(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 November 2011 (10.11.2011)

PCT

(10) International Publication Number
WO 2011/139230 A2

(51) International Patent Classification:
H04L 12/24 (2006.01) *H04L 12/12* (2006.01)
H04L 12/26 (2006.01) *H04L 12/16* (2006.01)

(21) International Application Number:
PCT/SG2011/000167

(22) International Filing Date:
29 April 2011 (29.04.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201003121-9 3 May 2010 (03.05.2010) SG

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) Title: SYSTEM AND METHOD FOR AUTOMATIC APPLIANCE MANAGEMENT

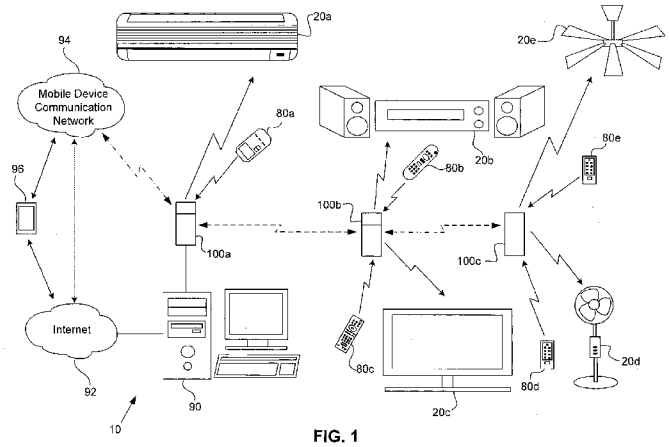

FIG. 1

(57) Abstract: An appliance management device can record or store sets of appliance control signals output by remote control units associated with distinct appliances. Such appliances can differ in appliance type and/or manufacturer. Distinct appliance control signal sets stored within the appliance management device can be identical, similar, or dissimilar with respect to type, format, or communication protocol. In response to detecting a lack of human activity, the appliance management device automatically outputs stored control signal sets to transition a group of appliances to an overall reduced power state. While in an alert mode, in response to detecting an alert condition indicating the presence of human activity or a threshold condition (e.g., a threshold temperature), the appliance management device automatically sends a corresponding SMS message or an e-mail message. Appliance management devices can form an appliance management device network in which status information or notifications can be communicated between appliance management devices.

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SYSTEM AND METHOD FOR AUTOMATIC APPLIANCE MANAGEMENT

Technical Field

The present disclosure generally relates to devices configured to automatically manage or control appliances that are responsive to remote control signals. More particularly, various embodiments of the disclosure relate to an automatic appliance management device that is suitable for at least one of controlling a set of appliances, adapting the operation of a set of appliances in accordance with real-time environmental situations, communicating with other appliance management devices, and transmitting environmental alerts or status information over a network.

Background

Electric appliances and devices can be manually controlled by an operator via control buttons or inputs located on the electric appliances/devices themselves. However, for operator ease and convenience, remote control devices have been developed. Electric appliances/devices which are responsive to remote control signals generated by remote control devices are now widespread, and can be found within premises such as homes, offices and commercial buildings. Examples of such electric appliances/devices include air-conditioning units, heater units, fans, computer-controlled devices, display units, entertainment systems and televisions.

For the purpose of adapting the operation of an electric appliance/device according to a real-time environmental situation, electric appliance/device control techniques predominantly depend on the operator to utilize an appliance-specific remote control to transmit control signals to the electric appliance/device in accordance with a particular real-time environmental situation. For example, in a situation where the operator leaves the vicinity of an active electric appliance/device and neglects to power down the appliance/device, the appliance/device will remain in operation, unnecessarily consuming power, until the operator or another individual returns to power it down. Existing electric appliance/device control techniques fail to adequately adapt the operation of appliances/devices in an operator's absence.

In addition, a given electric appliance/device is paired with a corresponding dedicated remote control device. Remote control signals transmitted by a given remote control device are unique to the type or brand of electric appliance/device that it controls. Control of a plurality of electric appliances/devices typically requires a corresponding plurality of remote control devices. Thus, an operator desiring to control a plurality of electric appliances/devices is tasked with the need to locate or identify a dedicated remote control device for each specific electric appliance/device. As such, conventional electric appliance/device control techniques undesirably inconvenience the operator with respect to controlling a plurality of electric appliances/devices.

It is therefore desirable to provide a solution to address at least one of the foregoing problems associated with conventional electric appliances/device control techniques.

Summary

In an embodiment, an automatic or automated appliance management device (AAMD) can learn, record, or store one or more sets of appliance control signals that are output by remote control units associated with distinct appliances, where such appliances can be identical, similar, or dissimilar with respect to appliance type, appliance manufacturer, control signal type, control signal format, and/or control signal communication protocol. Appliance control signal sets stored in an AAMD can be referred to as counterpart control signals that functionally mimic or match primary or source control signals generated by remote control devices used to program the AAMD.

An AAMD can record and automatically issue or transmit on a selective basis stored appliance control signal sequences to essentially any type of remote controlled appliance. Correspondingly, an AAMD can receive and learn, record, or store appliance control signals generated by essentially any type of remote control unit or device. An AAMD can therefore automatically control multiple appliances in a manner that is independent of appliance type and/or manufacturer. In an embodiment, an AAMD can additionally learn, record, or store appliance control signals output by another AAMD.

In various embodiments, sets of stored appliance control signals are directed to transitioning appliances corresponding thereto to an overall reduced power consumption state (in which at least one appliance can remain in an on or active state) or a zero power consumption state. An AAMD can therefore be categorized as an automatic or automated energy saving or energy management device.

An AAMD's selective issuance of appliance control signal sets or sequences to one or multiple appliances can be based upon one or more sensed or monitored conditions in the AAMD's external environment. For instance, in the event that an AAMD detects a lack of human activity in its external environment across a predetermined or programmable time interval, the AAMD can automatically output a plurality of stored appliance control signal sets, where each such appliance control signal set corresponds to a distinct appliance.

In response to user input, an AAMD can be transitioned to an alert or alarm mode. While in alert mode, in response to detecting an alert condition in its external environment, the AAMD can automatically transmit one or more SMS messages and/or e-mail messages to a network. An alert condition can correspond to, for instance, the presence of human activity, or the existence of a threshold condition such as a threshold temperature, a threshold lighting condition, or a threshold audio condition.

Individual AAMDs can communicate with each other in the context of an AAMD network. Communication between AAMDs can involve the transfer or exchange status information or notifications, which can indicate the existence of human activity in an AAMD's environment, and which can delay or prevent the output of appliance control signal sets. In response to the receipt of status information or a notification, a given AAMD can delay or avoid the output of stored appliance control signals, for instance, for a predetermined period of time.

In accordance with an aspect of the disclosure, an automated appliance management process includes storing a plurality of appliance control signal sets in an AAMD, each appliance control signal set corresponding to a distinct appliance within a

plurality of appliances, each appliance control signal set including at least one control instruction for adjusting an operating state of a corresponding appliance; monitoring, sensing, or detecting a set of environmental conditions in an environment corresponding to the AAMD; determining whether a monitored, sensed, or detected environmental condition indicates whether the plurality of appliances is to be transitioned to an overall reduced power consumption state or a zero power consumption state; and automatically outputting the plurality of appliance control signal sets if the plurality of appliances is to be transitioned to either a reduced overall or zero power consumption state. A monitored, sensed, or detected environmental condition that indicates the plurality of appliances is to be transitioned to a reduced or zero power consumption state can correspond to a lack of human activity (e.g., as determined in association with a motion detector or other device) during a predetermined or programmably specified time interval.

In accordance with an aspect of the disclosure, transitioning a plurality of appliances to an overall reduced power state can involve transitioning the plurality of appliances to a zero power consumption state, or transitioning some appliances to a zero power consumption state while leaving other appliances in an on or active state, which can be a reduced power state. For instance, the AAMD can issue an appliance control signal set to an air conditioner to automatically increase the air conditioner's temperature setpoint, thereby reducing the amount of energy the air conditioner consumes.

Additionally or alternatively, transitioning the plurality of appliances to an overall reduced power state can involve transitioning particular appliances to a reduced power consumption state or a zero power consumption state, as well as transitioning other appliances from an off or zero power consumption state to an on or active state. For instance, an AAMD can automatically issue one appliance control signal set to an air conditioner to turn the air conditioner off, and issue another appliance control signal set to a fan to turn the fan on, thereby reducing an overall level of power consumption by turning off an appliance that consumes a greater amount of energy than another appliance.

In accordance with another aspect of the disclosure, a first appliance control signal set can correspond to a first appliance, and a second appliance control signal set can correspond to a second appliance, where the first and second appliances can differ in terms of one or both of appliance type and appliance manufacturer. The first and second appliance control signal sets can differ from each other with respect to one or more of a control signal type, a control signal format, and a control signal communication protocol.

According to an aspect of the disclosure, an automated appliance management process can involve storing at least one set of appliance control signals in an AAMD, the set of appliance control signals including at least one control instruction for adjusting an operating state of an appliance; monitoring a set of environmental conditions in an environment corresponding to the AAMD; determining whether an environmental condition in the environment corresponding to the AAMD indicates that the set of appliance control signals is to be output; automatically outputting the set of appliance control signals in the event that the environmental condition in the environment corresponding to the AAMD indicates that the set of appliance control signals is to be output.

An aspect of the disclosure can involve one or more of the preceding aspects (e.g., storing a set of appliance control signals in an AAMD), as well as transitioning the AAMD to an alert mode; determining whether an environmental condition in an environment corresponding to the AAMD indicates an alert condition; and issuing a set of alerts or alert messages (e.g., at least one SMS message and/or e-mail message) to one or more networks in the event that an alert condition is indicated. An alert condition can correspond to a human occupancy condition (e.g., the presence of human activity), or the existence or detection of a threshold condition such as a threshold temperature, a threshold lighting condition, or a threshold audio condition.

