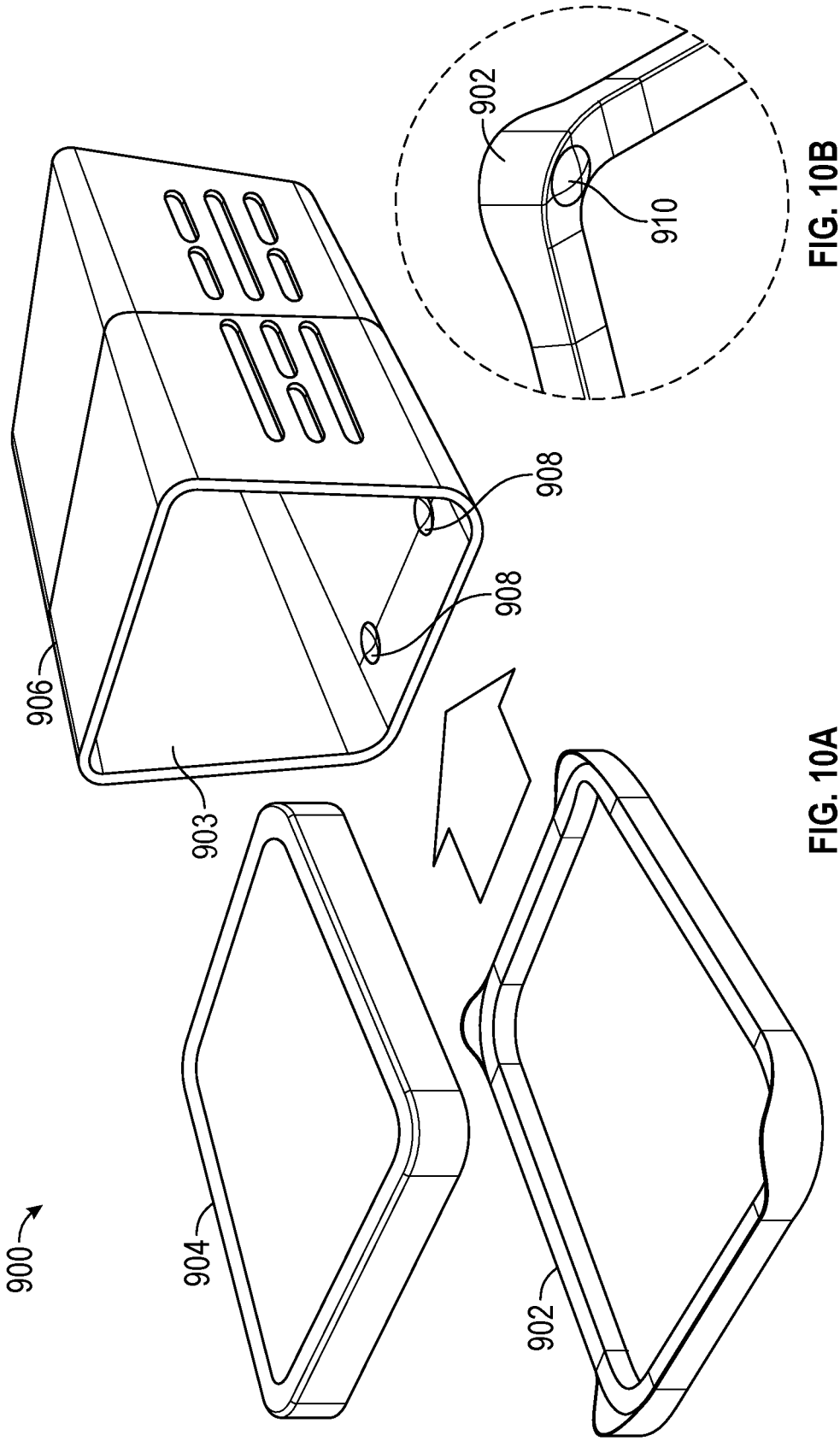


FIG. 10A

FIG. 10B

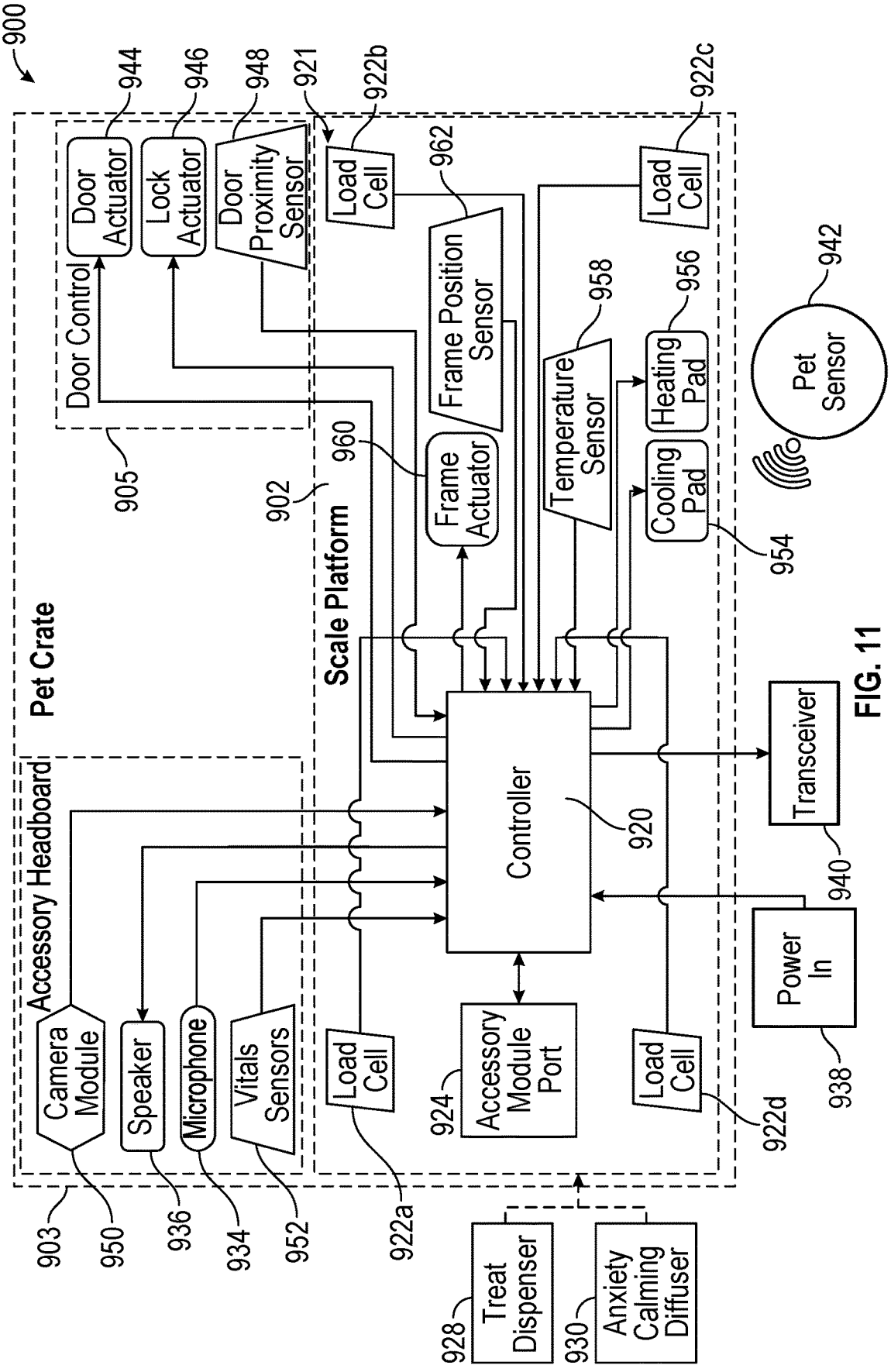

900
Pet Crate
Accessory Headboard
Camera Module
Speaker
Microphone
Vitals Sensors
903
950
936
934
952
Door Control
Door Actuator
Lock Actuator
Door Proximity Sensor
944
946
948
921
905
Scale Platform
902
Load Cell
922a
922b
922c
922d
962
960
Frame Position Sensor
Frame Actuator
Temperature Sensor
958
956
Heating Pad
Cooling Pad
954
Pet Sensor
942
Controller
920
Transceiver
940
Power In
938
Accessory Module Port
924
928
Treat Dispenser
930
Anxiety Calming Diffuser