In accordance with an aspect of the disclosure, an AAMD can include a processing unit; a set of transceivers coupled to the processing unit; a set of sensors coupled to the processing unit; and a memory coupled to the processing unit. The memory can include a set of appliance management data structures corresponding to a plurality of

appliances and storing appliance control signal sets. The memory can further include an appliance management module having program instructions configured to automatically output the appliance control signal sets in response to one or more sensed environmental conditions that indicate a lack of activity in an environment corresponding to the AAMD. The AAMD can also include a set of user selectable input elements (e.g., a set of switches) coupled to the processing unit. In an embodiment, the set of user selectable elements can selectively transition the AAMD into a programming mode, a test mode, a sensing mode, or an alert mode in response to user input. The AAMD can further include a communication unit configured for signal transfer involving one or more types of devices (e.g., a computer system or another AAMD) or networks (e.g., a mobile telephone network and/or the Internet) external to the AAMD.

The appliance management module can further include program instructions for managing or controlling one or more AAMD functions, processes, or operations of a type described herein, which can generally be categorized as energy saving or energy management processes; alert or alarm mode processes; AAMD network communication processes (e.g., involving a computer system, a mobile telephone network, or another AAMD); and AAMD configuration processes (e.g., involving configuration or programming operations, such as by way of a wire-based or wireless coupling to computer system that provides a graphical user interface for configuring or programming an AAMD).

Brief Description of the Drawings

Embodiments of the disclosure are described hereinafter with reference to the following drawings, in which:

FIG. 1 is a schematic illustration of an Automatic Appliance Management System (AAMS) according to an embodiment of the disclosure.

FIG. 2A is a schematic illustration of an Automatic Appliance Management Device (AAMD) according to an embodiment of the disclosure.

FIG. 2B is a block diagram of an AAMD according to an embodiment of the disclosure.

FIGs. 2C and 2D are block diagrams of representative appliance management data structures according to an embodiment of the disclosure.

FIG. 2E is a block diagram of a representative first configuration or communication data structure according to an embodiment of the disclosure.

FIG. 2F is a block diagram of a representative first configuration or communication data structure according to an embodiment of the disclosure.

FIG. 2G is an illustration of a representative first AAMD configuration interface according to an embodiment of the disclosure.

FIG. 2H is an illustration of a representative second AAMD configuration interface according to an embodiment of the disclosure.

FIG. 3A is a flow diagram of a first AAMD appliance control process according to an embodiment of the disclosure.

FIG. 3B is a flow diagram of a second AAMD appliance control process according to an embodiment of the disclosure.

FIG. 4A is a flow diagram of a first AAMD programming process according to an embodiment of the disclosure.

FIG. 4B is a flow diagram of a second AAMD programming process according to an embodiment of the disclosure.

FIG. 5A is a flow diagram of a first AAMD test process according to an embodiment of the disclosure.

FIG. 5B is a flow diagram of a second AAMD test process according to an embodiment of the disclosure.

FIG. 6 is a flow diagram of a representative alert process 600 according to an embodiment of the disclosure.

Detailed Description

Representative embodiments of the disclosure for addressing one or more of the foregoing problems associated with conventional electric appliance/devices and corresponding device control techniques are described hereafter with reference to FIGs. 1 to 6. For purposes of brevity and clarity, the description herein is primarily directed to systems, devices, and techniques for programmably defining operational parameters for one or more electric appliances/devices in relation to environmental or situational events or signals, and automatically controlling or adapting the operation of the appliance(s)/device(s) in accordance with such environmental or situational signals. This, however, does not preclude various embodiments of the disclosure from other applications where fundamental principles prevalent among the various embodiments of the disclosure such as operational, functional, or performance characteristics are required. In the description that follows, like or analogous reference numerals indicate like or analogous elements.

FIG. 1 is a schematic illustration of an automatic appliance management system (AAMS) 10 according to an embodiment of the disclosure. In one embodiment, the AAMS 10 includes at least one automatic appliance management device (AAMD) 100a-c that is configured for wireless signal communication with a set of appliances 20a-e. In various embodiments, an individual AAMDs 100a-c can be configured for wireless signal communication with multiple appliances 20a-e. Such wireless signal communication can involve identical, similar, categorically related, or dissimilar types of appliances 20a-e. Signal communication between an AAMD 100a-c and a plurality of appliances 20a-e can occur in accordance with identical, similar, or dissimilar communication signal types, formats, and/or protocols.

In general, each AAMD 100a-c can be a self-contained or portable device. As a result, various embodiments of the present disclosure eliminate the need to install new wiring or modify existing wiring within an environment in which the AAMDs 100a-c are intended to reside. In certain embodiments, however, a given AAMD 100a-c can be mountable, mounted, or affixed to a structure such as a wall. In particular embodiments, one or more AAMDs 100a-c can be built in to a structure such as a wall or entertainment centre, and one or more other AAMDs 100a-c can remain portable. As further detailed below, multiple AAMDs 100a-c can form an AAMD network, in which communication of status signals or other information can occur between two or more AAMDs 100a-c within the AAMD network.

The set of appliances 20a-e can include, for instance, one or more a) environmental temperature regulation or control appliances such as air conditioning units, air circulation units (e.g., a ceiling fan or floor fan), or heating units; b) entertainment systems, televisions, or stereos; and/or c) other devices (e.g., air purifiers). Each appliance 20a-e is responsive to primary or source control signals or instructions generated or issued by a principal, primary, or source remote control device or unit 80a-e that is associated with the appliance 20a-e, in a manner understood by one of ordinary skill in the art. A remote control unit 80a-e can generate and output a set of appliance control signals that is directed to adjusting an appliance's operating condition or state in accordance with a given signal type (e.g., RF control signals, infrared control signals, or ultrasonic control signals), format, and/or communication protocol. A remote control unit 80a-e corresponding to a particular appliance 20a-e can generate or output appliance control signals of a different type, format and/or communication protocol than a remote control unit 80a-e corresponding to another appliance 20a-e. In some embodiments, a remote control unit 80a-e can be a programmable universal remote control device that can output multiple sets of appliance control signals, where any given set of appliance control signals exhibits a control signal type, format, and/or protocol that is suitable for a particular type or model of appliance 80a-e.

An AAMD 100a-c is responsive to primary or source control signals generated by one or more primary or source remote control units 80a-e. More particularly, an

AAMD 100a-c can be programmed to receive and record/store, duplicate, or emulate one or more sets or sequences of primary control signals produced by a given primary remote control unit 80a-e. In the context of the present disclosure, signals that an AAMD 100a-c stores and outputs to duplicate or emulate the effect(s) of such primary control signals are referred to as counterpart control signals or instructions. Thus, counterpart control signals can correspond to or be functional duplicates of primary remote control signals. By way of outputting duplicate or counterpart control signals to an appliance 20a-e that is responsive to the primary remote control unit 80a-e which served as a control signal source when programming the AAMD 100a-c, the AAMD 100a-c can emulate or duplicate the operation of the primary remote control unit(s) 80a-e. An AAMD 100a-c can store different sets of counterpart control signals that correspond to different remote control units 80a-e and hence different appliances 20a-e. Different sets of counterpart control signals can exhibit different signal types, formats and/or communication protocols. That is, any given set of counterpart control signals can correspond to a distinct appliance 20a-e to which the AAMD 100a-c can direct such counterpart control signals based upon one or more environmental conditions.

As further detailed herein, an AAMD 100a-c can learn or record a plurality of primary control signal sequences, where each learned or recorded primary control signal sequence is referred to herein as a counterpart control signal sequence. Each received, recorded, or stored counterpart control signal sequence can correspond to a different appliance 20a-e. Furthermore, each counterpart control signal sequence need not be identical or even similar to another counterpart control signal sequence in terms of control signal type, format, or communication protocol. Hence, in various embodiments, an AAMD 100a-c can learn or record a primary control signal sequence output by essentially any type of remote control unit 80a-e. Therefore, distinct counterpart control signal sets can be independent of each other, for instance, in terms of appliance type and/or appliance manufacturer. An AAMD 100a-c can thus be appliance type independent and/or appliance manufacturer independent.

In view of the foregoing, a single AAMD 100a-c can programmably control multiple appliances 20a-e based upon received or recorded primary control signal sequences.

A given remote control unit 20a-e can "teach" an AAMD 100a-c one or more sequences of primary control signals (e.g., as a result of user interaction with the remote control unit 80a-e within an appropriate communication direction or range), which the AAMD 100a-c internally stores for purposes of automated appliance control operations based upon environmental conditions, as further detailed below. An AAMD 100a-c can therefore automatically and selectively mimic or replicate multiple primary control signal sequences that were originally generated by multiple remote control units 80a-e, thereby automatically and selectively controlling multiple distinct appliances 20a-e in accordance with a control signal type, format, and/or communication protocol that is appropriate for each appliance 20a-e. Thus, a single AAMD 100a-c can control multiple types of appliances 20a-e, including different types of appliances 20a-e that are responsive to different control signal types, formats, and/or communication protocols.

Based upon particular environmental conditions, events, signals, or triggers, the AAMD 100a-c can automatically output a sequence of secondary, corresponding, duplicate, counterpart, or emulated control signals that match or correspond to previously received, learned, or recorded primary control signals. Such environmental conditions can correspond, for instance, to a lack of human activity in the AAMD's environment. The presence of human activity indicates that a set of appliances 20a-e should remain under direct human control rather than AAMD control, while the lack of human activity across a given or a minimum time period indicates a likelihood that the appliances 20a-e need not continue consuming power at their current power consumption levels.

The AAMD 100 can manage the operation of one or more appliances 20a-e to transition a set of such appliances 20a-e to at least a reduced power consumption state, such as an overall reduced power consumption state or a zero power consumption state. With respect to controlling an appliance group that includes two or more appliances 20a-e, the AAMD 100 can issue counterpart control signals that are configured to transition an individual appliance 20a-e, multiple individual appliances 20a-e, or each individual appliance 20a-e within the appliance group to a reduced power consumption, yet still on or active, state; a standby, low, or near-zero

power consumption state; or a zero power consumption or off state. For instance, the AAMD 100 can transition an environmental temperature regulation unit to a reduced power consumption, yet still active, state by issuing a set of counterpart control signals that appropriately changes the temperature regulation unit's temperature set-point (e.g., by increasing an air conditioning unit's temperature set-point, or decreasing a heating unit's temperature set-point).