FIG. 11

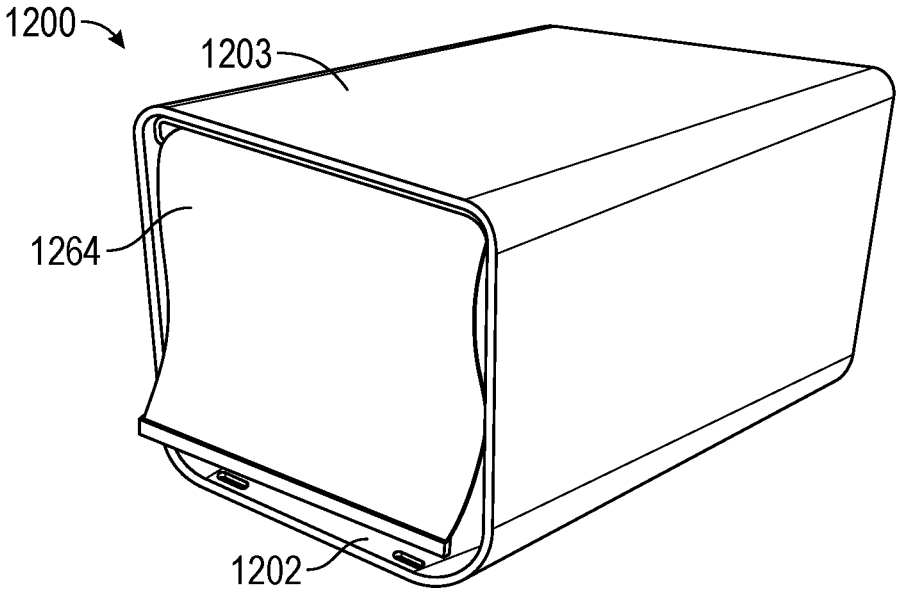


FIG. 12

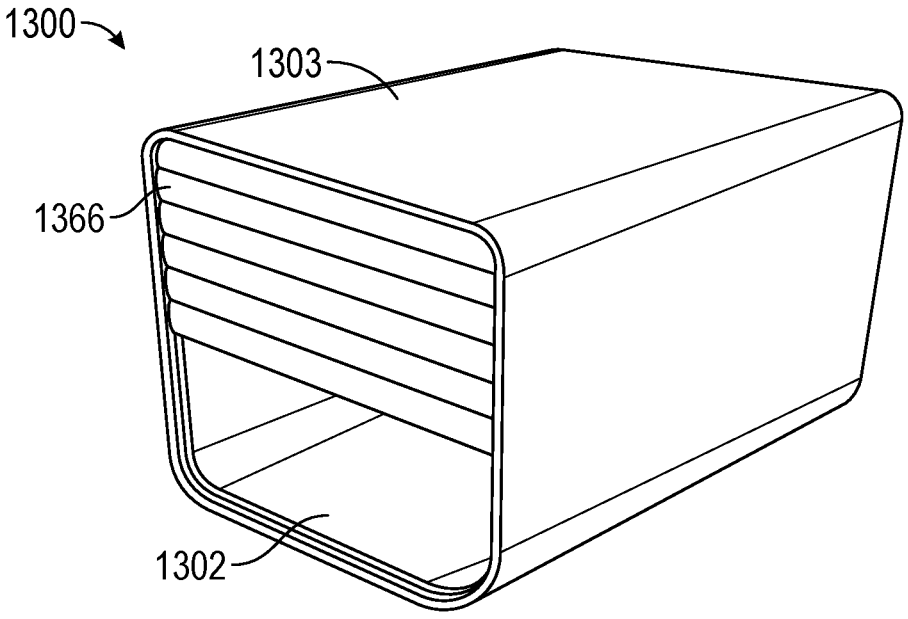


FIG. 13

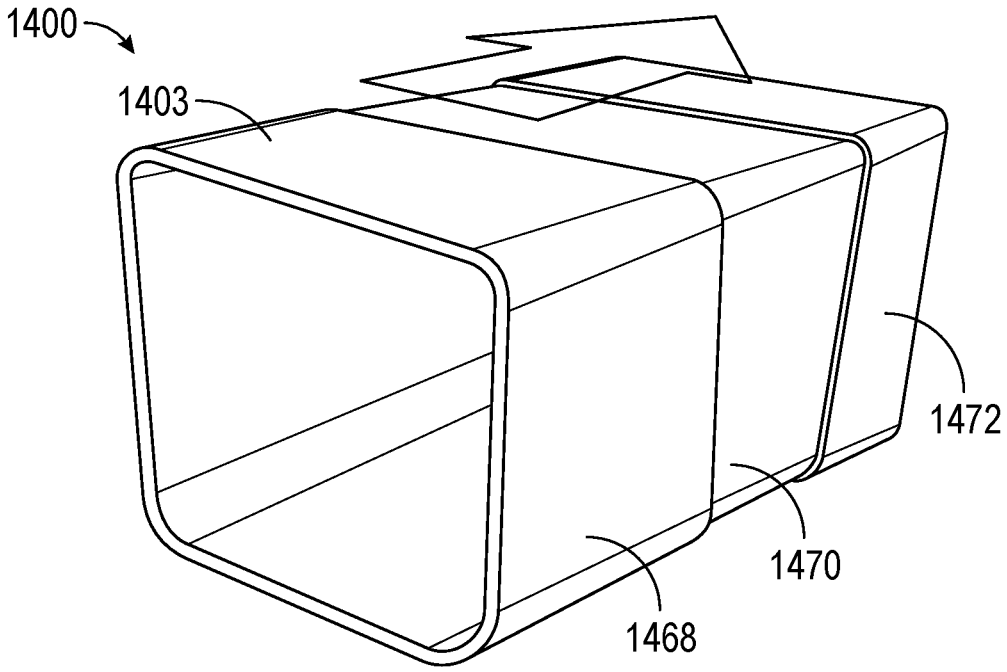


FIG. 14A

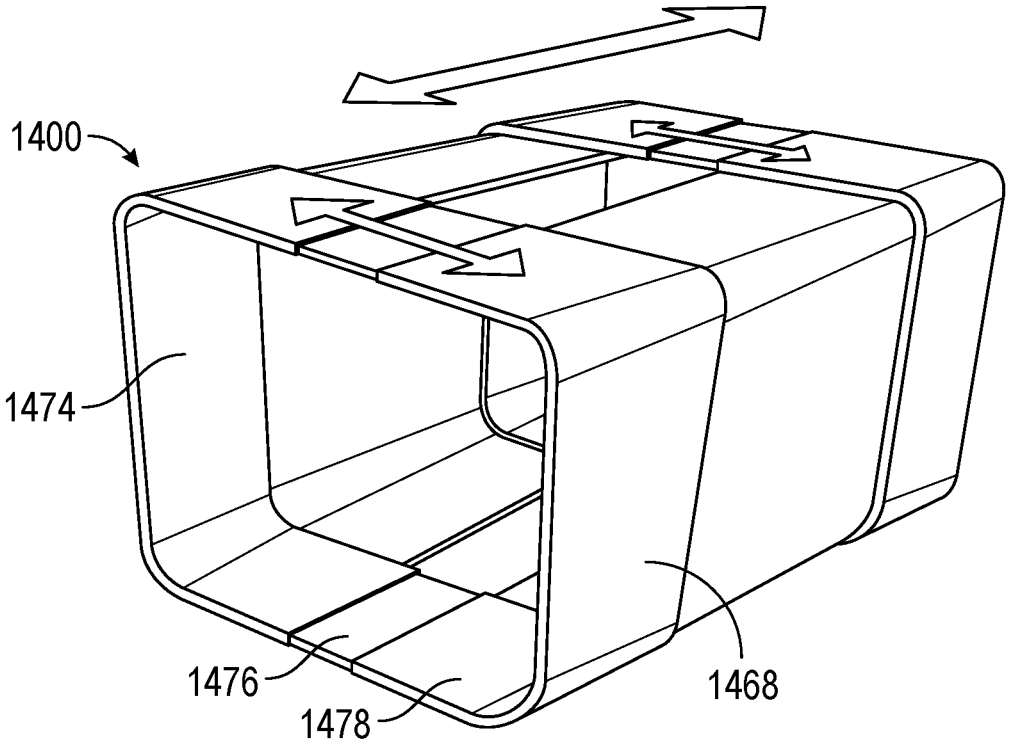


FIG. 14B

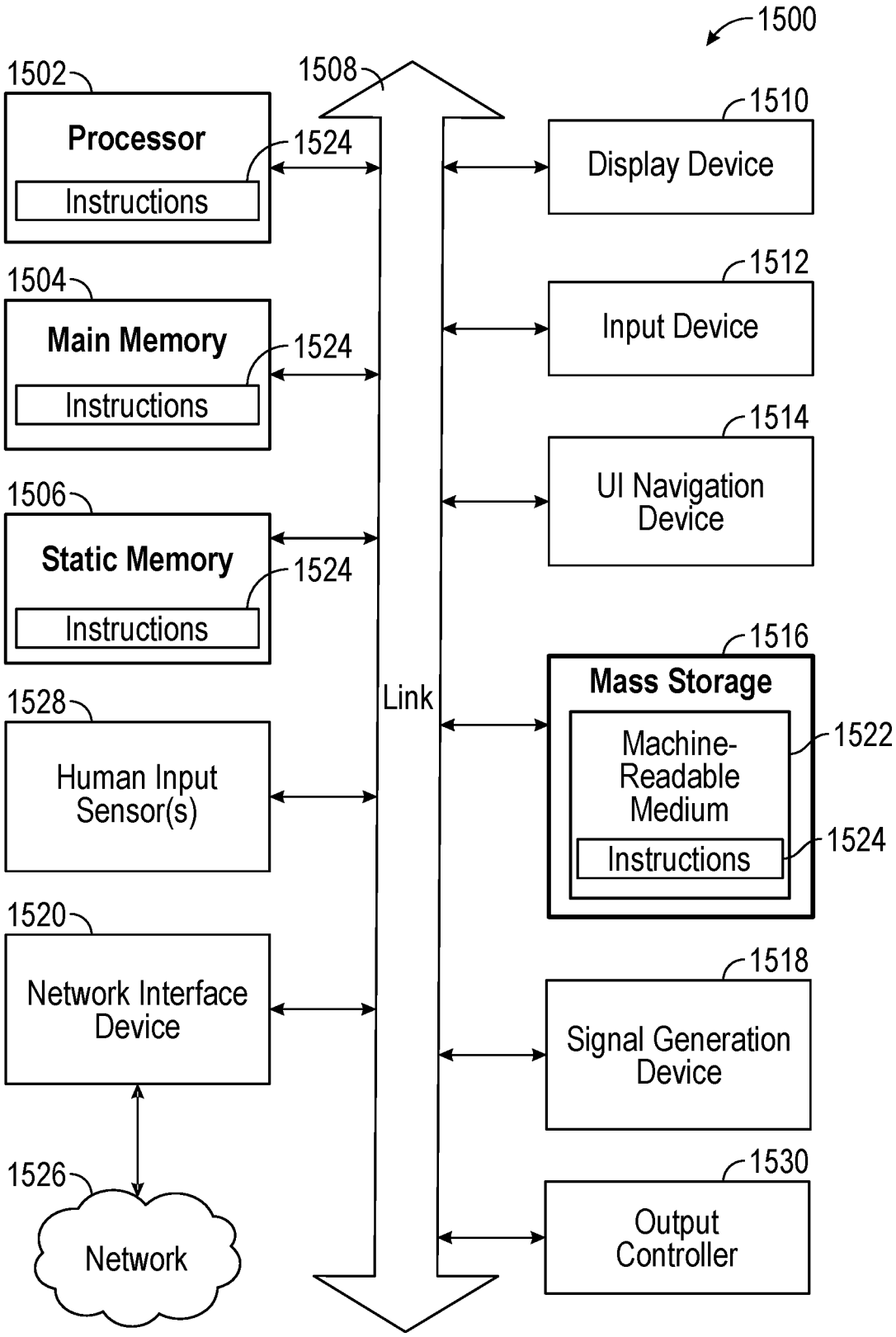

1500
1502
Processor
Instructions
1524
1504
Main Memory
Instructions
1524
1506
Static Memory
Instructions
1524
1528
Human Input Sensor(s)
1520
Network Interface Device
1526
Network
1508
Link
1510
Display Device
1512
Input Device
1514
UI Navigation Device
1516
Mass Storage
Machine-Readable Medium
1522
Instructions
1524
1518
Signal Generation Device
1530
Output Controller

FIG. 15

HOME PET SYSTEMS AND DEVICES

BACKGROUND

[0001] Pet owners often have many specialized devices and accessories for the pets. Owners use leashes for walking their pets, specialty bowls for feeding pets, beds for their pets to sleep in, and more. A growing trend is to include technology in some of these devices. For example, many pet owners use microchips for identifying their pets and some use smart collars for locating their pets and for tracking their activities throughout the day.

SUMMARY

[0002] Smart pet devices can be useful for helping to care for pets such as by automatically feeding a pet by dispensing food at a given time. However, such devices are limited in flexibility of dispensing and in capabilities of tracking dispensing and pet interaction with the food. This disclosure describes devices and methods that can help to address this problem such as by including a pet food and liquid dispenser that can dispense not only food but water. The device or system can also include one or more sensors to help determine whether food was dispensed, consumed, and a rate of uptake. Liquid uptake can be similarly monitored. The system can also include one or more identification sensors, such as an image capture device or wireless identification system for identifying pets (and optionally people) to help more accurately track consumption.

[0003] For example, a pet feeding system can include a housing, a food tray connected to the housing, and a liquid tray connected to the housing. The pet feeding system can include a food dispenser connected to the housing and configured to dispense food into the food tray. The pet feeding system can include a liquid dispenser connected to the housing and configured to dispense liquid into the liquid tray. The pet feeding system can include a controller communicatively connected to the food dispenser and the liquid dispenser. The controller can operate the food dispenser to dispense the food into the food tray and can operate the liquid dispenser to dispense liquid into the liquid tray.

[0004] Another common device used by pet owners are pet beds and crates, which can be used by pets for sleeping and can be used by owners for training. However, most pet peds and crates are limited in flexibility and provide little to no feedback about the pet. This disclosure describes devices and methods that can help to address this problem such as by including a pet crate or bed that is adjustable in size so that it can grow as the pet grows and can be condensed easily for storage and for reducing floor space when not in use. The crate or bed can also include one or more sensors for tracking a weight or mass of the pet to help determine pet health and to help guide pet feeding. The crate or bed can also include one or more identification sensors, such as an image capture device or wireless identification system for identifying pets (and optionally people).

[0005] For example, a pet bed system can include a cushion and a frame engageable with a floor surface and configured to support the cushion at least partially above the floor surface. The pet bed system can include a sensor connected to the frame, where the sensor can produce a sensor signal based on a condition of the cushion and the frame. The pet bed system can include a controller communicatively configured to produce an alert based on the sensor signal.

[0006] The above discussion is intended to provide an overview of subject matter of the present patent application. It is not intended to provide an exclusive or exhaustive explanation of the invention. The description below is included to provide further information about the present patent application.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] In the drawings, which are not necessarily drawn to scale, like numerals may describe similar components in different views. Like numerals having different letter suffixes may represent different instances of similar components. The drawings illustrate generally, by way of example, but not by way of limitation, various embodiments discussed in the present document.

[0008] FIG. **1** illustrates an isometric view of a pet feeding system.

[0009] FIG. **2**A illustrates a schematic view of a pet feeding system.

[0010] FIG. **2**B illustrates a diagram illustrating a communication network.

[0011] FIG. **3**A illustrates a perspective view of a pet feeding system and FIG. **3**B illustrates a perspective view of a pet feeding system.

[0012] FIG. **4** illustrates a perspective view of a pet bed system.

[0013] FIG. **5**A illustrates an isometric view of a pet bed system.

[0014] FIG. **5**B illustrates an isometric exploded view of a pet bed system.

[0015] FIG. **5**C illustrates an isometric view of a pet bed system.

[0016] FIG. **6**A illustrates a top view of a pet bed system in a first condition

[0017] FIG. **6**B illustrates a top view of a pet bed system in a second condition

[0018] FIG. **6**C illustrates a top view of a pet bed system in a third condition

[0019] FIG. **7** illustrates an enlarged isometric view of a portion of a pet bed system.

[0020] FIG. **8** illustrates a schematic view of a pet bed system.

[0021] FIG. **9** illustrates an isometric view of a pet bed system.

[0022] FIG. **10**A illustrates an exploded perspective view of a pet bed system.

[0023] FIG. **10**B illustrates an enlarged perspective view of a portion of pet bed system.

[0024] FIG. **11** illustrates a schematic view of a pet bed system.

[0025] FIG. **12** illustrates a perspective view of a pet bed system.

[0026] FIG. **13** illustrates a perspective view of a pet bed system.

[0027] FIG. **14**A illustrates a perspective view of a pet bed system in a first condition

[0028] FIG. **14**B illustrates a perspective view of a pet bed system in a second condition

[0029] FIG. **15** illustrates a block diagram illustrating an example of a machine upon which one or more embodiments may be implemented.

DETAILED DESCRIPTION

[0030] FIG. **1** illustrates an isometric view of a pet feeding system **100**. The pet feeding system **100** can be a system for automatically feeding a pet or for automatically delivering potable fluids or liquids to the pet, as well as receiving feedback about activities of the pet, as discussed in further detail below.

[0031] The pet feeding system **100** can include a housing **102** configured to house and support one or more components of the pet feeding system **100** on a floor surface or other surface. The housing **102** can include or can define a tray assembly **104** extending from a bottom portion of the housing **102**. The tray assembly **104** can be configured to support one or more trays or sensors therein. For example, the pet feeding system **100** can include a food tray **106** located at least partially within the tray assembly **104** and a liquid tray **108** located at least partially within the tray assembly **104**. Each of the food tray **106** and the liquid tray **108** can be containers with an open top configured to receive solid or liquid therein and configured to be accessible for retrieval of the solids or liquids therefrom. Optionally, the food tray **106** or the liquid tray **108** can be user-removable (including end-user removable) from the tray assembly **104**, such as for cleaning of the tray assembly **104** or to change to a new tray for a different pet.

[0032] The pet feeding system **100** can also include a food hopper **110** located at least partially within the housing **102** and connected thereto. The food hopper **110** can optionally be user-removable (including end-user removable) from the housing **102**. The food hopper **110** can be configured to receive and retain food or solids therein and can be operable to dispense food or solids into the food tray **106**. Similarly, the pet feeding system **100** can include a liquid hopper **112** located at least partially within the housing **102** and connected thereto. The liquid hopper **112** can optionally be user-removable (including end-user removable) from the housing **102**. The liquid hopper **112** can be configured to receive and retain liquids, such as water, therein, and the liquid hopper **112** can be operable to dispense liquid into the liquid tray **108**.

[0033] The pet feeding system **100** can also include a controller connected (such as communicatively connected) to a food dispenser and a liquid dispenser, as discussed in further detail below, such that the controller can be configured to operate the food dispenser to dispense the food into the food tray and can be configured to operate the liquid dispenser to dispense liquid into the liquid tray.

[0034] The pet feeding system **100** can also include a food sensor **114** that can be connected to the food tray **106**. The food sensor **114** can be configured to produce a food sensor signal based on a condition of the food tray **106** and the controller can be configured to operate the food dispenser based on the food sensor signal. For example, the food sensor can be a force sensor and the controller can be configured to determine a weight of food within the food tray **106** and can dispense food based on the determined weight.

[0035] The food hopper **110** can be located relative to a food hooper sensor **146** that can be configured to produce a food signal based on the condition of the food hopper **110** and the controller can be configured to operate the food dispenser based on the food hopper sensor signal **146**. The controller can be configured to monitor the food sensor **114** and the food hopper sensor **146** to provide a robust system for controlled delivery of food to the food tray **106**. The controller can also generate or transmit a signal to the user when the food sensor **114** detects an object added to the food tray **106** that was not delivered from the food hopper **110**, such as measured by the food hopper sensor **146**.

[0036] Similarly, the pet feeding system **100** can also include a liquid sensor **116** that can be connected to the liquid tray **108**. The liquid sensor **116** can be configured to produce a liquid sensor signal based on a condition of the liquid tray **108** and the controller can be configured to operate the liquid dispenser based on the liquid sensor signal. For example, the liquid sensor **116** can be a force sensor and the controller can be configured to determine a weight of liquid (which can be used to determine a volume of liquid) within the liquid tray **108** and can dispense liquid based on the determined weight.

[0037] The liquid hopper **112** can be positioned relative to a load cell **142** that can be configured to produce a liquid signal based on the condition of the liquid hopper **112** and the controller can be configured to operate the liquid dispenser based on a liquid hopper sensor signal from the load cell **142**. The controller can be configured to monitor both the liquid sensor **116** and the liquid hopper sensor **142** to create a robust system for the controlled delivery of liquid to the liquid tray **108**. The controller can also generate a signal to the user when the liquid sensor **116** detects an object added to the liquid tray **108** that was not delivered from the liquid hopper **112** as measured by the liquid hopper sensor **142**.

[0038] FIG. **2**A illustrates a schematic view of the pet feeding system **100**. The pet feeding system **100** can be consistent with the pet feeding system **100** of FIG. **1**; FIG. **2**A shows, schematically, additional components and details of the pet feeding system **100**. For example, FIG. **2**A shows that the pet feeding system **100** can include a sensor system **118**, which can be connected to the housing **102** and can be in communication with a controller **120**, where the controller **120** can also be connected to the housing **102**.

[0039] The controller **120** can be a programmable controller, such as a single or multi-board computer, a direct digital controller (DDC), a programmable logic controller (PLC), or the like. In other examples the controller **120** can be any computing device, such as a handheld computer, for example, a smart phone, a tablet, a laptop, a desktop computer, or any other computing device including a processor, memory, and communication capabilities.

[0040] The sensor system **118** can include one or more sensors or systems, such as an image capture device **122** (e.g., a camera). The image capture device **122** can be connected to the housing **102** and can be configured to transmit an image capture signal to the controller **120** based on imagery of an environment of the pet feeding system **100**, such as one or more pets or persons within the environment. The sensor system **118** can also include an audio sensor **126**, such as a microphone. The audio sensor **126** can be connected to the housing **102** and can be configured to transmit an audio signal to the controller **120** based on one or more sounds of an environment of the pet feeding system **100**.

[0041] The sensor system **118** can also include a first transceiver **128** and a second transceiver **130**. The first transceiver **128** can be, for example, a low energy Bluetooth-low-energy (BLE) transceiver and the second transceiver **130** can be a Wi-Fi transceiver. Each of the first transceiver **128** and the second transceiver **130** can be other transceiver

types, such as NFC, or the like. Each of the first transceiver **128** and the second transceiver **130** can be in communication with the controller **120** and can be configured to interact with one or more devices or components of the pet feeding system **100**, one or more external devices, or a network (such as a network **200** of FIG. **2**B discussed below).

[0042] The pet feeding system **100** can also include a liquid control system **132** that can include a pump **134**, a filter **136**, a temperature sensor **138**, a level sensor **140**, and a load cell **142**. Each of the components of the liquid control system **132** can be connected to the housing **102** or located at least partially within the housing **102**. Also, each of the components of the liquid control system **132** can be communicatively connected to the controller **120**.

[0043] More specifically, the pump **134** can be connected to the liquid hopper **112** such as to pump fluid or liquid (e.g., water) to the liquid tray **108** through a liquid line **144**. Optionally, the filter **136** can be mounted in the liquid line **144** such as downstream of the pump **134** and upstream of the liquid tray **108**. The filter **136** can be configured to filter the liquid before it is delivered to the liquid tray **108**. In some examples, the filter **136** can be an Ultraviolet filter.

[0044] The pump **134** can be a fluid or liquid pump, such as a positive displacement, a centrifugal pump, an axial pump, or the like. Optionally, the pump **134** can be replaced by a valve and the liquid can be delivered from the liquid hopper **112** to the liquid tray **108** using gravity. In some examples, the pump **134** can be a peristaltic pump and the controller **120** can be configured to operate the pump **134** to control a volume of water dispensed to the liquid tray **108**, such as based on the signal from the liquid sensor **116**.

[0045] The level sensor **140** can be a level sensor such as a float or optical level sensor. The level sensor **140** can be configured to produce a signal based on a level of fluid or liquid within the liquid hopper **112**. The level sensor **140** can transmit a level signal to the controller **120** based on the liquid level within the liquid hopper **112**. Similarly, the load cell **142** can transmit a signal to the controller **120** based on a force or load of the liquid hopper **112**. The controller **120** can use the level signal or the load signal to determine an amount of fluid or liquid within the liquid hopper **112**. The temperature sensor **138** can also be connected to the liquid hopper **112** and can transmit a temperature signal to the controller **120** based on a temperature of the fluid or liquid within the liquid hopper **112**.

[0046] The pet feeding system **100** can also include a load cell **146** connected to the pet feeding system **100**. The load cell **146** can transmit a signal to the controller **120** based on a force or load of the food hopper **110**. The pet feeding system **100** can further include a food dispenser **148**, which can be a pump or actuator operable to dispense food from the food hopper **110** into the food tray **106**. The food dispenser **148** can be connected to, and in communication with, the controller **120** such that the controller **120** can operate the food dispenser **148** to dispense the food from the food hopper **110**. The pet feeding system **100** can also include a desiccant container **150** that can include desiccant and can be connected to the food hopper **110**, such as to absorb moisture from the food hopper **110** to help keep food within the food hopper **110** fresh or dry.

[0047] The pet feeding system **100** can also include a medication hopper **152** that can be located at least partially within the housing **102** or can be connected to the housing **102**. Optionally, the medication hopper **152** can be external to the housing **102** and can be controlled by the controller **120**, such as through an auxiliary connection (e.g., to provide power and control) or through a wireless connection. The medication hopper **152** can be configured to receive and store medication therein, such as for dispensing to the food tray **106** or the liquid tray **108**. The medication hopper **152** can be optionally user-removable (including end-user removable) from the housing **102**. A load cell **156** can be connected to the medication hopper **152** and can be in communication with the controller **120** such as to transmit a medication hopper load cell signal to the controller **120**. A pump **154**, which can be any type of pump, such as a positive displacement pump, can be connected to the medication hopper **152** and can be connected to a medication line **158**, such as to deliver medication to the food tray **106**. The pump **154** can be in communication with the controller **120** such that the controller **120** can control operation of the pump **154**.

[0048] The pet feeding system **100** can also include a supplement hopper **160** that can be located at least partially within the housing **102** or can be connected to the housing **102**. Optionally, the supplement hopper **160** can be external to the housing **102** and can be controlled by the controller **120**, such as through an auxiliary connection (e.g., to provide power and control) or through a wireless connection. The supplement hopper **160** can be configured to receive and store one or more supplements therein (such as food flavoring or one or more medical supplements, e.g., glucosamine), such as for dispensing to the food tray **106** or the liquid tray **108**. The supplement hopper **160** can be optionally user-removable (including end-user removable) from the housing **102**.

[0049] A heating or cooling device **162**, such as a thermoelectric cooler, can be connected to the supplement hopper **160** and can be connected to the controller **120**. The heating or cooling device **162** can be operable to heat or cool the supplement hopper **160** and contents thereof. A load cell **164** can be connected to the supplement hopper **160** and can be in communication with the controller **120** to transmit a supplement hopper load cell signal to the controller **120**.

[0050] A temperature sensor **166** can also be connected to the supplement hopper **160** and can transmit a temperature signal to the controller **120** based on a temperature of the supplement or wet food within the supplement hopper **166**. An actuator **168**, which can be any type of pump, such as a positive displacement pump, auger, or other mechanism for transporting supplements to the food tray **106**, can be connected to the supplement hopper **160** and can be connected to a supplement line **170**. The actuator **168** can be operable to deliver supplements to the food tray **106**. The actuator **168** can be in communication with the controller **120**, allowing the controller **120** to control operation of the actuator **168**.

[0051] The pet feeding system **100** can also include a circulating pump **174** connected to the liquid tray **108** in a recirculation line **176**. A filter **178** can also be connected to the recirculation line **176**. The circulating pump **174** can be in communication with the controller **120**, which can allow the controller **120** to operate the circulating pump **174** to circulate liquid within the liquid tray **108**, which can optionally be filtered by the filter **178** to help clean the fluid or liquid clean.

[0052] The pet feeding system **100** can also include a food tray cleaner **180** and a liquid tray cleaner **182**. The food tray

cleaner **180** and the liquid tray cleaner **182** can each be connected to the controller **120** and can be operable to dispense a cleaning liquid to its respective tray.

[0053] FIG. **2**A also shows that the pet feeding system **100** can include a drawer actuator **184** that can be connected to the housing **102** and the tray assembly **104**. In such an example, the tray assembly **104** can be movable with respect to the housing to extend the food tray **106** and the liquid tray **108** for access thereto and can be movable to retract the food tray **106** and the liquid tray **108** to limit access thereto. The drawer actuator **184** can be in communication with the controller **120**, which can operate the drawer actuator **184** to move the food tray **106** and the liquid tray **108** between the extended and the retracted positions based on one or more sensor signals. For example, the trays can be moved at a scheduled time of day, based on proximity of a pet nearby, proximity of the correct pet nearby, proximity of the incorrect pet nearby, etc.

[0054] The pet feeding system **100** can also include a power supply **186** connected to the housing **102**. The power supply **186** can be connected to any of the components of the pet feeding system **100** such as to deliver power thereto.

[0055] In operation of some examples, the controller **120** can be configured to control the liquid in the liquid tray **108**. For example, the controller **120** can operate the circulating pump **174** to circulate the liquid through the liquid tray **108** based on a timer or based on a load cell signal from the liquid sensor **116**, such as when the controller **120** determines (based on the load cell signal from the liquid sensor **116**) that liquid is in the liquid tray **108**.