In several embodiments, the AAMD 100 can output or issue counterpart control signals that are configured to transition different appliances 20a-e within an appliance group to altered power consumption states in different manners (e.g., by increasing an air conditioner's temperature set-point as well as turning a stereo off) to realize an overall reduced power consumption state for the appliance group. In certain situations, the AAMD 100 can transition one or more appliances 20a-e within an appliance group, for instance, an air conditioning unit, to a reduced power or zero power consumption state, and additionally transition one or more other (more energy efficient) appliances 20a-e such as a fan to an active or on state to establish an overall reduced power consumption condition for the appliance group. Additionally, in certain embodiments, the AAMD 100 can establish a series of reduced power consumption states for an appliance or an appliance group over time, such that successively established power consumption states exhibit lower power consumption than previously established power consumption states.

Thus, in view of the foregoing, an AAMD 100a-c can be configured and positioned for control signal communication with one or more appliances 20a-e (e.g., within control signal communication range and/or along a control signal communication path) in order to manage the operation of the appliance(s) 20a-e by issuing counterpart control signals to the appliance(s) 20a-e. Such counterpart control signals can match or correspond to particular primary or source control signals that the principal remote control unit 80a-e associated with a given appliance 20a-e is configured to produce. An AAMD 100a-c can be positioned, for instance, on a table, desk, stand, or other support structure that is proximate to or within reliable communication range or distance of the appliance(s) 20a-e that the AAMD 100a-c is intended to automatically control.

Depending upon the particular counterpart control signals received or recorded, which can define portions of an appliance control program or sequence, an AAMD 100a-c can perform appliance control operations such as turning one or more appliances off; transitioning a set of appliances to a reduced power consumption or power saving state (e.g., by way of increasing an air conditioner temperature setting and/or reducing a fan or blower speed); and/or turning particular appliances off or on (e.g., a fan), for instance, after turning off another (e.g., a related or functionally associated) appliance (e.g., an air conditioner).

In response to the detection or determination of one or more conditions that exist within an environment (e.g., an area or room) in which an AAMD 100a-c resides, for instance, a lack of human activity such as movement during a time interval such as 30 minutes, the AAMD 100a-c can automatically perform one or more appliance adjustment operations, in association with which the AAMD 100a-c outputs or issues one or more sets of counterpart control signals to one or more appliances 20a-e at one or more times to terminate, adjust, or initiate the operation of such appliances 20a-e. As further detailed below, in several embodiments an AAMD 100a-c can issue counterpart control signals in view of one or more selectable or programmable delay times. Additionally, in some embodiments an AAMD 100a-c that is configured to manage the operation of multiple appliances 20a-e can output counterpart control signals on an appliance-selective basis in view of particular conditions, events, signals, or triggers sensed by the AAMD 100a-c.

As indicated above, in particular embodiments, a plurality of AAMDs 100a-c can be configured to communicate with each other, for instance, to exchange status information, messages, or signals. That is, a plurality of AAMDs 100a-c can form a local AAMD network. Status information communicated from one AAMD 100a-c to another can include, for instance, an occupancy notification generated by a particular AAMD 100a-c in response to the detection of movement or other indication(s) of human presence in this AAMD's local surroundings or environment during a first or most-recent predetermined time period (e.g., 10 minutes, 30 minutes, or longer). In some embodiments, in response to the receipt of an occupancy notification from an originating AAMD 100a-c, one or more other AAMDs 100a-c can avoid

transitioning corresponding appliances to an off state or a reduced power state unless such other AAMD's 100a-c a) independently determine that there has been a lack of movement or other indication(s) of occupancy in their own local environment; and b) receive no further occupancy notification from the originating AAMD 100a-c during a second or next predetermined time period (e.g., 10 minutes, 20 minutes, or longer). Depending upon embodiment details, the first time period and the second time period can be equal or unequal (e.g., the first and second time periods can each be approximately 10 minutes; or the first time period can be approximately 10 minutes, and the second time period can be approximately 20 minutes).

In addition or as an alternative to the foregoing, in certain embodiments an AAMD 100a-c can be configured for unidirectional or bidirectional communication with one or more types of external devices and/or networks at particular times. For instance, an AAMD 100a-c can be configured to communicate with a computing device such as a computer system 90, which can be coupled to the Internet 92; and/or an AAMD 100a-c can be configured to communicate with a mobile communication network 94, which can transfer signals to one or more mobile communication or mobile computing devices 96 such as a cellular telephone or smartphone.

As a representative example, in particular embodiments an AAMD 100a-c and a computer system 90 can be configured for communication, for instance, by way of program instructions executing on the computer system 90 that provide a graphical user interface (GUI) for user input. The GUI can receive user input identifying a set of mobile telephone numbers and email addresses. The computer system 90 transfers the set of mobile telephone numbers and email addresses to the AAMD 100a-c, which stores such number(s) and addresses, for instance, in a programmable non-volatile memory. The AAMD 100a-c can selectively issue alerts or email messages, such as by way of Short Message Service (SMS) messages, directed to the set of mobile telephone numbers in response to the detection of one or more alert conditions in the AAMD's environment as well to email addresses, as further detailed below.

Additionally or alternatively, in certain embodiments one or more stored sets of counterpart control signals can be transferred between a computer system 90 and an AAMD 100a-c. Such transfer of counterpart control signals between a computer system 90 and an AAMD 100a-c can facilitate AAMD backup operations, which can be useful in the event that one or more remote control units 80a-e becomes lost or broken after an AAMD 100a-c is initially programmed by such remote control units 80a-e (e.g., AAMD backup operations can facilitate computer-based programming or reprogramming of an AAMD 100a-c).

Representative AAMD Structural Details

FIG. 2A is a schematic illustration of an AAMD 100 and FIG. 2B is a block diagram of an AAMD 100 according to an embodiment of the disclosure. In various embodiments, the AAMD 100 includes a sensing unit 110, at least one control signal transceiver 120, a status indication unit 130, a mode selection unit 150, and a communication unit 160. The AAMD 100 further includes a processing unit 200, a memory 210, and a power source 190. One or more of such elements can be carried by a housing 102 of the AAMD 100.

The sensing unit 110, each control signal transceiver 120, the status indication unit 130, the mode selection unit 150, the communication unit 160, the processing unit 200, the memory 210, and the power source 190 are each electrically coupled in a manner that facilitates automatically adjusting or adapting the operation of one or more appliances 20 in accordance with conditions within an environment in which the AAMD 100 and the appliances 20 reside. In an embodiment, the memory 210, the sensing unit 110, each control signal transceiver 120, the status indication unit 130, the mode selection unit 150, and the communication unit 160 are coupled to the processing unit 200, for instance, in a manner corresponding, analogous, or generally analogous to that illustrated in FIG. 2B.

Each element of the AAMD 100 is coupled to the power source 190. In various embodiments, the power source 190 can include a battery, which in some embodiments can be rechargeable, for instance, by way of a coupling to AC line power (e.g., involving a plug-in transformer). In certain embodiments, the power

source 190 can include an energy harvesting unit such as solar cell, vibration, thermal, etc. Thus, in the event that the AAMD 100 resides in an area in which a significant amount of incident and/or ambient light is present at one or more times (e.g., proximate to a window, or a set of artificial light sources such as a lamp and/or a light-emitting appliance such as a television), the solar cell can contribute to charging the battery (e.g., by way of trickle charging). Particular embodiments that include a rechargeable battery and a coupling to AC line power can automatically (re)charge the battery on an as-needed basis (e.g., in the event that a battery charge level has reached a predetermined low charge threshold), for instance, by selectively coupling the battery to AC line power during a preprogrammed off-peak power usage time, or after the AAMD's issuance of counterpart control signals to one or more appliances 20 that transition the appliances 20 an off or low-power state.

The processing unit 200 can be a programmable device that is capable of executing stored program instructions, for instance, a microprocessor, a microcontroller, or a programmable logic device (PLD) such as a Field Programmable Gate Array (FPGA). Depending upon embodiment details, the processing unit 200 can poll and/or service requests (e.g., interrupts) from one or more AAMD elements coupled thereto, in a manner understood by those skilled in the art. In a representative implementation, the processing unit 200 is a low power processor, microcontroller, Application Specific Integrated Circuit (ASIC), or programmable logic device, for instance, as manufactured by or available from Mircochip, ARMS, Zilog, Intel, Texas Instruments, Hitachi, NEC, SONY, Panasonic, Philips, Xilinx, or another manufacturer or source.

The memory 210 includes a set of electrically and/or magnetically (re)programmable storage elements or media configured to store program instructions, data, and/or signals, including counterpart control signals corresponding to multiple remote control units 80a-e. Counterpart control signals stored in the memory can be of different types and/or formats, in a manner that corresponds to a remote control unit type and/or format. The memory 210 can include, for instance, one or more types of Programmable Read Only (PROM) such as flash memory or an Electrically Erasable PROM (EEPROM). The memory 210 can further include a Random Access Memory

(RAM), as well as one or more storage elements within the processing unit 200 (e.g., a set of registers, and/or a portion of a processing unit internal RAM).

In one embodiment, the memory 210 includes an appliance management module 220, which can include program instructions configured to direct the operation of the AAMD 100 in a manner that facilitates automatic environment-based control of a set of appliances 20 in accordance with the present disclosure, as further detailed below with reference to FIGs. 3A – 5B. Portions of the appliance management module 220 are executable by the processing unit 200. The memory 210 can additionally include an appliance management data structure 230, which can store at least one set or sequence of counterpart control signals (e.g., as digital data) corresponding to each appliance 20 that the AAMD 100 is programmed to manage, as further detailed below with respect to FIGs. 2C and 2D. In certain embodiments, the memory 210 can further include a configuration or communication data structure 240 such as described below with reference to FIG. 2E, which can store AAMD configuration and/or communication information such as a set of mobile telephone numbers and/or e-mail addresses.

Each control signal transceiver 120 includes a signal transmission / reception device that is configured for control signal exchange by way of a particular control signal type, modality, or format that is supported by a given type of appliance / primary remote control unit communication protocol. Thus, a control signal transceiver 120 can receive primary control signals generated by a primary or source remote control unit 80, and transmit or output duplicate or counterpart control signals directed to an appliance 20 that is responsive to the primary remote control unit 80. Depending upon embodiment details, an AAMD 100 can include a number of control signal transceivers 120 configured to support one or more control signal communication modalities such as optical, infrared (IR), radio frequency (RF), ultrasound, and/or another wireless communication medium. Thus, depending upon an appliance 20a-e and/or remote control 80a-e to which it corresponds, a given set of counterpart control signals stored in the AAMD's memory 210 can exhibit a different signal format or signal type than another set of counterpart control signals.