[0056] The controller **120** can also control the circulating pump **174** based on liquid quality. For example, the controller **120** can determine a liquid quality based on a liquid quality signal from a liquid quality sensor **188** that can be connected to the liquid tray. The controller **120** can operate the circulating pump **174** based on the liquid quality signal to help keep the liquid within the liquid tray **108** fresh.

[0057] Optionally, the controller **120** can operate the drawer actuator **184** based on the liquid quality sensor **188**. For example, when the controller **120** determines that a quality of the liquid within the liquid tray **108** falls below a threshold, the drawer actuator **184** can be operated by the controller **120** to retract into the housing **102**. When such a determination is made by the controller **120**, the controller **120** can transmit (such as using the second transceiver **130**) an alert that there is a water quality issue to a user device or network. The controller **120** can also control the pump **134** to improve water quality of the liquid. The controller **120** can also control the pump **134** to maintain a minimum liquid level in the liquid tray **108** such as based on the load cell signal from the liquid sensor **116**.

[0058] In some examples, the controller **120** can operate the circulating pump **174** to remove liquid from the liquid tray **108**, such as by pumping the liquid into a dirty liquid container. The controller **120** can perform such an action when the controller **120** determines that the liquid within the liquid tray **108** is dirty or bad, such as based on the liquid quality sensor **188** or based on time following dispensing of liquid into the liquid tray **108**.

[0059] Similarly, the controller **120** can operate an actuator (or produce and transmit an alert) to remove food from the food tray **106**. The controller **120** can perform such an action when the controller **120** determines that the food within the food tray **106** is dirty or bad, such as based on time following dispensing of food into the food tray **106**.

[0060] In further operation of the pet feeding system **100**, the controller **120** can determine whether a specified amount of liquid has been consumed. For example, the controller **120** can determine how much liquid has been dispensed by the pump **134** over a time period and how much liquid has been consumed (such as based on the load cell signal from the liquid sensor **116**). For example, the controller **120** can be configured to determine whether 1 liter of liquid per day has been consumed. The controller **120** can transmit an alert to the user (e.g., via a user device) when the specified amount to be consumed is met or has not been met.

[0061] The controller **120** can also provide liquid into the liquid tray **108** in small increments to help reduce an amount of time that water is left sitting out. The controller **120** can also use the signal from the liquid sensor **116** to determine if a foreign object or foreign liquid has been added to the liquid tray **108**. For example, the signal from the liquid sensor **116** can indicate that the weight or mass of the liquid tray **108** has increased though fluid has not been dispensed by the liquid tray cleaner **182**.

[0062] The controller **120** can also monitor the liquid hopper **112**. For example, the controller **120** can determine, based on a temperature signal from the temperature sensor **138**, whether a temperature of the liquid within the liquid hopper **112** exceeds a threshold temperature. The controller **120** can transmit an alert when the temperature exceeds a threshold temperature or when the temperature exceeds a threshold temperature for a predetermined amount of time. The controller **120** can also produce an alert based on the load signal from the load cell **142** (or based on the level signal from the level sensor **140**), such as when a volume or mass of the liquid within the liquid hopper **112** falls below a threshold level, which can be an indication that the liquid hopper **112** is empty or nearing empty and requires refilling.

[0063] The system **100** can also monitor a fluid consumption trend of the pet, such as based on an amount of fluid dispensed and based on the signal from the liquid sensor **116**. The controller **120** can use this information to estimate a number of days of water remaining in the liquid hopper **112** based on the rate of consumption. Similarly, the system **100** can also monitor a food consumption trend of the pet, such as based on an amount of food dispensed and based on the signal from the food sensor **114**. The controller **120** can use this information to estimate a number of days of food remaining in the food hopper **110** based on the rate of consumption. The system **100** can thereby more accurately predict when maintenance (or refilling) will be required, as consumption can vary significantly from pet to pet due to breed, size, age, activity, etc.

[0064] In operation of some examples, the controller **120** can operate the food dispenser **148** to dispense a specified volume or mass of food, or a specified amount of food over a period of time. For example, the food dispenser **148** can be operated to dispense 500 grams of food per day. In such an example, the controller **120** can determine (based on the load cell signal from the food sensor **114**) when the food tray **106** can accept more food and can operate the food dispenser **148** to dispense food into the food tray **106** until the controller **120** has determined that the specified amount of food per time has been reached. The controller **120** can also monitor, such as based on the load cell signal from the food sensor **114**, that the specified amount of food per time has been

consumed (or has not been consumed). The controller **120** can also be configured to deliver small amounts of food over a given time period. For example, the controller **120** can be configured to deliver 500 grams of food in a given day while delivering 50 grams of food every two hours.

[0065] Optionally, the amount of food to be delivered per day can be delivered in increments, such as 125 grams per serving, which can be delivered when the controller **120** determines (based on the load cell signal from the food sensor **114**) when the food in the food tray **106** has been consumed, such that each serving can be dispensed based on a schedule or based on consumption of the previous serving. The pet feeding system **100** can also deliver food optimized for pets that may consume food at too high of a rate, which can result in consumption difficulties or health or digestive issues. The system **100** can be set to deliver, for example, a serving (e.g., 125 grams) of food at a constant rate, such as at a rate of 1 gram per second. Dispensing at a reduced rate (instead of all at once) can help to ensure that the food is not eaten too quickly, such as no faster than 2 minutes in the example of 125 grams at 1 gram per minute. Dispensing can also be divided into small and less frequent servings. For example, the pet feeding system **100** can dispense 25 grams every 60 seconds for a total of 5 minutes.

[0066] The controller **120** can also be configured operate the pump **154** to dispense a specified volume or mass of medication from the medication hopper **152** over a period of time. For example, the pump **154** can be operated to dispense 2 grams of medication per day. The controller **120** can also monitor or determine, such as based on the load cell signal from the food sensor **114**, whether the medication has been consumed and the controller **120** can produce an alert to indicate whether or not the medication has been consumed. The controller **120** can optionally be configured to dispense the medication when the controller **120** determines that there is food in the food tray **106** (or that there is not food in the tray), such as based on the signal from the food sensor **114**.

[0067] The controller **120** can also operate the actuator **168** to dispense a specified volume or mass of supplement from the supplement hopper **160** over a period of time. For example, the actuator **168** can be operated to dispense 10 grams of supplement per day. The controller **120** can optionally be configured to dispense the supplement when the controller **120** determines that there is food in the food tray **106**, such as based on the signal from the food sensor **114**. Or, the controller **120** can be configured to dispense the supplement after the controller **120** operates the food dispenser **148** to dispense food into the food tray **106**. The meal supplement can be in support of added nutrition, vitamins, or a topper to encourage pets to eat the food.

[0068] The pet feeding system **100** can also be configured to operate one or more components of the pet feeding system **100** based on identification of a pet or other individual. For example, the pet feeding system **100** can use the image capture device **122**, the audio sensor **126**, the first transceiver **128**, or the second transceiver **130** to identify a pet or individual near the pet feeding system **100**. For example, the image signal from the image capture device **122** can be used by the controller **120** to identify a pet, such as in the case of multi-pet homes. Also, the first transceiver **128** can be used to identify a pet such as using an identifying tag on a collar of the pet (e.g., a BLE transmitter). The controller **120** can operate one or more of the pump **134** to deliver liquids or the food dispenser **148** to deliver food based on the identification.

[0069] Upon detection of a pet by the controller **120**, the controller **120** can also perform one or more actions or can limit performance of actions. For example, upon detection of Pet A, the controller **120** can monitor food intake from the food tray **106**, such as based on the food sensor **114** and can update a record, log, or table, which can be updated for a given time period, such as over a day for the Pet A. The controller **120** can then determine when consumption of food by the pet A reaches a threshold minimum food intake or maximum intake. Optionally, the controller **120** can limit further dispensing of food for the Pet A when the maximum intake is determined to be reached and can transmit an alert.

[0070] In a similar example where an environment includes a second pet, Pet B, the controller **120** can limit dispensing of food when the Pet A reaches its maximum. However, the controller **120** can detect Pet B and can dispense food for consumption by Pet B and can maintain a record for consumption of food by the Pet B, such that the controller **120** can limit food dispensing for pet B once consumption by Pet B reaches a maximum.

[0071] In an example of a multi pet household, if food is dispensed for Pet B and the pet feeding system **100** determines that the dispensed food is uneaten, it is possible that the dispensed food may then be consumed by Pet A. When the controller **120** determines that food for Pet B is consumed by Pet A, the controller **120** can record or log the consumption by Pet A (and not Pet B). Optionally, when Pet B leaves food behind, the controller **120** can operate the actuator **184** to store the uneaten food until Pet B returns, such as to help prevent Pet A from eating the food of Pet B.

[0072] Similarly, the controller **120** can control dispensing from the medication hopper **152** or the supplement hopper **160** based on identification. For example, the controller **120** can dispense medication from the medication hopper **152** only upon detection of the Pet A. The controller **120** can also use the load cell **156** to determine an amount of medication remaining in the medication hopper **152**. Upon a determination that the amount of medication is below a threshold an alert can be transmitted to a user device.

[0073] In an example of a multi pet household, if a supplement or medication is dispensed for Pet B and the pet feeding system **100** determines that the dispensed medication or supplement is unconsumed, it is possible that the dispensed medication or supplement may then be consumed by Pet A. When the controller **120** determines that medication or supplement for Pet B is consumed by Pet A, the controller **120** can record or log the consumption by Pet A (and not Pet B). Optionally, when Pet B leaves medication or supplement behind, the controller **120** can operate the actuator **184** to store the unconsumed medication or supplement until Pet B returns, such as to help prevent Pet A from eating the medication or supplement of Pet B.

[0074] The controller **120** can also detect non-pet users. For example, the controller **120** can determine, using one or more signals from the sensor system **118** and the food sensor **114**, that a person, such as a child, removed food from the food tray **106**. Upon such an occurrence, the controller **120** can transmit an alert to a user device or a network. The controller **120** can also operate the drawer actuator **184** to retract the tray assembly **104** when the controller **120** identifies a non-pet user, such as using an identification

signal from one or more of the sensor system **118**. The controller **120** can also operate the drawer actuator **184** to retract the tray assembly **104** when the controller **120** identifies a pet (e.g., Pet A) that has reached its maximum food intake for a time period and when the controller **120** determines there is food in the bowl for another pet (e.g., Pet B).

[0075] Optionally, the image capture device **122** can photograph foreign material placed in the food tray **106** or the liquid tray **108** (such as following detection by the food sensor **114** or the liquid sensor **116**) and the controller **120** can produce and transmit a notification to the user based on the image or including the image of the foreign material. The controller **120** or the user device can include a catalog or list of items that can be dangerous to a pet. The list can be used to train a machine learning model, such as within the controller **120**. The controller **120** can then use the model to determine that the foreign material added to the food tray **106** or the liquid tray **108** is hazardous and can perform one or more actions based on this determination. For example, the controller **120** can transmit an alert or can operate the drawer actuator **184** to reduce access to the hazardous material. The controller **120** can also operate the circulating pump **174** to remove the hazard from liquid tray **108**. Optionally, the controller **120** can produce and transmit a high priority notification to the user to make them aware of the hazard.

[0076] The controller **120** can use the level signal or the load signal to determine an amount of fluid or liquid within the liquid hopper **112**. The controller **120** can also use the load cell signal of the load cell **146** to determine an amount of food or liquid within the food hopper **112**. The controller **120** can transmit an alert to a user device when the amount of liquid falls below a threshold amount or when an amount of food falls below a threshold amount.

[0077] The controller **120** can also identify a product label using, for example, the image capture device **122**, such as when a new bag or container is opened and added to the food hopper **110**. The controller **120** can, using the second transceiver **130** to communicate with a network, determine a total mass of food in the container. The controller **120** can track the use of food over time and produce an alert when the container or bag (which can be stored away from the feeder system) falls below a threshold amount and can optionally automatically order a container or bag of food upon determining that the container has fallen below the threshold value.

[0078] FIG. **2**B is a diagram illustrating an example communication network **200** that can enable networking between the pet feeding system **100** and one or more other devices, such as a mobile robot **202**, a mobile device **204**, a cloud computing system **206**, or a pet bed **400** (discussed in further detail below). Using the communication network **200**, the robot **202**, the mobile device **204**, the pet feeding system **100**, the pet bed **400**, and the cloud computing system **206** can communicate with one another to transmit and receive data from one another. In some examples, the robot **202**, the pet feeding system **100**, the pet bed **400**, or all three can communicate with the mobile device **204** through the cloud computing system **206**. Alternatively, or additionally, the robot **202**, the pet feeding system **100**, the pet bed **400** or all three can communicate directly with the mobile device **204**. Various types and combinations of wireless networks (e.g., BLE, radio frequency, optical based, etc.) and network architectures (e.g., mesh networks) can be employed by the communication network **200**.

[0079] In some examples, the mobile device **204** can be a remote device that can be linked to the cloud computing system **206** and can enable a user to provide inputs. The mobile device **204** can include user input elements such as, for example, one or more of a touchscreen display, buttons, a microphone, a mouse, a keyboard, or other devices that respond to inputs provided by the user. The mobile device **204** can also include immersive media (e.g., virtual reality) with which the user can interact to provide input. The mobile device **204**, in these examples, can be a virtual reality headset or a head-mounted display.

[0080] The user can provide inputs corresponding to commands for the pet feeding system **100**. In such cases, the mobile device **204** can transmit a signal to the cloud computing system **206** to cause the cloud computing system **206** to transmit a command signal to the pet feeding system **100**. In some implementations, the mobile device **204** can present augmented reality images. In some implementations, the mobile device **204** can be a smart phone, a laptop computer, a tablet computing device, or other mobile device.

[0081] According to some examples discussed herein, the mobile device **204** can include a user interface configured to display one or more devices within the environment. The interface can receive a user instruction to modify a feeding schedule, updating a number of pets in an environment, or viewing a pet health status.

[0082] In some examples, the communication network **200** can include additional nodes. For example, nodes of the communication network **200** can include additional robots or pet devices. Also, nodes of the communication network **200** can include network-connected devices that can generate information about the environment **40**. Such a network-connected device can include one or more sensors, such as an acoustic sensor, an image capture system, or other sensor generating signals, to detect characteristics of the environment **40** from which features can be extracted. Network-connected devices can also include home cameras, smart sensors, identification devices, activity trackers, or the like.

[0083] The mobile device **204** can be configured to receive information from one or more devices of the communication network **200** such as alerts and data. For example, the mobile device **204** can receive one or more alerts (such as those described above) from the second transceiver **130** or the first transceiver **128** of the pet feeding system **100**. The mobile device **204** can also receive alerts or data from the pet bed **400**, as discussed below.

[0084] The mobile device **204** can also be configured to display a dashboard on a screen **205** of the device. The dashboard can be configured to display food dispensing or liquid dispensing activities throughout a day, such as based on one or more signals from the pet feeding system **100**. The mobile device **204** or the pet feeding system **100** can also store data from one or more sensors of the pet feeding system **100** or from one or more determinations made by the controller **120** or the mobile device **204**. The pet feeding system **100** or the mobile device **204** can use the stored data to determine trends, such as short-term or long-term trends including eating and drinking trends of a pet. Regular analysis of the trends, including in comparison to new data, can help the controller **120** or the mobile device **204**

determine health or wellness of a pet. For example, a sharp decrease in food or liquid intake can indicate a health problem of the pet.

[0085] The trends or determinations can be displayed on the dashboard of the screen **205** to help inform a user of trends and activities of one or more pets interacting with the pet feeding system **100** or the pet bed **400**. Any or all data reported from devices of the pet feeding system **100** or the pet bed **400** can be used as a general health metric, which can be indicated on a dashboard (such as a dashboard presented to the user on the user device), such as based on their metrics for that day compared to metrics collected historically. This comparison can provide a baseline and comparison, helping the user to assess health and wellness of their pet.

[0086] The pet feeding system **100** or the mobile device **204** can also receive information from auxiliary devices, such as a pet tracking device. For example, hourly activity of a pet can be transmitted to the controller **120** or to the mobile device **204** and the controller **120** or the mobile device **204** can determine, based on the activity of the pet, whether an adjustment to the food or liquid settings (e.g., minimum or maximum) should be made. Such adjustments can be transmitted, for example, from the mobile device **204** to the controller **120** for control of the pump **134** or the food dispenser **148**.

[0087] Other devices of the communication network **200** can also work together. For example, the pet feeding system **100** can transmit to the communication network **200** that food has been dispensed and consumed, indicating that cleaning of the area may be required. Any of the devices of the communication network **200** can instruct the robot **202** to initiate a cleaning mission around the pet feeding system **100** such as to vacuum or mop (or both) an area around the pet feeding system **100**. Optionally, during such a mission, the robot **202** can use a camera or other sensors to detect whether food was taken out of the food tray **106** and not consumed. Upon such a detection, the robot **202** can transmit an alert to the mobile device **204** to notify the user and can adjust its dashboard. Optionally, the pet feeding system **100** can modify the daily food allotment based on food detected out of the food tray **106** by the robot **202**.

[0088] In the communication network **200**, the wireless links can utilize various communication schemes, protocols, etc., such as, for example, Bluetooth classes, Wi-Fi, Bluetooth-low-energy, also known as BLE, 802.15.4, Worldwide Interoperability for Microwave Access (WiMAX), an infrared channel, satellite band, or the like. In some examples, wireless links can include any cellular network standards used to communicate among mobile devices, including, but not limited to, standards that qualify as 1G, 2G, 3G, 4G, 5G, 6G, or the like. The network standards, if utilized, qualify as, for example, one or more generations of mobile telecommunication standards by fulfilling a specification or standards such as the specifications maintained by International Telecommunication Union. For example, the 4G standards can correspond to the International Mobile Telecommunications Advanced (IMT-Advanced) specification. Examples of cellular network standards include AMPS, GSM, GPRS, UMTS, LTE, LTE Advanced, Mobile WiMAX, and WiMAX-Advanced. Cellular network standards can use various channel access methods, e.g., FDMA, TDMA, CDMA, or SDMA.

[0089] FIG. **3**A illustrates a perspective view of a pet feeding system **300**. FIG. **3**B illustrates a perspective view of a variation of the pet feeding system **300**. The pet feeding system **300** can be similar to the pet feeding system **100** discussed above; the pet feeding system **300** can include an integrated cushion or bed. Any of systems discussed above or below can be modified to include the features of the pet feeding system **300**.

[0090] More specifically, FIG. **3** shows that the pet feeding system **300** can include a housing **302**, a tray assembly **304**, a food tray **306**, and a liquid tray **308**. As shown in FIG. **3**B, the housing **302** can include a support **390** at a top portion of the housing **302**, where the support **390** can be configured to support a cushion **392** therein or thereon. The support **390** and the cushion **392** can together form a bed or rest area for a pet. The cushion **392** can optionally be integrated into the support **390** or can be separate or connectable to the support **390**.

[0091] FIG. **4** illustrates a perspective view of a pet bed system **400**. The pet bed **400** can include a frame **402** engageable with a floor surface and configured to support a cushion **404** on or at least partially above the floor surface. The frame **402** and the cushion **404** can together form a bed or rest area for a pet **50**. The frame **402** can be a smart frame, such as a frame including one or more sensor or actuators. Optionally, the frame **402** can be a manually adjustable or mechanical frame. Further details of the pet bed **400** are discussed below.

[0092] FIG. **5**A illustrates an isometric view of the pet bed system **400**. FIG. **5**B illustrates an isometric exploded view of the pet bed system **400**. FIG. **5**C illustrates an isometric view of the pet bed system **400**. FIGS. **5**A-**5**C are discussed together below.

[0093] The pet bed system **400** can be consistent with the pet bed **400** discussed above. FIG. **5**B shows that the cushion **404** can be removed or separated from the frame **402** so that the frame **402** can be adjusted. Optionally, the cushion **404** can be separable from the frame **402**, such as for cleaning of the **404** or replacement of the cushion **404**. FIG. **5**C shows that, following removal of the cushion **404**, the frame **402** can receive a different cushion **404**C. In this way, the pet bed **400** can be optimized for pets of various sizes and weights using the adjustability of the frame **402**.

[0094] FIGS. **6**A-**6**C are discussed together below and show how the frame **402** of the pet bed **400** can be adjusted to various sizes. For example, FIG. **6**A illustrates a top view of the frame **402** in a small size configuration, FIG. **6**B illustrates a top view of the frame **402** in a medium size configuration, and FIG. **6**C illustrates a top view of the frame **402** in a large size configuration. As discussed in further detail below, the frame **402** can be adjusted between the various sizes shown (and optionally other sizes) to accommodate cushions (and pets) of various sizes.

[0095] The pet bed **400** can include a controller **420** connected to the frame **402**. The controller **420** can connect to the communication network **200** and can interface with one or more of the sensors of the pet bed **400**, such as sensors embedded in the frame **402**, load cells, or the sensor system **421**. The controller **420** can also interface with a port/interface to an accessory module **424** allowing optional components to be connected to the controller **420** that may be available for the pet bed, such a Camera monitor, Speaker, Microphone, treat dispenser, calming diffuser, or the like, as discussed in further detail below.

[0096] FIG. **7** illustrates an enlarged isometric view of a portion of the pet bed system **400**, specifically the frame **402** thereof. The pet bed **400** can be consistent with the pet bed **400** discussed above. FIG. **7** shows additional details of the pet bed **400**. For example, FIG. **7** shows that the frame **402** can include a corner member **406** and a side member **408**. The pet bed **400** can also include a corner support **410** connected to the corner member **406**. The corner support **410** can include a vertical portion **412** extending upward from the **406** configured to laterally support the cushion **404**. The corner support **410** can also include a support **414**.

[0097] The side member **408** can include sizing notches **416**S, **416**M, and **416**L. Each of the notches **416** can be a hole or bore in the side member **408** configured to receive a sizing button **418** (or portion thereof) at least partially therein. The frame **402** can include four buttons, one on each side, or can include one button operable to change a size of the entire frame.

[0098] The sizing button **418** can be an actuator biased toward an extended position (shown in FIG. **7**) that is user-operable (including end-user operable) to move to a retracted position for increasing or decreasing a size of the frame **402**. For example, when the actuator is located in the notch **416***s*, the frame can be a small size, as shown in FIG. **6**A. When the actuator is located in the notch **416***m*, the frame can be a medium size, as shown in FIG. **6**B. When the actuator is located in the notch **4161**, the frame can be a large size, as shown in FIG. **6**C. In this way, the frame **402** can be user-operable to adjust a size of the frame. One or more actuators can be operated to adjust a size of the frame **402** or a single actuator can be operated. For example, the frame **402** can include four side members **408**, each including an actuator.

[0099] The frame **402** can also be used to perform autonomous sizing or footprint reduction. For example, the frame **402** can include one or more actuators operable to adjust a size of the frame **402** and can optionally include a cushion capable of scaling along with the frame **402**. The frame **402** can be adjusted by the **420** automatically or autonomously, such as to accommodate growth of the pet so that the bed is properly sized for their pet. The controller **420** can also operate the actuators to reduce a size or footprint of the frame **402** as determined by the user (such as based on a signal received from a user device). For example, if a user indicates a desire for the pet bed **400** to take up less floor space when the pet bed **400** was not in use, the controller **420** can automatically reduce a size of the frame **402** when it determines that bed is not in use. Optionally, the user can use the user device (or can interface directly with the pet bed **400**) reduce a size of the frame **402** before an event (e.g., a party).

[0100] FIG. **8** illustrates a schematic view of a pet bed system **400**. The pet bed **400** can be consistent with FIGS. **4**-**7** discussed above; FIG. **8** shows, schematically, how various components of the pet bed **400** can be connected. For example, FIG. **8** shows that the pet bed **400** can include a controller **420** that can be connected to or located within the frame **402**. The controller **420** can be a programmable controller, such as a single or multi-board computer, a direct digital controller (DDC), a programmable logic controller (PLC), or the like. In other examples the controller **420** can be any computing device, such as a handheld computer, for example, a smart phone, a tablet, a laptop, a desktop computer, or any other computing device including a processor, memory, and communication capabilities.

[0101] The pet bed **400** can also include a sensor system **421** including, for example, sensors **422***a*-**422***d*. The sensor system **421** can include one or more sensors or systems, such as load cells **422***a*-**422***d*. The sensors **422***a*-**422***d* can be other types of sensors in other examples. The sensors **422***a*-**422***d* can be connected to the frame **402** and can be in communication with the controller **420** such as to transmit a load signal (e.g., from each of the sensors **422***a*-**422***d*) to the controller **420**.

[0102] The pet bed **400** can also include an accessory module port **424** that can be connected to the frame **402** and can be in communication with the controller **420**. The accessory module port **424** can be a wireless interface (e.g., BLE) or a wired interface (e.g., Universal Serial Bus (USB)) configured to connect to one or more accessory devices, such as a white noise device **426**, a treat or food dispenser **428** (such as the pet feeding system **100**), a diffuser **430** (such as a scent or pheromone diffuser), or an image capture device **432**. Any of the accessory devices can be connected to the frame **402** and integrated into the pet bed **400** or can be independent devices incorporated or connected by a user. The image capture device **432** can be connected to the frame **402** and configured to transmit an image capture signal to the controller **420** based on imagery of an environment of the pet bed **400**, such as one or more pets or persons within the environment.

[0103] The sensor system **421** can also include an audio sensor **434**, such as a microphone. The audio sensor **434** can be connected to the frame **402** and can be configured to transmit an audio signal to the controller **420** based on one or more sounds of an environment of the pet bed **400**. The pet bed **400** can also include a speaker **436** configured to emit sounds, such as produced based on a speaker signal from the controller **420**.