Depending upon the position of the AAMD 100 and/or the orientation of the AAMD's control signal transceiver(s) 120 relative to the appliance(s) 20 in the AAMD's external environment, any given control signal transceiver 120 can transmit counterpart control signals to one or multiple appliances 20. In various embodiments, an AAMD 100 includes multiple control signal transceivers 120. In several embodiments, the control signal transceivers 120 can be independently, generally independently, or somewhat independently positioned or oriented with respect to a) each other, and/or b) a set of appliances 20 in an environment in which the AAMD 100 resides. In a number of embodiments, the positions or orientations of particular control signal transceiver(s) 120 can be adjustable (e.g., rotatably adjustable) in three x-y-z axes, which can be defined in a manner illustrated in FIG. 2A. In multiple embodiments, the AAMD 100 includes a set of infrared (IR) transceivers (e.g., one, two, or more IR transceivers). In a representative implementation, an AAMD 100 includes a first IR transceiver 120a and a second IR transceiver 120b.

In addition to the foregoing, in some embodiments a given AAMD's control signal transceiver(s) 120 can facilitate the communication of AAMD status signals, such as occupancy notifications, to one or more other AAMDs 100. Such inter-AAMD communication can notify a number of AAMDs 100 within an AAMD network that a particular AAMD 100 has a) detected an environmental condition (e.g., corresponding to one or more of detected motion or a change in an ambient sound or lighting condition) that is relevant to appliance control or operation; or b) initiated appliance power-down or power management operation, as further detailed below.

An AAMD's sensing unit 110 can include a number of devices configured to sense, detect, monitor, or measure a set of signal states, levels, and/or changes therein corresponding to real-time or near real-time conditions in the environment in which the AAMD 100 resides. Such conditions or parameters can correspond to one or more of movement, a lighting level, a temperature level, a sound or noise level, and/or other conditions. Correspondingly, the sensing unit 110 can include one or more motion detectors (such as Passive Infrared (PIR), Microwave, or photosensor based motion sensing devices), a thermocouple, a microphone, and/or another device.

In a representative implementation, the sensing unit 110 includes at least one PIR motion sensor.

In certain embodiments, the sensing unit 110 can also include one or more of the AAMD's control signal transceivers 120. Thus, the AAMD 100 can utilize a given control signal transceiver 120 to detect whether primary control signals have been transmitted within the AAMD's environment (e.g., by another AAMD 100), indicating the likely presence or likely absence of human activity in the environment. The AAMD 100 can additionally or alternatively utilize a given control signal transceiver 120 to detect or receive status signals output by another AAMD 100, such as occupancy notifications.

The mode selection unit 150 is responsive to AAMD user input directed to transitioning the AAMD 100 into a programming mode, a test mode, a sensing mode, and possibly an alert mode. The mode selection unit 150 can include a set of input devices or elements such as switches. The set of input devices or elements can control the transition of the AAMD 100 into a programming mode, as well as user selection of a particular appliance 20 for which programming, program deletion, or reprogramming operations are to occur.

When in the programming mode, the AAMD 100 stores primary control signals received by a control signal transceiver 120 in the memory 210, thereby creating duplicate or counterpart control signals. The mode selection unit 150 can also include a set of input devices or elements that facilitate user specification or programming of one or more time delays corresponding to each appliance 20 or a subset of appliances 20, such that following the sensing unit's consistent detection of an environmental condition (e.g., a lack of detected movement) that is intended to result in or trigger the AAMD's issuance of counterpart control signals to one or more appliances 20, the AAMD 100 outputs such counterpart control signals after the time delay(s) have elapsed. Depending upon embodiment details, a time delay can be a number of minutes, such as approximately 5, 10, 30, or 60 minutes. In a representative implementation, a time delay can be approximately 20 minutes.

The mode selection unit 150 further includes a user selectable input device or element that transitions the AAMD 100 into a test mode. When in the test mode, the AAMD 100 can issue stored counterpart control signals corresponding to individual or multiple appliances 20 to such appliances 20. As a result, an AAMD user can verify that the counterpart control signals directed to a particular appliance 20 result in a desired or intended type of appliance control operation or operation sequence.

In some embodiments, the mode selection unit 150 also includes a user selectable input device or element that transitions the AAMD 100 into an alert or alarm mode in response to user input. When in an alert or alarm mode, the AAMD 100 can issue one or more types of alerts or alarms to an external network or device. An alert or alarm can include a message or notification that provides an indication to one or more individuals (e.g., a homeowner, a business owner, or a tenant) that normally occupy a space, room, or area in which an AAMD 100 is disposed, but who are away, that the AAMD 100 has detected a particular set of conditions in its surrounding environment which may be of concern to such individuals. For instance, an occupancy alert or alarm can indicate or correspond to the detection of movement (e.g., caused by the presence of an unauthorized individual), or a temperature alert or alarm can correspond to the detection of an undesirable temperature condition, in the AAMD's environment.

When in alert mode, an AAMD 100 can issue a set of alerts or alert messages to one or more types of external devices or networks, for instance, a mobile telephone network 94. An alert can include predetermined or user programmed alert message content. In particular embodiments, an alert can include an SMS message that specifies a mobile telephone number and a corresponding text message pertaining to a detected environmental condition. The SMS message can be, for instance, "activity / motion detected." An alert can additionally include a date and time stamp. Depending upon embodiment details, the AAMD 100 can communicate the alert (e.g., by way of the communication module 160) to the mobile telephone network 94, which further communicates the alert to a mobile communication device 96 corresponding to the specified mobile telephone number. In certain embodiments, the AAMD 100 can generate or issue multiple alerts or alarms directed to multiple

networks or mobile telephone numbers. In addition or as an alternative to the foregoing, an AAMD 100 can issue a set of alerts or alert messages directed to one or more e-mail addresses, for instance, by sending a set of SMS messages that reference or include such e-mail addresses to a gateway number supported by a mobile communication network 94 that includes an SMS to e-mail gateway.

As indicated above, in several embodiments the AAMD 100 includes a communication unit 160 that facilitates or enables communication with one or more types of external devices (e.g., a computer 90) and/or networks (e.g., a cellular communication network 94). The communication unit 160 can include communication elements that are appropriate for communicating with supported types of external devices and/or networks. For instance, depending upon embodiment details, the communication unit 160 can include hardware as well as associated firmware configured to support signal transfer in accordance with one or more of USB, RS232, RS485, TCP/IP, WiFi, Bluetooth, ZigBee, and cellular communication protocols. For wireless communication, the communication unit 160 can include an appropriate set of antennas. For wire-based communication, the communication unit 160 can include an appropriate type of communication interface and/or port 162 (e.g., a USB and/or an Ethernet port).

Communication between an AAMD 100 and a computer system 90 can facilitate AAMD programming and/or AAMD diagnostic operations by way of a graphical user interface (GUI); and/or the transfer of updated AAMD firmware to the AAMD's memory 210 from the computer system 90 or a server that is coupled thereto (e.g., by way of the Internet). In one embodiment, when an AAMD 100 is coupled to a computer system 90 by way of a USB or other coupling that is capable of supplying power, the AAMD's power source 190 can be recharged on an as-needed basis.

The status indication unit 130 provides visual feedback that indicates an AAMD operational state or status and/or an AAMD mode of operation. The status indication unit 130 can indicate, for instance, whether a) motion has been detected within the AAMD's environment with respect to one or more time periods; b) the AAMD 100 is in a programming mode; c) the AAMD 100 is in a test mode; d) the AAMD 100 is in

alert mode; and/or e) the AAMD 100 is issuing counterpart control signals to one or more appliances 20. In various embodiments, the status indication unit 130 includes a set of visual signal generation devices, such as one or more LEDs 132 and/or a display device such as an LCD. In a representative implementation, the status indication unit 130 includes multiple LEDs 132.

Representative Types of AAMD Data Structures

As previously indicated, the memory 210 can include one or more appliance management data structures 230. An appliance management data structure 230 stores counterpart control signals corresponding to each appliance 20 for which the AAMD 100 has been programmed to manage. FIGs. 2C and 2D are block diagrams of representative appliance management data structures 230a-b according to an embodiment of the disclosure. As shown in FIG. 2C, an appliance management data structure 230a can store a set or list of counterpart control signals corresponding to each appliance 20 (e.g., appliance 1 through appliance N) that the AAMD 100 has been programmed to manage. As a representative example, appliance 1 can correspond to an air conditioner, and appliance 2 can correspond to a television. If an AAMD 100 within or proximate to a room in which the air conditioner and the television reside detects a consistent lack of movement in the room or space across a user selectable, programmable, or predetermined time interval (e.g., 30 minutes), the AAMD 100 can output a) counterpart air conditioner control signals that increase the air conditioner's temperature set-point by approximately +3 degrees; and b) counterpart television control signals that mute the television volume control. Alternatively, the AAMD 100 can output counterpart control signals that turn off one or each of the air conditioner and the television.

As indicated in FIG. 2D, an appliance management data structure 230b can additionally store a set of user selectable or programmable delay conditions corresponding to one or more appliances 20 that the AAMD 100 has been programmed to manage. Such delay conditions can specify a condition-based or temporal sequencing for the AAMD's issuance of counterpart control signals to particular appliances. As a representative example, a first appliance can correspond to a first air conditioner, a second appliance can correspond to a second air

conditioner, and a third appliance can correspond to a fan (e.g., a ceiling, table, or floor-standing fan). In the event that an AAMD 100 within or proximate to a room or space in which the first, second, and third appliances reside detects a lack of movement across a given time interval (e.g., 20 minutes), the AAMD 100 can perform or execute the following representative appliance control program(s) by outputting counterpart control signals directed to each of the first, second, and third appliances, where such counterpart control signals are stored within the appliance management data structure 230b:

a) immediately turn off the first air conditioner;
b) immediately increase the temperature setpoint of the second air conditioner by a predetermined or programmed number of degrees (e.g., approximately 3, 5, or 8 degrees);
c) after a delay of approximately 30 minutes across which no movement has been detected in the room, turn on the fan;
d) after a delay of approximately 60 minutes during which no movement has been detected in the room, turn off the second air conditioner; and
e) after a delay of approximately 2 hours across which no movement has been detected in the room, or after an internal clock (e.g., a clock or timer within the processing unit 200) or a detected lighting condition (as detected by the sensing unit 110) indicates that daytime has transitioned to nighttime, turn off the fan.