[0104] The pet bed **400** can also include a power supply **438** connected to the frame **402**. The power supply **438** can be connected to any of the components of the pet bed **400** such as to deliver power thereto. The pet bed **400** can also include a transceiver **440**, which can be, for example, a low energy BLE transceiver. The transceiver **440** can be in communication with the controller **420** and can be configured to interact with one or more devices or components of the pet bed **400**, one or more external devices, or a network (e.g., the communication network **200**). Also shown in FIG. **8** is a pet sensor **442**, which can be a transceiver configured to communicate with the controller **420**, such as through the transceiver **440**.

[0105] In operation of the pet bed **400**, one or more of the sensors of the sensor system **421** can be configured to produce a sensor signal based on a condition of the cushion **404** or the frame **402**, which can be transmitted to the controller **420**. The controller **420** can receive the one or more signals and can make one or more determinations based on the signals. Optionally, the controller **420** can produce and transmit an alert (e.g., through the transceiver **440** or another transceiver) to another device, such as the mobile device **204** of the communication network **200**.

[0106] In one example, the controller **420** can receive a signal from one or more of the sensors **422**, which can be, for example, a plurality of load cells connected to the frame **402**. The controller **420** can receive the one or more load cell signals to make one or more determinations. The controller

420 can determine a mass or weight of the pet. The controller **420** can also determine occupancy or an amount of time spent by the pet in the pet bed **400**, which can be correlated to sleeping or resting time of the pet. When the frame **402** is occupied, the frame **402** can use one or more signals from the load cells **422***a-d* to determine if the pet is resting or restless/active and the controller **420** can log this time, which can be correlated to each mode. The controller **420** can transmit the determinations to an external device (such as the mobile device **204**) and can optionally produce and transmit an alert based on one or more of the signals.

[0107] The controller **420** can also identify a pet, such as based on an identification signal produced by the transceiver **440** based on one or more interactions with the pet sensor **442**. The controller **420** can be configured to produce an alert or transmit data based on the identification signal and based on one or more signals of the sensors **422**. For example, the controller **420** can determine an amount of rest time for a particular pet (e.g., Pet A) based on the identification signal and based on signals from the sensors **422**. The controller **420** can also identify a pet based on its weight (e.g., using signals from the sensors **422**), such as if there are multiple pets in the home that are of different weights. For example, Pet A can be identified because it weighs 10 kilograms, and pet B can be identified because it weighs 22 kilograms.

[0108] The controller **420** can also use the identification signal and one or more signals of the sensors **422** to determine a weight of the pet or a weight over time. The weight can be determined, for example, each time the pet uses the pet bed **400** or once per day. The weight can be transmitted to the mobile device **204** for storage by the mobile device **204** (or can be stored at the controller **420** or in memory associated with the pet bed **400**). Optionally, the controller **420** or the mobile device **204** can produce an alert based on the stored weights, such as when the weight increases or decreases relatively quickly over time. Optionally, the controller **420** can determine when the pet bed **400** is occupied and the pet is resting before determining a weight of the pet based on the sensors **422**, to help increase measurement accuracy. The controller **420** can determine if the calculated pet weight is out of a range (such as 25 percent over or under a weight of the pet) and can ignore such determinations. This can help to avoid logging incorrect data from instances where a pet lays partially on the bed and partially on the floor or another object.

[0109] In some examples, the controller **420**, the controller **120**, or the mobile device **204** can make a recommendation to adjust a food intake based on the weight or weight over time. When an adjustment is accepted, such as by a user via the mobile device **204**, the controller **120** can adjust an amount of food dispensed by the food dispenser **148**, such as an amount of food dispensed per day.

[0110] In some examples, when an environment includes the pet feeding system **100** and the pet bed **400**, the controller **420** can be in communication with the controller **120** and either the controller **120** or the controller **420** can make one or more correlations based on diet and weight. For example, a pet who has not been eating their full serving of food for several days could be further indicated by a loss of weight detected by the pet bed **400**. Further, additional insight into the health of the pet can be gained combining the historical collection and baseline of data the system has for food, water, weight, and rest along with general guideline health information for a specific breed of pet. For example, a notification can be sent to the user if either the controller **420** or the controller **120** determine that their pet is eating twice as much food as recommended, while getting more rest than average for the dogs breed and age, and as a result is significantly heavier than average.

[0111] FIG. **9** illustrates an isometric view of a pet crate system **900**. The pet crate system **900** can be similar to the pet bed **400** discussed above; the pet crate system **900** can include an enclosure, such as a crate. Any of the systems discussed above or below can be modified to include the features of the pet crate system **900**.

[0112] More specifically, the pet crate system **900** can include a frame **902**, a cushion **904**, a housing **903**, and a door **905**. The frame **902** and the cushion **904** can be similar to the frame **402** and the cushion **404**, respectively, discussed above. Alternatively, the housing **903** and door **905** can be configured to receive the pet bed **400** including the frame **402** and cushion **404**. The housing **903** can be connected to the frame **902** or can support the frame **902** therein. The housing **903** can also support the cushion **904** therein. The door **905** can be connected to the housing **903** such as to open and close the housing **903**.

[0113] FIG. **10**A illustrates an exploded perspective view of the pet crate system **900**. FIG. **10**B illustrates an enlarged perspective view of a portion of the pet crate system **900**. The pet crate system **900** can be consistent with the pet crate system **900** discussed above. FIGS. **10**A and **10**B show additional details of the pet crate system **900**. For example, FIG. **10**A shows that the frame **902** and the cushion **904** can be removed from the housing **903**, such as to use the frame **902** and the cushion **904** independently (without the housing **903**). The frame **902** and the cushion **904** can also be user-removable (including end-user removable) to adjust a size of the frame **902** (as discussed above with respect to the frame **402**) or a size of the housing **903**. For example, the housing **903** can include a joint **906** allowing the crate to move between an expanded and a contracted position.

[0114] FIG. **10**A also shows that the housing **903** can include recesses **908** configured to receive projections **910** of the frame **902** (shown in FIG. **10**B). The projections **910** can be connected to the frame **902** and located, for example on or near each corner on an underside of the frame **902**. The projections **910** can be locatable at least partially within the recesses **908** to orient the frame **902** with respect to the housing **903** and to help limit movement of the frame **902** with respect to the housing **903**.

[0115] FIG. **11** illustrates a schematic view of the pet crate system **900**. The components of the pet crate system **900** can be consistent with the pet bed **400** such that like numerals can represent like components. For example, the pet crate system **900** can include a controller **920**, a sensor system **921**, sensors **922**, an accessory module port **924**, a treat or food dispenser **928**, a diffuser **930**, an audio sensor **934**, a speaker **936**, a power supply **938**, a transceiver **940**, and a pet sensor **942**.

[0116] These components can be connected and can operate similarly to those discussed with respect to the pet bed **400**; the pet crate system **900** can include additional features or components. For example, the pet crate system **900** can include controls for the door **905**, such as a door actuator **944**, a lock actuator **946**, and a proximity sensor **948**. The door actuator **944**, the lock actuator **946**, and the proximity sensor **948** can be connected to one or more of the door **905** and the housing **903** and can be in communication with the

controller **920**. The controller **920** can operate the door actuator **944** to open and close the door **905** with respect to the housing **903** such as to allow a pet to enter or exit the housing **903**. The controller **920** can operate the lock actuator **946** to lock the door **905** to the housing **903**, such as in a closed position.

[0117] The pet crate system **900** can also include an image capture device **950** (e.g., a camera). The image capture device **950** can be connected to the housing **903** and can be configured to transmit an image capture signal to the controller **920** based on imagery of an environment of the pet crate system **900**, or within the housing **903**, such as one or more pets or persons. The pet crate system **900** can also include one or more vitals sensors **952**. The one or more vitals sensors **952** can be connected to the housing **903** or the frame **902** (or the cushion **904**) and can be in communication with the controller **920**. The one or more vitals sensors **952** can include a heart rate monitor, oxygen sensor, pulse oximeters, electrocardiogram, or the like.

[0118] The pet crate system **900** can also include a cooling pad **954** and a heating pad **956**. The cooling pad **954** and the heating pad **956** can be connected to the housing **903** or the frame **902** and can be in contact with the cushion **904** such as to provide cooling or heating, respectively, to the cushion **904** and a pet therein. The cooling pad **954** and the heating pad **956** can also be in communication with the controller **920** such that the controller **920** can control operation of the cooling pad **954** and the heating pad **956**. The pet crate system **900** can also include a temperature sensor **958** that can be connected to the frame **902**, the housing **903**, or the cushion **904**.

[0119] The pet crate system **900** can also include a frame actuator **960** and a frame position sensor **962**. The frame actuator **960** can be connected to one or more parts of the frame and can be in communication with the controller **920**. The frame position sensor **962** can be connected to the frame actuator **960** and can be in communication with the controller **920**. Optionally, the frame position sensor **962** can be integral to the frame actuator **960**.

[0120] In operation, the controller **920** can operate the frame actuator **960** to adjust a size of the frame **902** between an expanded position and a contracted position, such as by modifying a length or width of the frame **902**. The frame position sensor **962** can transmit a position signal to the controller **920** allowing the controller **920** to determine a size (e.g., length or width) of the frame **902**. In some examples, the controller **920** can receive a signal from a user device (e.g., the mobile device **204**) to select a size of the frame **902** and can operate the frame actuator **960** to adjust the size of the frame **902** accordingly. Also, the controller **920** can identify a pet, such as using an identification signal from the transceiver **940** or using an image signal from the image capture device **950** and can change the size of the frame **902** based on the identified pet. Optionally, the controller **920** can detect the presence of a pet using signals from one or more of the transceiver **940**, the image capture device **950**, or load cells **922**, and the controller **920** can limit or prevent any adjustment of the crate size when a pet is detected.

[0121] In some examples, the controller **920** can operate the door actuator **944** and the lock actuator **946** based on identification of a pet, which can be determined by the controller **920** using an identification signal from the transceiver **940** or using an image signal from the image capture device **950**. The controller **920** can also operate the door actuator **944** and the lock actuator **946** based on identification and one or more other signals or criteria, such as a predetermined schedule.

[0122] Also, in operation, the controller **920** can monitor one or more of the sensors of the sensor system **921** and can produce an alert upon occurrence of one or more events or when a threshold is exceeded. For example, when the one or more vitals sensors **952** is a heart rate monitor, the controller **920** can produce an alert when the heart rate is determined to be above a threshold or below a threshold (or out of a range).

[0123] The controller **920** can also operate the cooling pad **954** or the heating pad **956**, such as based on a temperature signal from the temperature sensor **958** and one or more signals from other devices, such as the mobile device **204**. For example, the mobile device **204** can deliver a setpoint temperature to the controller **920**, and the controller **920** can operate the cooling pad **954** or the heating pad **956** to maintain the cushion **904** or an air temperature within the housing **903** to the setpoint temperature. Optionally, the mobile device **204** can interface with other third-party applications to enable a heating or cooling pad. For example, a smart thermostat on the mobile device **204** can determine or receive a temperature of the environment and can determine whether the temperature is above or below a certain threshold. The controller **920** can autonomously enable a heating or cooling pad in the crate when the temperature is determined to be outside the range or beyond the threshold.

[0124] Also, the controller **920** can transmit data or alerts (such as those described above) to one or more devices of the communication network **20**, such as the mobile device **204**. The mobile device **204** can also be configured to display a dashboard on a screen **205** of the device. The dashboard can be configured to display information about the pet crate system **900** throughout a day, such as based on one or more signals from the pet crate system **900**. The mobile device **204** or the pet crate system **900** can also store data from one or more sensors of the pet crate system **900** or from one or more determinations made by the controller **920** or the mobile device **204**.

[0125] The pet crate system **900** or the mobile device **204** can use the stored data to determine trends, such as short-term or long-term trends including eating and drinking trends of a pet. Regular analysis of the trends, including in comparison to new data, can help the controller **920** or the mobile device **204** determine health or wellness of a pet. The pet crate system **900** or the mobile device **204** can use any or all data reported from devices in the system. For example, data from the pet feeding system **100** or the pet bed **400** can be used to determine a general health metric associated with a pat, which can be indicated on the dashboard based on their metrics for a given day compared to metrics collected historically, such as to provide a baseline, e.g., for comparison.

[0126] In some examples, the daily dashboard can display one or more data points per day, which can help a user to track, for example, rest of the pet. The controller **920** can determine pet rest based on one or more signals from the load cells **922**, and the amount of rest can be displayed on the screen **205**, such as in an hour-by-hour overview of rest. The controller **920** or the mobile device **204** can also perform long-term or trend analysis using data from the signals, which can be correlated to general health and

wellness and can be used to identify potential health issues. The trends or correlated health and wellness can be displayed on the dashboard on the screen **205**.