As previously indicated, in certain embodiments an AAMD 100 can utilize one or more of its control signal transceivers 120 (e.g., an IR receiver) to facilitate the detection of human activity within or proximate to the AAMD's environment. Thus, as another example corresponding to the aforementioned first, second, and third appliances, the AAMD 100 can perform or execute the following representative appliance control program(s) after detecting a lack of movement or a lack of primary appliance control signals across a given time period such as 20, 30, or 40 minutes:

a) immediately turn off the first air conditioner;

b) immediately increase the temperature setpoint of the second air conditioner by a predetermined or programmed number of degrees (e.g., approximately 3, 5, or 8 degrees);

c) after a delay of approximately 30 minutes across which no movement has been detected in the room, turn on the fan;

d) after a delay of approximately 2 hours during which no primary appliance control signals have been detected in the room, turn off the second air conditioner; and

e) after a delay of approximately 4 hours during which no primary appliance control signals have been detected in the room, or after an internal clock or a detected lighting condition indicates that daytime has transitioned to night time, turn off the fan.

Basing the output of one or more counterpart control signals upon the detection of primary appliance control signals can facilitate the maintenance of environmental conditions that are sufficiently comfortable for pets, which can be a source of detected movement, while simultaneously reducing overall appliance power consumption.

As previously indicated, an AAMD 100 can be configured by way of communication with a computer 90 to store AAMD configuration information or a configuration data set, such as alert-related information or data. Such configuration data can be stored in one or more data structures, as described in detail hereafter.

FIG. 2E is a block diagram of a representative first configuration or communication data structure 240a according to an embodiment of the disclosure. In an embodiment, the first communication data structure 240a can store an AAMD identifier (which can be predefined or user-definable), and a set of mobile telephone numbers to which one or more occupancy alerts can be directed. The first communication data structure 240a can additionally or alternatively store a set of e-mail addresses to which one or more occupancy notifications can be directed. The quantity of mobile telephone numbers and the quantity of e-mail addresses stored within the communication data structure can, but need not, be equal. The first

communication data structure 240a further stores occupancy alert message content (e.g., textual information). In various embodiments, an occupancy alert can be an SMS message and/or an e-mail that includes corresponding message content, which an AAMD 100 can send to one or more mobile telephone numbers and/or e-mail addresses in response to the detection of activity in the AAMD's surrounding environment.

FIG. 2F is a block diagram of a representative second configuration or communication data structure 240b according to an embodiment of the disclosure. In an embodiment, the second communication data structure 240b can store the information or data detailed above for the first communication data structure 240a, as well as a temperature alert message and a corresponding threshold temperature. In various embodiments, a temperature alert can be an SMS message and/or an e-mail that includes corresponding message content, which an AAMD 100 can send to a set of mobile telephone numbers and/or a set of e-mail addresses in response to the detection of a temperature that meets or exceeds the specified threshold temperature.

The present disclosure provides for embodiments in which an AAMD 100 can issue other types of alerts in addition or as an alternative to occupancy alerts or temperature alerts. For instance, in specific embodiments, an AAMD 100 can issue alerts based upon the detection of a given lighting condition (e.g., corresponding to the activation of lights in a curtained or normally dark room, where a sensed or detected light intensity exceeds a threshold light intensity), or the detection of sound (e.g., which exceeds a particular threshold sound intensity or level). In such embodiments, a relevant type of alert message and any associated threshold condition can be stored in a communication data structure in a manner analogous to that described above.

Representative Computer-based AAMD Configuration / Reconfiguration

As indicated above, in a number of embodiments a computer system 90 to which an AAMD 100 is coupled can provide a GUI that can receive user input defining AAMD configuration information such as a set of mobile telephone numbers and/or e-mail addresses to which alerts and/or AAMD status information can be sent. In

some embodiments, the computer system 90 can additionally provide a GUI that can receive user input for performing other types of operations, such as downloading updated firmware to an AAMD 100 and/or performing AAMD self-test or diagnostic operations. In certain embodiments, the computer system 90 can launch or initiate the execution of such a GUI in response to auto-detection of communication with an AAMD 100, for instance, as established by coupling the computer system 90 and the AAMD 100 by way of a USB cable or other type of communication link. In specific embodiments, an AAMD's mode selection unit 150 can include a selectable input element (e.g., a switch) that transitions the AAMD 100 to a configuration mode to enable computer system – AAMD communication, for instance, for controlling the launch of a GUI, the retrieval of existing AAMD configuration information from the AAMD 100, and/or the download and storage of AAMD configuration information from the computer system 90 to the AAMD 100.

FIG. 2G is an illustration of a representative first AAMD configuration interface 250a according to an embodiment of the disclosure. In an embodiment, the first configuration interface 250a includes a GUI that facilitates the retrieval, entry, display, and/or storage of AAMD configuration information such as one or more of an AAMD identifier; AAMD location or description information; occupancy alert message content; and a set of mobile telephone numbers and/or e-mail addresses to which occupancy alerts are to be directed. The first configuration interface 250a can include a set of graphical control elements such as text boxes, list boxes, and buttons responsive to user input. In certain embodiments, the first configuration interface 250a can additionally include graphical control elements that initiate AAMD firmware update and/or AAMD self test or diagnostic operations in response to user input.

FIG. 2H is an illustration of a representative second AAMD configuration interface 250b according to an embodiment of the disclosure. In an embodiment, the second configuration interface 250b includes a GUI that facilitates the retrieval, entry, display, and/or storage of the information or data specified above for the first configuration interface 250a, as well as temperature alert content and a corresponding threshold temperature.

In response to user selection of a "save data" or similar type of graphical control element, a computer system 90 transfers data or information specified by way of the first or second configuration interface 250a, 250b to the AAMD's memory 200.

Representative AAMD Appliance Control Processes

FIG. 3A is a flow diagram of a first AAMD appliance control process 300 according to an embodiment of the disclosure. In one embodiment, the process 300 includes a first process portion 310 involving performing AAMD initialization or power-up operations, and a second process portion 312 that involves determining whether the AAMD 100 has been or is to be transitioned to a program mode P. In various embodiments, the AAMD 100 can be transitioned to a programming mode in response to user input, for instance, by way of interaction with the mode selection unit 150 (e.g., in response to user selection or positioning of a programming mode switch, button, or the like). If the AAMD 100 has been transitioned to a programming mode, the AAMD 100 performs a sequence of programming operations, as further detailed below with respect to FIGs. 4A and 4B.

The process 300 further includes a third process portion 314 in which the AAMD 100 determines whether it has been or is to be transitioned to a test mode T. In a number of embodiments, the AAMD 100 can be transitioned to a test mode in response to user input, such as by way of user interaction with a switch or user input element carried by the mode selection unit 150. If the AAMD 100 has been transitioned to a test mode, the AAMD 100 performs a sequence of test operations, as further detailed below with respect to FIGs. 5A and 5B.

The process 300 additionally includes a fourth process portion 316 in which the AAMD 100 enters or transitions into and operates in an environmental sensing mode S. The fourth process portion 312 involves the sensing unit's generation of sensing or environmental characterization signals, where the sensing unit 110 can include one or more of a motion sensor, an optical sensor, a thermal sensor, an audio sensor, or another sensing device configured to detect, monitor, or measure whether activity (e.g., human activity) and/or another condition exists in the AAMD's surrounding environment.

The process 300 can include a fifth process portion 320 that involves determining whether to issue one or more alerts based upon sensed environmental conditions. The fifth process portion 320 can involve, for instance, a determination of whether the AAMD 100 is operating in an alert mode, and a determination of whether one or more alert conditions exist. An alert condition can correspond to the detection of an indication of human activity (e.g., movement), or the detection of an environmental condition corresponding to a type of alert threshold, such a temperature threshold, in the AAMD's environment. If one or more alerts are to be issued, a sixth process portion 322 can involve the generation, output, or issuance of a set of alerts, which can include one or more SMS messages and/or e-mails corresponding to detected alert conditions.

The process 300 further includes a seventh process portion 330 in which the AAMD 100 determines whether to transition or enter into an appliance management mode. The seventh process portion 330 can involve determining whether one or more predetermined or programmed environmental conditions or criteria (e.g., a lack of movement in the AAMD's environment across a given time period such as 30 minutes or 1 hour) have been satisfied based upon signals generated or not generated by the sensing unit 110. If an appropriate set of environmental conditions has not been satisfied (e.g., movement has been detected in the AAMD's environment during a given time period), the process 300 can return to the second process portion 312.

In the event that an environmental condition indicates that appliance management or adjustment is appropriate, the process 300 can determine a delay time in an eighth process portion 332. In a ninth process portion 334, the process 300 can select a first or next appliance for which counterpart control signals are stored in the memory 210, retrieve such counterpart control signals in a tenth process portion 336, and output the counterpart control signals corresponding to the appliance under consideration in an eleventh process portion 338. The AAMD's output or issuance of the counterpart control signals can cause the appliance to transition to a reduced power, power saving, standby, near-zero power consumption, or zero power consumption mode, thereby significantly reducing or eliminating energy wastage.

The process 300 can determine whether another appliance requires consideration in a twelfth process portion 360. If so, the process 300 returns to the ninth process portion 334; otherwise the process 300 determines whether to terminate operations in a thirteenth process portion 380. If sensing operations are to continue, the process 300 can return to the fourth process portion 316; otherwise the AAMD 100 can transition to a standby or powered down state in association with a fourteenth process portion 390.

As previously indicated, in some embodiments an AAMD 100 can facilitate, accommodate, or provide multiple control signal sets, sequences, or programs corresponding to a particular appliance, where such control signal sets can be serially output based upon one or more delay conditions. FIG. 3B is a flow diagram of a second AAMD appliance control process 302 according to an embodiment of the disclosure. In an embodiment, the second AAMD control process 302 includes a first through a seventh process portion 310 – 330 that are identical or analogous to those described above with respect to FIG. 3A.