[0127] The pet crate system **900** can also be used for training a pet to stay or rest in the pet crate system **900**, such as by automatically opening or locking the door **905** using the door actuator **944** or the lock actuator **946** based on a schedule or identification of the pet. The controller **920** can use one or more signals from the sensors **922** during a training period to monitor trends in rest, such as improvements in rest during the training period.

[0128] Optionally, one or more additional parameters in a mobile device application (e.g., of the mobile device **204**) can allow for customization of when the pet can be let out of the pet crate system **900**. For example, the controller **920** can open the door **905** after a set amount of time to help ensure the pet is rested before being free to play/roam. Optionally, the application could indicate that the door **905** should open automatically upon the mobile device **204** to a home network (such as following a period where the **204** has not been connected to the home network), enabling the pet to be let out of the crate **900** and waiting for their owner when returning home.

[0129] The controller **920** can also use one or more signals from the sensors **922** to determine sleep quality or restlessness, such as based on changes in the signals from the sensors **922**. The controller **920** can also use one or more signals from the sensors **922** to determine where in the housing **903** (or frame **902**) the pet is located when the restlessness occurs. The controller **920** can use this information (or one or more signals from the sensors **922**) to monitor trends in restlessness and can transmit one or more alerts or data regarding restlessness to the mobile device **204**. The controller **920** can also use the audio sensor **934** to help with restlessness, such as by playing a pre-recorded audio message or by playing audio transmitted from the mobile device **204**. Optionally, specific recommendations can be made to the user depending one where restlessness is occurring within the pet crate system **900**. For example, if the controller **920** determines that restlessness occurs near the front door, the controller **920** can determine (and can transmit such a determination) that the pet wants to be let out for one reason or another. If the controller **920** determines that restlessness occurs in the back of the crate, the controller **920** can determine (and can transmit such a determination) that the pet is anxious or afraid.

[0130] The controller **920** can also use signals from one or more of the sensors **922** to determine whether a size of the frame **902** or the housing **903** needs to be adjusted based on restlessness, lack of use, changes in size of the pet (e.g., weight), or other determinations.

[0131] Optionally, the controller **920** can use one or more signals or data to determine or predict when events may occur. For example, the controller **920** can determine that a pet has been in the housing **903** for three hours based on the sensors **922** and the controller **920** can receive a signal from the communication network **200** or the controller **120** indicating that the pet consumed 100 ml of water before entering the housing **903**. The controller **920** can determine, in consideration of water intake and based on restlessness, that the pet may need to be taken outside and can transmit an alert to the mobile device **204** indicating as much. The controller **920** or the mobile device **204** can also consider the breed of the pet, its age, or its size in making such a determination before producing an alert.

[0132] In some examples, restlessness occurring at a specific time each day can be identified and logged by the controller **920** such as to create a trend over time. The data can optionally be used by the controller **920** to determine events that occur near restlessness. Optionally, the controller **920** can operate the diffuser **930** to release a calming pheromone and can operate the speaker **936** to play white noise ahead of an event, which can help calm the pet before the anxiety occurs and may prevent it altogether. Such data and events can be provided to the user in a dashboard on mobile device **204**, optionally making note of the improvement in behavior/anxiety.

[0133] The controller **920** can also transmit alerts to the mobile device **204** (or the mobile device **204** can produce an alert) based on one or more rules. For example, the user can create a rule to remind (e.g., via an alert) the pet owner to give their pet a break from the crate at specified timer intervals or times of the day.

[0134] Any or all of the data collected can be stored or used to produce one or more trends, which can be optionally transmitted (e.g., from the controller **920**) to the mobile device **204** where the mobile device **204** can use the data or trends in the form of a digital training coach. The application (e.g., the digital trainer) can make recommendations and observations to help users, such as new pet owners, with behavior training, such as crate training or potty training. The data or trends can be used to offer encouragement to the pet owner. For example, "Your puppy whined an average of 78 minutes per night last week and only 36 minutes per night this week." The mobile device **204** can also be configured to transmit message such as tips and tricks for their pet based on the data we have gathered, such as, "your pet is not drinking enough water", "your pet is resting too much", "your pet is spending too much time locked in the crate", or, "your pet is eating too much."

[0135] For example, the controller **920** or the mobile device **204** can also transmit notes of encouragement or reassurance. For example, "we know your dog is whining, but let's wait a few minutes so we hit our Crate goal of 7 minutes." The controller **920** or the mobile device **204** can also produce recommendations to help with pet training such as potty training, crate training, or a feeding schedule. The controller **920** or the mobile device **204** can provide messages or reminders to help maintain a schedule or to help acclimate the pet to the training activity.

[0136] FIG. **12** illustrates a perspective view of a pet bed system **1200**. The pet bed system **1200** can be similar to the pet crate system **900** discussed above. The pet bed system **1200** can differ in that the pet bed system **1200** can include a cover (or front door) **1264**, which can be a passive opening cover or a retractable and cover. Optionally, the cover **1264** can be relatively flexible. Any of the systems discussed above or below can be modified to include the features of the pet bed system **1200**.

[0137] FIG. **13** illustrates a perspective view of a pet bed system **1300**. The pet bed system **1300** can be similar to the pet bed systems discussed above. The pet bed system **1300** can differ in that the pet bed system **1300** can include a door **1366**, which can be a retractable door. Optionally, the door **1366** can be connected to an actuator (e.g., an opener) and in communication with a controller (e.g., the controller **920**), such that the controller can open and close the **1366** based

on one or more sensor signals. Any of the systems discussed above or below can be modified to include the features of the pet bed system **1300**.

[0138] FIG. **14**A illustrates a perspective view of a pet bed system **1400** in a first condition. FIG. **14**B illustrates a perspective view of the pet bed system **1400** in a second condition. The pet bed system **1400** can be similar to the pet bed systems discussed above. The pet bed system **1400** can include a housing **1403** that is adjustable, where the adjustment can be passive, such as requiring user interaction, or can be automated, such as via a controller and one or more actuators. Any of the systems discussed above or below can include the features of the pet bed system **1400**.

[0139] The **1403** include a front portion **1468**, a center portion **1470**, and a rear portion **1472**. As shown in FIG. **14**A, the front portion **1468** and the rear portion **1472** can be movable with respect to each other and with respect to the center portion **1470** to adjust a length of the housing **1403**. In this way, the housing **1403** can be adjustable to accommodate pets of different sizes or to accommodate a growing pet. Optionally, open areas created by the panels of the portions or panels moving away from each other can be closed using an extensible material such a fabric, netting, or mesh, or can be closed using one or more interconnected linkages.

[0140] As shown in FIG. **14**B, the front portion **1468** can include a left portion **1474**, a middle portion **1476**, and a right portion **1478**. As shown in FIG. **14**B, the left portion **1474** and right portion **1478** can be movable with respect to each other and with respect to the middle portion **1476** to adjust a width of the housing **1403**. The rear portion **1472** can be similarly configured to the front portion **1468** and the length can be adjustable independent of the width. In this way, the housing **1403** can be adjustable to accommodate pets of different sizes or to accommodate a growing pet.

[0141] FIG. **15** illustrates a block diagram of an example machine **1500** upon which any one or more of the techniques (e.g., methodologies) discussed herein may perform. Examples, as described herein, may include, or may operate by, logic or a number of components, or mechanisms in the machine **1500**. Circuitry (e.g., processing circuitry) is a collection of circuits implemented in tangible entities of the machine **1500** that include hardware (e.g., simple circuits, gates, logic, etc.). Circuitry membership may be flexible over time. Circuitries include members that may, alone or in combination, perform specified operations when operating. In an example, hardware of the circuitry may be immutably designed to carry out a specific operation (e.g., hardwired). In an example, the hardware of the circuitry may include variably connected physical components (e.g., execution units, transistors, simple circuits, etc.) including a machine readable medium physically modified (e.g., magnetically, electrically, moveable placement of invariant massed particles, etc.) to encode instructions of the specific operation. In connecting the physical components, the underlying electrical properties of a hardware constituent are changed, for example, from an insulator to a conductor or vice versa. The instructions enable embedded hardware (e.g., the execution units or a loading mechanism) to create members of the circuitry in hardware via the variable connections to carry out portions of the specific operation when in operation. Accordingly, in an example, the machine-readable medium elements are part of the circuitry or are communicatively coupled to the other components of the circuitry when the device is operating. In an example, any of the physical components may be used in more than one member of more than one circuitry. For example, under operation, execution units may be used in a first circuit of a first circuitry at one point in time and reused by a second circuit in the first circuitry, or by a third circuit in a second circuitry at a different time. Additional examples of these components with respect to the machine **1500** follow.

[0142] In alternative embodiments, the machine **1500** may operate as a standalone device or may be connected (e.g., networked) to other machines. In a networked deployment, the machine **1500** may operate in the capacity of a server machine, a client machine, or both in server-client network environments. In an example, the machine **1500** may act as a peer machine in peer-to-peer (P2P) (or other distributed) network environment. The machine **1500** may be a personal computer (PC), a tablet PC, a set-top box (STB), a personal digital assistant (PDA), a mobile telephone, a web appliance, a network router, switch or bridge, or any machine capable of executing instructions (sequential or otherwise) that specify actions to be taken by that machine. Further, while only a single machine is illustrated, the term "machine" shall also be taken to include any collection of machines that individually or jointly execute a set (or multiple sets) of instructions to perform any one or more of the methodologies discussed herein, such as cloud computing, software as a service (SaaS), other computer cluster configurations.

[0143] The machine (e.g., computer system) **1500** may include a hardware processor **1502** (e.g., a central processing unit (CPU), a graphics processing unit (GPU), a hardware processor core, or any combination thereof), a main memory **1504**, a static memory (e.g., memory or storage for firmware, microcode, a basic-input-output (BIOS), unified extensible firmware interface (UEFI), etc.) **1506**, and mass storage **1508** (e.g., hard drive, tape drive, flash storage, or other block devices) some or all of which may communicate with each other via an interlink (e.g., bus) **1530**. The machine **1500** may further include a display unit **1510**, an alphanumeric input device **1512** (e.g., a keyboard), and a user interface (UI) navigation device **1514** (e.g., a mouse). In an example, the display unit **1510**, input device **1512** and UI navigation device **1514** may be a touch screen display. The machine **1500** may additionally include a storage device (e.g., drive unit) **1508**, a signal generation device **1518** (e.g., a speaker), a network interface device **1520**, and one or more sensors **1516**, such as a global positioning system (GPS) sensor, compass, accelerometer, or other sensor. The machine **1500** may include an output controller **1528**, such as a serial (e.g., universal serial bus (USB), parallel, or other wired or wireless (e.g., infrared (IR), near field communication (NFC), etc.) connection to communicate or control one or more peripheral devices (e.g., a printer, card reader, etc.).

[0144] Registers of the processor **1502**, the main memory **1504**, the static memory **1506**, or the mass storage **1508** may be, or include, a machine readable medium **1522** on which is stored one or more sets of data structures or instructions **1524** (e.g., software) embodying or utilized by any one or more of the techniques or functions described herein. The instructions **1524** may also reside, completely or at least partially, within any of registers of the processor **1502**, the main memory **1504**, the static memory **1506**, or the mass storage **1508** during execution thereof by the machine **1500**.

In an example, one or any combination of the hardware processor **1502**, the main memory **1504**, the static memory **1506**, or the mass storage **1508** may constitute the machine-readable media **1522**. While the machine readable medium **1522** is illustrated as a single medium, the term "machine readable medium" may include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) configured to store the one or more instructions **1524**.

[0145] The term "machine readable medium" may include any medium that is capable of storing, encoding, or carrying instructions for execution by the machine **1500** and that cause the machine **1500** to perform any one or more of the techniques of the present disclosure, or that is capable of storing, encoding or carrying data structures used by or associated with such instructions. Non-limiting machine readable medium examples may include solid-state memories, optical media, magnetic media, and signals (e.g., radio frequency signals, other photon based signals, sound signals, etc.). In an example, a non-transitory machine readable medium comprises a machine readable medium with a plurality of particles having invariant (e.g., rest) mass, and thus are compositions of matter. Accordingly, non-transitory machine-readable media are machine readable media that do not include transitory propagating signals. Specific examples of non-transitory machine readable media may include: non-volatile memory, such as semiconductor memory devices (e.g., Electrically Programmable Read-Only Memory (EPROM), Electrically Erasable Programmable Read-Only Memory (EEPROM)) and flash memory devices; magnetic disks, such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks.