The second AAMD appliance control process 302 can further include an eighth process portion 350 that involves identifying a first or next nearest delay time, period, or interval (e.g., corresponding to a soonest upcoming or nearest approaching time at which counterpart control signals are to be output); and a ninth process portion 352 that involves determining whether a set of delay condition(s) corresponding to the delay period under consideration have been satisfied. One or more delay times and corresponding delay conditions can be stored in the memory 210 in a manner identical or analogous to that indicated above with respect to FIG. 2D. If the delay conditions under consideration are met, a tenth process portion 354 can retrieve and output counterpart control signals corresponding to the appliance(s) associated with the delay condition(s) under consideration. An eleventh process portion 356 can determine whether another delay time (e.g., a next sequential delay period or interval) requires consideration. If so, the process 302 can return to the eighth process portion 350.

In the event that each relevant delay time has been considered, or in the event that one or more delay conditions under consideration have not been met, the process 302 can include a twelfth process portion 380 that involves determining whether to continue AAMD sensing operations or transition to an AAMD standby or shutoff state. If sensing operations are to continue, the AAMD 100 can be transitioned to a sensing mode S; otherwise, the AAMD 100 can be transitioned to a standby mode or an off condition in association with a thirteenth process portion 390.

FIG. 4A is a flow diagram of a first AAMD programming process 400 according to an embodiment of the disclosure. In an embodiment, the first AAMD programming process 400 includes a first process portion 410 that involves identifying or selecting a given appliance *k* for which programming-related operations are to be performed. The selection of a given appliance can occur in response to user input, for instance, user interaction with the mode selection unit 150 (e.g., by way of a switch associated with appliance *k*). A second process portion 412 can involve determining whether an existing program corresponding to counterpart control signals that had been previously stored for appliance *k* is to be deleted. An indication that an existing or prior counterpart control signal program is to be deleted can occur in response to user in put, for instance, a user toggling of a switch (e.g., a test switch) on the mode selection unit 150 while the AAMD 100 is in program mode. If an existing counterpart control signal program is to be deleted, a third process portion 414 can delete the program from the memory 210.

A fourth process portion 416 can determine whether the AAMD has received or is receiving primary control signals, for instance, by way of one or more control signal transceivers 120 that detect control signals output by a primary remote control unit 80. Such primary control signals can define or correspond to a counterpart control signal program for appliance *k*. If primary control signals are not received, a fifth process portion 418 can determine whether an exit or timeout condition has occurred. If so, the process 400 can return to a sensing mode S.

In the event that primary control are received, a sixth process portion 420 can store such primary control signals in the memory 210 at a location associated with

appliance *k*, thereby defining portions of a counterpart control signal program for appliance *k*. A seventh process portion 422 can determine whether a delay time or period corresponding to this counterpart control signal program has been specified or defined, for instance, in response to user interaction with the mode selection unit 150 (e.g., by way of one or more delay time switch toggles, where each toggle can increment a delay time by a predetermined amount). If no delay has been specified, an eighth process portion 424 can store a default delay time; otherwise, a ninth process portion 426 can store a user-specified delay. Following either of the eighth or ninth process portions 424, 426, the AAMD 100 can be transitioned to a sensing mode S.

FIG. 4B is a flow diagram of a second AAMD programming process 402 according to an embodiment of the disclosure. In an embodiment, the second AAMD programming process 402 includes a first through a sixth process portion 410 – 420 that are identical or analogous to those described above with respect to FIG. 4A. The second AAMD programming process 402 further includes a seventh process portion 430 that involves determining whether a set of delay conditions or criteria corresponding to received counterpart controls signals has been defined. If not, an eighth process portion 432 can store a set of default delay criteria; otherwise, a ninth process portion 434 can store a set of user-defined or user-specified delay criteria.

A tenth process portion 436 can determine whether additional primary control signals corresponding to appliance k have been or are being received. If so, the process 402 can return to the sixth process portion 420. Otherwise, an eleventh process portion 438 can determine whether an exit or timeout condition has occurred. If not, the process 402 can return to the tenth process portion 438; otherwise, the process 402 can transition to a sensing mode S.

FIG. 5A is a flow diagram of a first AAMD test process 500 according to an embodiment of the disclosure. In an embodiment, the first AAMD test process 500 includes a first process portion 510 that involves selecting a first or next appliance for consideration. A second and a third process portion 520, 522 can respectively involve retrieving and outputting counterpart control signals for the appliance under

consideration, and an optional fourth process portion 524 can involve pausing for a given time period that enables a user to evaluate or verify the automatically adjusted operation of the appliance under consideration. A fifth process portion 540 can involve determining whether another appliance requires consideration. If so, the process 500 can return to the first process portion 510; otherwise the AAMD can be transitioned to a sensing mode or state S.

FIG. 5B is a flow diagram of a second AAMD test process 502 according to an embodiment of the disclosure. In an embodiment, the process 502 includes a first process portion 510 that involves identifying a first or next appliance for consideration, and a second process portion 515 that involves selecting a first or next set of counterpart control signals corresponding to or forming a program phase within a counterpart control signal program corresponding to the selected appliance. A third and a fourth process portion 520, 522 can respectively retrieve and output the counterpart control signals corresponding to the program phase under consideration. An optional fifth process portion 524 can pause for a given time period that enables a user to evaluate or verify the automatically adjusted behaviour of the appliance under consideration.

A sixth process portion 530 can determine whether another program phase requires consideration. If so, the process 502 can return to the second process portion 515. Otherwise, a seventh process portion 540 can determine whether another appliance requires consideration, in which case the process 502 can return to the first process portion 510. If testing or verification of another appliance's operation is not desired or required, the AAMD 100 can be transitioned to a sensing mode S.

Representative AAMD Alert Processes

FIG. 6 is a flow diagram of a representative alert process 600 according to an embodiment of the disclosure. In an embodiment, the alert process 600 includes a first process portion 602 that involves transitioning an AAMD 100 to an alert mode, for instance, in response to user selection of an input element (e.g., which forms a portion of the mode selection unit 150) corresponding to an alert mode. The alert process 600 further includes a second process portion 604 that that involves

determining whether the AAMD 100 has detected an alert condition. An alert condition can include, for instance, the detection of movement or another indication of human activity or presence; or the detection of an environmental condition that satisfies an alert threshold specified in a configuration data structure (e.g., the detection of an environmental temperature that meets or exceeds a threshold alert temperature).

In response to the detection of an alert condition, a third process portion 606 involves issuing one or more alerts such as SMS messages and/or e-mails to a set of mobile telephone numbers and/or e-mail addresses, respectively. SMS messages and/or e-mail message content, as well as the respective mobile telephone numbers and/or e-mail addresses to which such message content is directed, can be specified within an AAMD's configuration data structure.

Following the third process portion 606, or in the absence of the detection of an alert condition in the second process portion 604, the process 600 can determine in a fourth process portion 608 whether to exit alert mode. The alert mode can be exited, for instance, in response to user selection of an appropriate input element carried by the AAMD 100. In the event that alert mode is to continue, the process 600 can return to the second process portion 604. Otherwise, the process 600 exits alert mode.

In the foregoing manner, various embodiments of the disclosure are described for addressing at least one of the foregoing disadvantages. Such embodiments are intended to be encompassed by the following claims, and are not to be limited to specific forms or arrangements of parts so described and it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification can be made, which are also intended to be encompassed by the following claims.

Claims

1. An appliance management method performed by a set of automated appliance management devices, the method comprising:

receiving a first set of appliance control signals at a first appliance management device, the first set of appliance control signals generated by a remote control corresponding to a first appliance, the first set of appliance control signals comprising at least one control instruction for the first appliance;

storing a first set of counterpart control signals in the first appliance management device, the first set of counterpart control signals comprising functional duplicates of the first set of appliance control signals;

receiving a second set of appliance control signals at the first appliance management device, the second set of appliance control signals generated by a remote control corresponding to the second appliance, the second set of appliance control signals comprising at least one control instruction for the second appliance;

storing a second set of counterpart control signals in the first appliance management device, the second set of counterpart control signals comprising functional duplicates of the second set of appliance control signals;

sensing a set of environmental conditions in an environment corresponding to the first appliance management device;

determining whether a sensed environmental condition indicates a lack of human activity during a first time period in the environment corresponding to the first appliance management device; and

automatically issuing the first set of counterpart control signals to the first appliance and the second set of counterpart control signals to the second appliance if a sensed environmental condition indicates a lack of human activity during the first time period in the environment corresponding to the first appliance management device.

2. The method of claim 1, wherein the first set of counterpart control signals and the second set of counterpart control signals exhibit at least one of a different

signal type, a different signal format, and a different signal communication protocol relative to each other.

3. The method of claim 1, wherein automatically issuing the first set of counterpart control signals and the second set of counterpart control signals transitions one of the first appliance and the second appliance to a reduced power consumption yet still active state.

4. The method of claim 3, wherein automatically issuing the first set of counterpart control signals changes a temperature set-point of an environmental control unit that remains active after issuing the first set of counterpart control signals.

5. The method of claim 4, wherein automatically issuing the first set of counterpart control signals increases a temperature set-point of an air conditioning unit.

6. The method of claim 1, wherein automatically issuing the first set of counterpart control signals transitions the first appliance to one of a reduced power consumption and a zero power consumption state, and automatically issuing the second set of counterpart control signals transitions the second appliance to one of a reduced power consumption and a zero power consumption state.

7. The method of claim 1, wherein automatically issuing the first set of counterpart control signals transitions the first appliance to one of a reduced power state and an off state, and automatically issuing the second set of counterpart control signals transitions the second appliance to an on state.

8. The method of claim 7, wherein automatically issuing the first set of counterpart control signals and the second set of counterpart control signals transitions the first appliance and the second appliance to an overall reduced power consumption state.

9. The method of claim 1, further comprising:

determining whether a sensed environmental condition corresponds to an alert condition in the environment corresponding to the first appliance management device; and

automatically issuing at least one of an SMS message and an e-mail message in the event that a sensed environmental condition corresponds to an alert condition.

10. The method of claim 9, wherein an alert condition exists when a sensed environmental condition indicates a presence of human activity in the environment corresponding to the first appliance management device.

11. The method of claim 9, wherein an alert condition exists when a sensed environmental condition indicates an alert threshold has been satisfied in the environment corresponding to the first appliance management device.

12. The method of claim 11, wherein the alert threshold comprises one of a threshold temperature, a threshold light intensity, and a threshold sound level.

13. The method of claim 9, further comprising:

receiving user input that defines alert message content;

storing alert message content in the first appliance management device; and

generating one of an SMS message and an e-mail message that includes the alert message content.

14. The method of claim 13, wherein user input that defines alert message content is received by way of a graphical computer interface executing on a computer system coupled to the first appliance management device.

15. The method of claim 1, further comprising issuing an occupancy notification to a second appliance management device in response to a sensed

environmental condition that indicates a presence of human activity in the environment corresponding to the first appliance management device.

16. The method of claim 1, further comprising issuing an occupancy notification to a second appliance management device in response to a sensed environmental condition that indicates a presence of human activity during one of a predetermined time interval and a user programmable time interval in the environment corresponding to the first appliance management device.

17. The method of claim 1, further comprising:

receiving a third set of appliance control signals at a second appliance management device distinct from the first appliance management device, the third set of appliance control signals generated by a remote control corresponding to a third appliance distinct from the first appliance and the second appliance, the third set of appliance control signals comprising at least one control instruction for the third appliance;

storing a third set of counterpart control signals in the second appliance management device, the third set of counterpart control signals comprising functional duplicates of the third set of appliance control signals;

sensing a set of environmental conditions in an environment corresponding to the second appliance management device;

determining whether a sensed environmental condition indicates a lack of human activity during a second time period in the environment corresponding to the second appliance management device; and

automatically issuing the third set of counterpart control signals to the third appliance if a sensed environmental condition indicates a lack of human activity during the second time period in the environment corresponding to the second appliance management device.

18. The method of claim 17, further comprising automatically exchanging status signals between the first appliance management device and the second appliance management device.

19. The method of claim 17, wherein each of the first appliance, the second appliance, and the third appliance are distinct with respect to at least one of appliance type, appliance manufacturer, control signal type, appliance control signal type, appliance control signal format, and appliance control signal communication protocol.

20. An automated appliance management method comprising:

storing a plurality of appliance control signal sets in an appliance management device, each appliance control signal set corresponding to a distinct appliance within a plurality of appliances, each appliance control signal set comprising at least one control instruction for adjusting an operating state of a corresponding appliance;

monitoring a set of environmental conditions in an environment corresponding to the appliance management device;

determining whether an environmental condition in the environment corresponding to the appliance management device indicates whether the plurality of appliances is to be transitioned to one of a reduced overall power consumption state and a zero power consumption state; and

automatically outputting the plurality of appliance control signal sets in the event that the environmental condition in the environment corresponding to the appliance management device indicates that the plurality of appliances is to be transitioned to one of a reduced overall power consumption state and a zero power consumption state.

21. The method of claim 20, wherein the plurality of appliance control signal sets comprises a first appliance control signal set corresponding to a first appliance and a second appliance control signal set corresponding to a second appliance, and wherein the first appliance and the second appliance differ in terms of at least one of appliance type and appliance manufacturer.

22. The method of claim 20, wherein the plurality of appliance control signal sets comprises a first appliance control signal set and a second appliance control signal set that differs from the first appliance control signal set in at least one

of a control signal type, a control signal format, and a control signal communication protocol.

23. The method of claim 20, wherein automatically outputting the plurality of control signal sets transitions the plurality appliances to an overall reduced power consumption state in which at least one appliance remains in an on state.

24. The method of claim 20, wherein outputting the plurality of control signal sets transitions a first appliance from an on state to a zero power consumption state and transitions a second appliance to an on state from a zero power consumption state.

25. The method of claim 20, wherein automatically outputting the plurality of control signal sets automatically results in a change in a temperature set point of an environmental control unit that remains active after the change in the temperature set point.

26. The method of claim 25, wherein the environmental control unit comprises one of an air conditioning unit and a heating unit.

27. The method of claim 20, wherein determining whether an environmental condition indicates whether an appliance is to be transitioned to one of a reduced power consumption state and a zero power consumption state comprises determining whether an environmental condition corresponds to a lack of human activity during a predetermined time interval.

28. The method of claim 20, further comprising:

transitioning the appliance management device to an alert mode;

determining whether an environmental condition in an environment corresponding to the appliance management device indicates an alert condition; and

issuing at least one of an SMS message and an e-mail message to a network in the event that an environmental condition in an environment corresponding to the appliance management device indicates an alert condition.

29. The method of claim 28, wherein the at least one of an SMS message and an e-mail message indicates one of a human occupancy condition, a threshold temperature condition, a threshold lighting condition, and a threshold audio condition.

30. The method of claim 20, further comprising:

automatically determining that an environmental condition in an environment corresponding to the appliance management device indicates a presence of human activity; and

outputting a set of status signals directed to another appliance management device in response to determining that the environmental condition indicates the presence of human activity.

31. The method of claim 20, further comprising:

receiving a set of status signals from another appliance management device; and

avoiding the outputting of the plurality of control signal sets for a predetermined time period in response to receiving the set of status signals.

32. An automated appliance management method comprising:

storing a set of appliance control signals in an appliance management device, the set of appliance control signals comprising at least one control instruction for adjusting an operating state of an appliance;

transitioning the appliance management device to an alert mode;

determining whether an environmental condition in an environment corresponding to the appliance management device indicates an alert condition; and

issuing an alert to a network in the event that an environmental condition in an environment corresponding to the appliance management device indicates an alert condition.

33. The appliance management method of claim 32, wherein the alert condition corresponds to one of the presence of human activity, a threshold temperature condition, a threshold lighting condition, and a threshold audio condition.

34. The appliance management method of claim 32, wherein the alert comprises one of an SMS message and an e-mail message.

35. The appliance management method of claim 32, further comprising:

monitoring a set of environmental conditions in an environment corresponding to the appliance management device;

determining whether an environmental condition in the environment corresponding to the appliance management device indicates that the set of appliance control signals is to be output; and

automatically outputting the set of appliance control signals in the event that the environmental condition in the environment corresponding to the appliance management device indicates that the set of appliance control signals is to be output.

36. The appliance management method of claim 35, wherein determining whether an environmental condition in an environment corresponding to the appliance management device indicates that the set of appliance control signals is to be output comprises determining whether the environmental condition indicates a lack of human presence during a predetermined time period.

37. An automated appliance management device comprising:

a processing unit;

a set of transceivers coupled to the processing unit;

a set of sensors coupled to the processing unit; and

a memory coupled to the processing unit, the memory comprising:

a set of appliance management data structures storing a first set of counterpart control signals corresponding to a first appliance and a second set of counterpart control signals corresponding to a second appliance distinct from the first appliance, the first appliance responsive to the first set of counterpart control signals and the second appliance responsive to the second set of counterpart control signals; and

an appliance management module comprising program instructions configured to automatically output the first set of appliance control signals and the second set of appliance control signals in response to a sensed environmental condition that indicates a lack of human activity in an environment corresponding to the automated appliance management device.

38. The automated appliance management device of claim 37, wherein the first appliance and the second appliance differ in at least one of appliance type and appliance manufacturer.

39. The automated appliance management device of claim 37, wherein the first set of counterpart control signals exhibits one of a different signal type, a different signal format, and a different signal communication protocol than the second set of counterpart control signals.

40. The automated appliance management device of claim 37, wherein the appliance management module comprises program instructions configured to transition the first and second appliances to at least one of of an overall reduced power consumption yet still active state and a zero power consumption state in response to a sensed environmental condition that indicates a lack of human activity in the environment corresponding to the automated appliance management device.

41. The automated appliance management device of claim 40, wherein the first set of counterpart control signals comprises signals configured to transition

the first appliance to one of a reduced power consumption yet still active state and a zero power consumption state, and the second set of counterpart control signals comprises signals configured to transition the second appliance to one of a reduced power consumption yet still active state and a zero power consumption state.

42. The automated appliance management device of claim 37, wherein the first set of counterpart control signals comprises signals configured to transition the first appliance to one of a reduced power consumption yet still active state and a zero power consumption state, and the second set of counterpart control signals comprises signals configured to transition the second appliance to an on state.

43. The automated appliance management network of claim 37, further comprising a communication unit coupled to the processing unit, the communication unit configured for signal transfer between each of a computer system and a mobile telephone network.

44. The automated appliance management device of claim 43, wherein the appliance management module further comprises program instructions configured to issue a set of alerts by way of the communication unit in response to a sensed alert condition.

45. The automated appliance management device of claim 44, wherein the set of alerts includes at least one of an SMS message and an e-mail message.

46. The automated appliance management device of claim 44, wherein the sensed alert condition corresponds to the presence of human activity in the environment corresponding to the automated appliance management device.

47. The automated appliance management device of claim 44, wherein the sensed alert condition corresponds to one of a threshold temperature, a threshold light intensity, and a threshold sound level.

48. The automated appliance management device of claim 37, further comprising a set of user selectable input elements coupled to the processing unit.

49. The automated appliance management device of claim 48, wherein the set of user selectable input elements is configured to transition the automated appliance management device into an operational mode selected from the group of a programming mode, a test mode, a sensing mode, and an alert mode.

50. The automated appliance management device of claim 48, wherein the set of user selectable input elements comprises a set of switches.

51. The automated appliance management device of claim 48, further comprising a housing that carries the processing unit, the set of transceivers, the set of sensors, the memory, and the set of user selectable input elements.

52. An automated appliance management device comprising:

a processing unit;

a set of transceivers coupled to the processing unit;

a set of sensors coupled to the processing unit;

a communication unit coupled to the processing unit, the communication unit configured for signal transfer with a network; and

a memory coupled to the processing unit, the memory comprising:

a set of counterpart control signals corresponding to an appliance responsive to the set of counterpart control signals; and

an appliance management module comprising:

program instructions configured to automatically output the set of appliance control signals in response to a sensed environmental condition that indicates a lack of human activity in an environment corresponding to the automated appliance management device; and

program instructions configured to issue a set of alerts to a network by way of the communication unit in response to a sensed alert condition.