[0146] The instructions **1524** may be further transmitted or received over a communications network **1526** using a transmission medium via the network interface device **1520** utilizing any one of a number of transfer protocols (e.g., frame relay, internet protocol (IP), transmission control protocol (TCP), user datagram protocol (UDP), hypertext transfer protocol (HTTP), etc.). Example communication networks may include a local area network (LAN), a wide area network (WAN), a packet data network (e.g., the Internet), mobile telephone networks (e.g., cellular networks), Plain Old Telephone (POTS) networks, and wireless data networks (e.g., Institute of Electrical and Electronics Engineers (IEEE) 802.11 family of standards known as Wi-Fi®, IEEE 802.16 family of standards known as WiMax®), IEEE 802.15.4 family of standards, peer-to-peer (P2P) networks, among others. In an example, the network interface device **1520** may include one or more physical jacks (e.g., Ethernet, coaxial, or phone jacks) or one or more antennas to connect to the communications network **1526**. In an example, the network interface device **1520** may include a plurality of antennas to wirelessly communicate using at least one of single-input multiple-output (SIMO), multiple-input multiple-output (MIMO), or multiple-input single-output (MISO) techniques. The term "transmission medium" shall be taken to include any intangible medium that is capable of storing, encoding or carrying instructions for execution by the machine **1500**, and includes digital or analog communications signals or other intangible medium to facilitate communication of such software. A transmission medium is a machine readable medium.

NOTES AND EXAMPLES

[0147] The following, non-limiting examples, detail certain aspects of the present subject matter to solve the challenges and provide the benefits discussed herein, among others.

[0148] Example 1 is a pet feeding system comprising: a housing; a food tray connected to the housing; a liquid tray connected to the housing; a food dispenser connected to the housing and configured to dispense food into the food tray; a liquid dispenser connected to the housing and configured to dispense liquid into the liquid tray; a controller communicatively connected to the food dispenser and the liquid dispenser, the controller configured to: operate the food dispenser to dispense the food into the food tray; and operate the liquid dispenser to dispense liquid into the liquid tray.

[0149] In Example 2, the subject matter of Example 1 includes, a food sensor connected to the food tray, the food sensor configured to produce a food sensor signal based on a condition of the food tray, the controller configured to operate the food dispenser based on the food sensor signal.

[0150] In Example 3, the subject matter of Example 2 includes, a liquid sensor connected to the liquid tray, the liquid sensor configured to produce a liquid sensor signal based on a condition of the liquid tray, the controller configured to operate the liquid dispenser based on the liquid sensor signal.

[0151] In Example 4, the subject matter of Example 3 includes, wherein the liquid sensor is a force sensor and wherein the controller is configured to determine a weight of liquid within the liquid tray and dispense liquid based on the determined weight.

[0152] In Example 5, the subject matter of Example 4 includes, wherein the food sensor is a force sensor and wherein the controller is configured to determine a weight of food within the food tray and dispense food based on the determined weight.

[0153] In Example 6, the subject matter of Examples 2-5 includes, a liquid sensor connected to the liquid tray, the liquid sensor configured to produce a liquid sensor signal based on a condition of the liquid tray, the controller configured to operate the liquid dispenser based on the liquid sensor signal.

[0154] In Example 7, the subject matter of Examples 2-6 includes, a supplement dispenser connected to the housing, the controller configured to operate the supplement dispenser, based on the food sensor signal, to dispense a supplement into the food tray.

[0155] In Example 8, the subject matter of Examples 1-7 includes, an identification sensor configured to produce an identification signal based on interaction with an identification device associated with a pet, the controller configured to operate one or more of the liquid dispenser and the food dispenser based on the identification signal.

[0156] In Example 9, the subject matter of Example 8 includes, a medication dispenser connected to the housing, the controller configured to operate the medication dispenser based on the identification signal.

[0157] In Example 10, the subject matter of Examples 8-9 includes, an actuator connected to the food tray and the liquid tray to move the food tray and the liquid tray between a stored position and a deployed position, the controller configured to operate the actuator based on the identification signal.

[0158] In Example 11, the subject matter of Example 10 includes, a liquid quality sensor connected to the liquid tray and configured to produce a liquid quality signal based on liquid within the liquid tray, the controller configured to operate the actuator based on the liquid quality signal.

[0159] Example 12 is a pet bed system comprising: a cushion; a frame engageable with a floor surface and configured to support the cushion at least partially above the floor surface; a sensor connected to the frame, the sensor configured to produce a sensor signal based on a condition of the cushion and the frame; and a controller communicatively configured to: produce an alert based on the sensor signal.

[0160] In Example 13, the subject matter of Example 12 includes, a plurality of load cells connected to the frame, the controller configured to produce an alert based on one or more signals from one or more of the plurality of load cells.

[0161] In Example 14, the subject matter of Examples 12-13 includes, an identification sensor connected to the frame and configured to produce an identification signal based on interaction with an identification device connected to a pet, the controller configured to produce the alert based on the sensor signal and the identification signal.

[0162] In Example 15, the subject matter of Example 14 includes, an actuator connected to the frame, the controller configured to operate the actuator to move the frame between an expanded position and a contracted position.

[0163] In Example 16, the subject matter of Examples 12-15 includes, a crate connected to the frame and configured to at least partially enclose the cushion, the crate including a door movable between an open position and a closed position.

[0164] In Example 17, the subject matter of Example 16 includes, an image capture device connected to the crate and configured to produce an image capture signal, the controller configured to identify a pet based on the image capture signal, and the controller configured to move the door based on the identified pet.

[0165] In Example 18, the subject matter of Example 17 includes, an actuator connected to the frame and the crate, the controller configured to operate the actuator to move the frame and the crate between an expanded position and a contracted position.

[0166] In Example 19, the subject matter of Examples 16-18 includes, wherein the controller is configured to operate the actuator based on the identified pet.

[0167] In Example 20, the subject matter of Examples 17-19 includes, a heating or cooling device connected to the crate or the frame and in thermal communication with the cushion, wherein the sensor is a temperature sensor connected to the frame or the crate configured to produce a temperature signal based on a temperature within the crate, and wherein the controller is configured to operate the heating or cooling device based on the temperature signal.

[0168] Example 21 is a method of operating a pet feeding system, the method comprising: operating a food dispenser to dispense the food into a food tray of connected to a housing; and operating a liquid dispenser to dispense liquid into a liquid tray connected to the housing.

[0169] In Example 22, the subject matter of Example 21 includes, receiving a food sensor signal indicative of a condition of the food tray; and operating the food dispenser based on the food sensor signal.

[0170] In Example 23, the subject matter of Example 22 includes, receiving a liquid sensor signal indicative of a condition of the liquid tray; and operating the liquid dispenser based on the liquid sensor signal.

[0171] In Example 24, the subject matter of Example 23 includes, determining a weight of liquid within the liquid tray based on the liquid sensor signal; and dispensing liquid based on the determined weight.

[0172] Example 25 is at least one machine-readable medium including instructions that, when executed by processing circuitry, cause the processing circuitry to perform operations to implement of any of Examples 1-24.

[0173] Example 26 is an apparatus comprising means to implement of any of Examples 1-24.

[0174] Example 27 is a system to implement of any of Examples 1-24.

[0175] Example 28 is a method to implement of any of Examples 1-24.

[0176] In Example 29, the apparatuses or method of any one or any combination of Examples 1-28 can optionally be configured such that all elements or options recited are available to use or select from.

[0177] The above detailed description includes references to the accompanying drawings, which form a part of the detailed description. The drawings show, by way of illustration, specific embodiments in which the invention can be practiced. These embodiments are also referred to herein as "examples." Such examples can include elements in addition to those shown or described. However, the present inventors also contemplate examples in which only those elements shown or described are provided. Moreover, the present inventors also contemplate examples using any combination or permutation of those elements shown or described (or one or more aspects thereof), either with respect to a particular example (or one or more aspects thereof), or with respect to other examples (or one or more aspects thereof) shown or described herein.

[0178] In this document, the terms "a" or "an" are used, as is common in patent documents, to include one or more than one, independent of any other instances or usages of "at least one" or "one or more." In this document, the term "or" is used to refer to a nonexclusive or, such that "A or B" includes "A but not B," "B but not A," and "A and B," unless otherwise indicated. In this document, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Also, in the following claims, the terms "including" and "comprising" are open-ended, that is, a system, device, article, composition, formulation, or process that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim. Moreover, in the following claims, the terms "first," "second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects.

[0179] In the event of inconsistent usages between this document and any documents so incorporated by reference, the usage in this document controls. In this document, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Also, in the following claims, the terms "including" and "comprising" are open-ended, that is, a system, device, article, composition, formulation, or process

that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim.

[0180] The above description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) may be used in combination with each other. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above description. The Abstract is provided to comply with 37 C.F.R. § 1.72(b), to allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. Also, in the above Detailed Description, various features may be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter may lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description as examples or embodiments, with each claim standing on its own as a separate embodiment, and it is contemplated that such embodiments can be combined with each other in various combinations or permutations. The scope of the invention should be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

1. A pet feeding system comprising:
a housing;
a food tray connected to the housing;
a liquid tray connected to the housing;
a food dispenser connected to the housing and configured to dispense food into the food tray;
a liquid dispenser connected to the housing and configured to dispense liquid into the liquid tray; and
a controller communicatively connected to the food dispenser and the liquid dispenser, the controller configured to:
operate the food dispenser to dispense the food into the food tray; and
operate the liquid dispenser to dispense liquid into the liquid tray.

2. The pet feeding system of claim **1**, comprising:
a food sensor connected to the food tray, the food sensor configured to produce a food sensor signal based on a condition of the food tray, the controller configured to operate the food dispenser based on the food sensor signal.

3. The pet feeding system of claim **2**, comprising:
a liquid sensor connected to the liquid tray, the liquid sensor configured to produce a liquid sensor signal based on a condition of the liquid tray, the controller configured to operate the liquid dispenser based on the liquid sensor signal.

4. The pet feeding system of claim **3**, wherein the liquid sensor is a force sensor and wherein the controller is configured to determine a weight of liquid within the liquid tray and dispense liquid based on the determined weight.

5. The pet feeding system of claim **4**, wherein the food sensor is a force sensor and wherein the controller is configured to determine a weight of food within the food tray and dispense food based on the determined weight.

6. The pet feeding system of claim **2**, comprising:
a supplement dispenser connected to the housing, the controller configured to operate the supplement dispenser, based on the food sensor signal, to dispense a supplement into the food tray.

7. The pet feeding system of claim **1**, comprising:
a liquid sensor connected to the liquid tray, the liquid sensor configured to produce a liquid sensor signal based on a condition of the liquid tray, the controller configured to operate the liquid dispenser based on the liquid sensor signal.

8. The pet feeding system of claim **1**, comprising:
an identification sensor configured to produce an identification signal based on interaction with an identification device associated with a pet, the controller configured to operate one or more of the liquid dispenser and the food dispenser based on the identification signal.

9. The pet feeding system of claim **8**, comprising:
a medication dispenser connected to the housing, the controller configured to operate the medication dispenser based on the identification signal.

10. The pet feeding system of claim **8**, comprising:
an actuator connected to the food tray and the liquid tray to move the food tray and the liquid tray between a stored position and a deployed position, the controller configured to operate the actuator based on the identification signal.

11. The pet feeding system of claim **10**, comprising:
an liquid quality sensor connected to the liquid tray and configured to produce a liquid quality signal based on liquid within the liquid tray, the controller configured to operate the actuator based on the liquid quality signal.

12. A pet bed system comprising:
a cushion;
a frame engageable with a floor surface and configured to support the cushion at least partially above the floor surface;
a sensor connected to the frame, the sensor configured to produce a sensor signal based on a condition of the cushion and the frame; and
a controller communicatively configured to:
produce an alert based on the sensor signal.

13. The pet bed system of claim **12**, comprising:
a plurality of load cells connected to the frame, the controller configured to produce an alert based on one or more signals from one or more of the plurality of load cells.

14. The pet bed system of claim **12**, comprising:
an identification sensor connected to the frame and configured to produce an identification signal based on interaction with an identification device connected to a pet, the controller configured to produce the alert based on the sensor signal and the identification signal.

15. The pet bed system of claim **14**, comprising:
an actuator connected to the frame, the controller configured to operate the actuator to move the frame between an expanded position and a contracted position.

16. The pet bed system of claim **12**, comprising:
a crate connected to the frame and configured to at least partially enclose the cushion, the crate including a door movable between an open position and a closed position.

17. The pet bed system of claim **16**, comprising:

an image capture device connected to the crate and configured to produce an image capture signal, the controller configured to identify a pet based on the image capture signal, and the controller configured to move the door based on the identified pet.

18. The pet bed system of claim **17**, comprising:

an actuator connected to the frame and the crate, the controller configured to operate the actuator to move the frame and the crate between an expanded position and a contracted position.

19. The pet bed system of claim **18**, wherein the controller is configured to operate the actuator based on the identified pet.

20. The pet bed system of claim **17**, comprising:

a heating or cooling device connected to the crate or the frame and in thermal communication with the cushion, wherein the sensor is a temperature sensor connected to the frame or the crate configured to produce a temperature signal based on a temperature within the crate, and wherein the controller is configured to operate the heating or cooling device based on the temperature signal.

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