53. The automated appliance management device of claim 52, wherein the sensed alert condition corresponds to one of the presence of human activity, a threshold temperature condition, a threshold lighting condition, and a threshold audio condition.

54. The automated appliance management device of claim 52, wherein the set of alerts comprises at least one of an SMS message and an e-mail message.

55. An automated appliance management system comprising:

a first appliance management device comprising:

a processing unit;

a set of transceivers coupled to the processing unit;

a set of sensors coupled to the processing unit;

a communication unit; and

a memory coupled to the processing unit, the memory comprising:

a first appliance management data structure storing a first set of counterpart control signals corresponding to a first appliance, the first appliance responsive to the first set of counterpart control signals; and

an appliance management module comprising:

program instructions configured to automatically output the first set of appliance control signals in response to a set of sensed environmental conditions that indicates a lack of human activity in an environment corresponding to the first appliance management device; and

program instructions configured to output first appliance management device status information to another appliance management device; and

a second appliance management device comprising:

a processing unit;

a set of transceivers coupled to the processing unit;

a set of sensors coupled to the processing unit;

a communication unit; and

a memory coupled to the processing unit, the memory comprising:

a second appliance management data structure storing a second set of counterpart control signals corresponding to a second appliance distinct from the first appliance, the second appliance responsive to the second set of counterpart control signals; and

an appliance management module comprising:

program instructions configured to automatically output the second set of appliance control signals in response to a set of sensed environmental conditions that indicates a lack of human activity in an environment corresponding to the second appliance management device; and

program instructions configured to process first appliance management device status information received from the first appliance management device.

56. The automated appliance management system of claim 55, wherein the communication unit of at least one of the first appliance management device and the second appliance management device is configured to communicate with a mobile telephone network.

57. The automated appliance management system of claim 56, wherein the communication unit of at least one of the first appliance management device and the second appliance management device is configured to communicate an SMS message to a mobile telephone network.

58. The automated appliance management system of claim 57, wherein the appliance management module of at least one of the first appliance management device and the second appliance management device further comprises program instructions for directing the issuance of an SMS message in response to a sensed environmental condition that indicates the presence of human activity.

59. The automated appliance management system of claim 55, further comprising a computer system coupled to one of the first appliance management device and the second appliance management device, the computer system including a graphical user interface responsive to user input that establishes a configuration data set for an appliance management control device to which the computer system is coupled.

60. The automated appliance management system of claim 59, wherein the configuration data set includes message content corresponding to at least one of an SMS message and an e-mail message.

61. The automated appliance management system of claim 59, wherein the configuration data set includes a set of alert conditions corresponding to at least one of a temperature threshold, a light intensity threshold, and a sound level threshold.

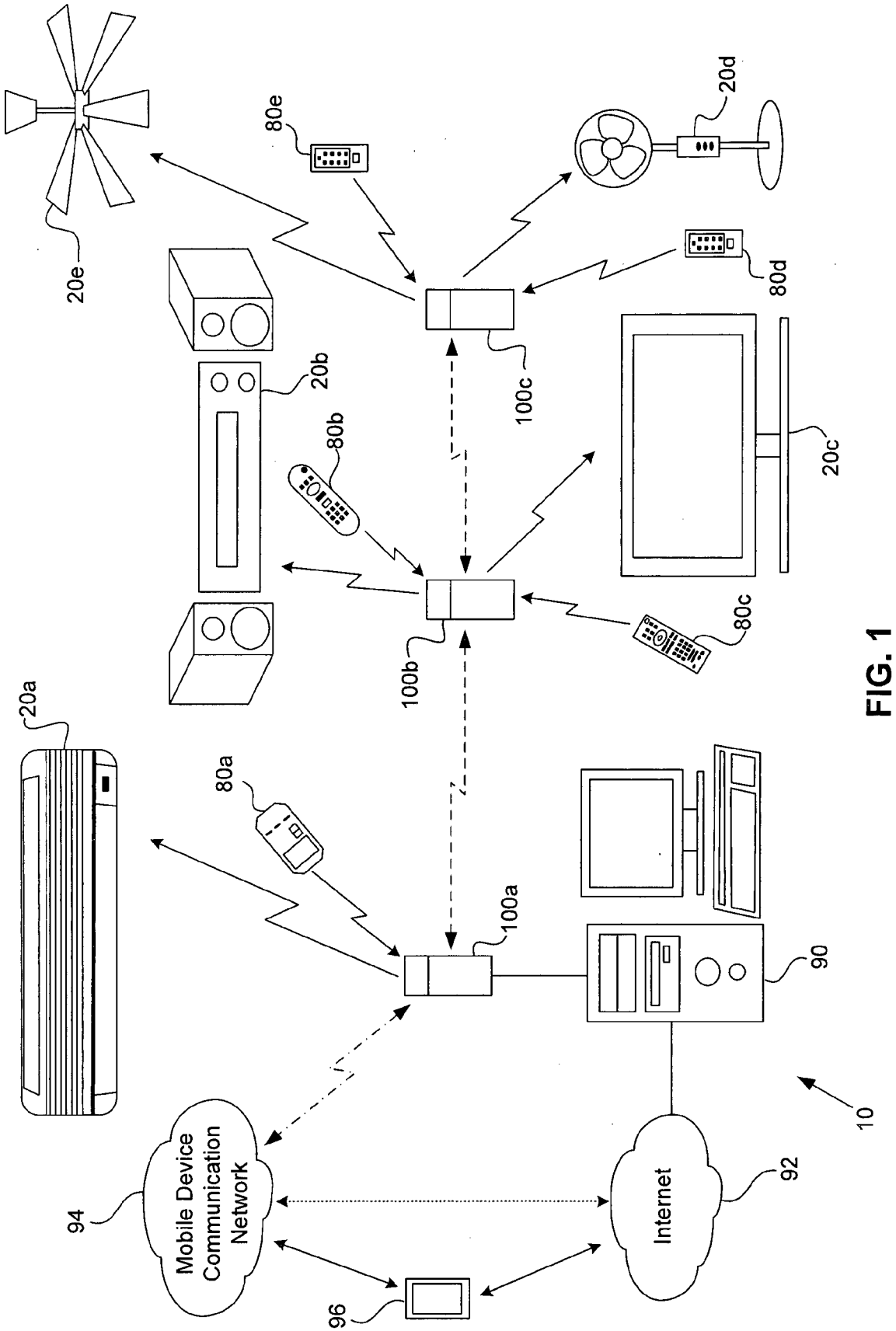
20e
80e
20d
80d
20b
80b
100c
20c
100b
80c
20a
80a
100a
90
Mobile Device Communication Network
94
Internet
92
96
10

FIG. 1

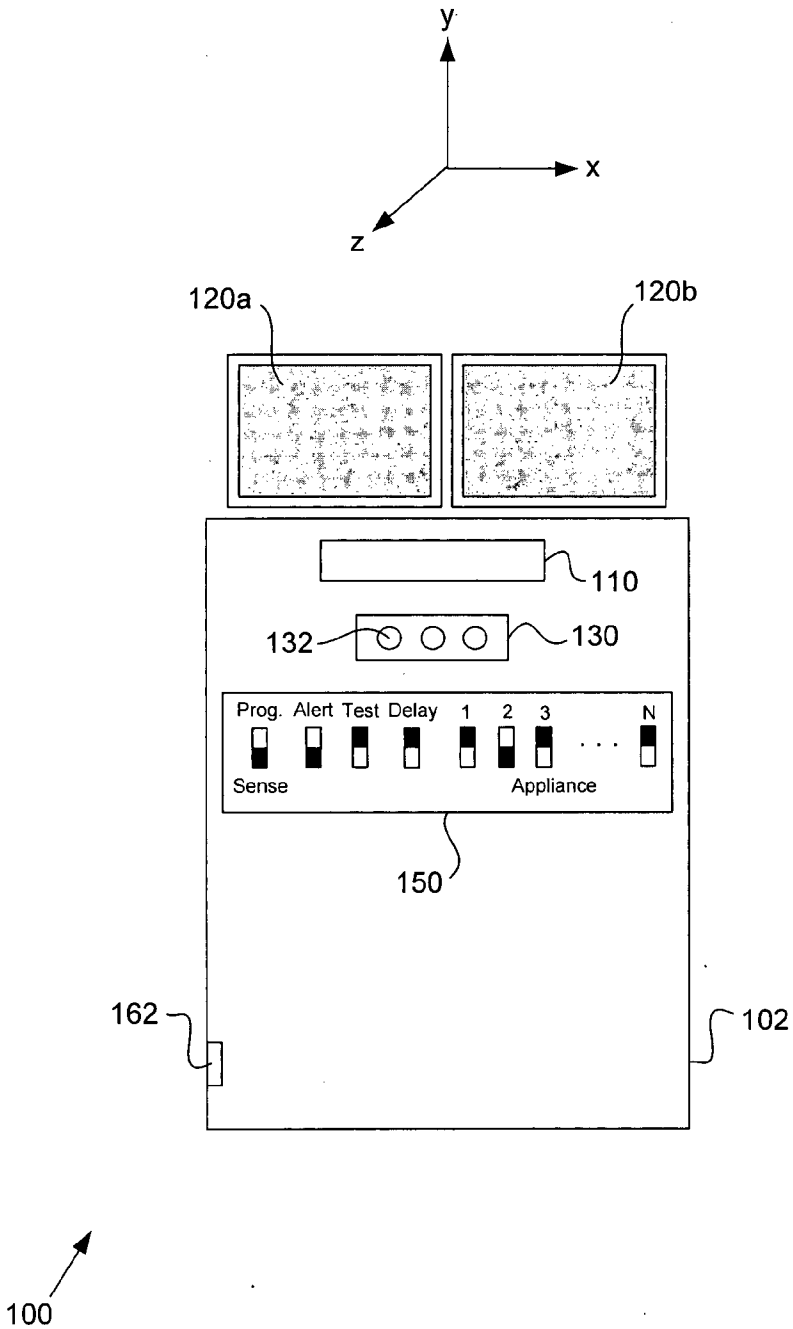
y
x
z
120a
120b
110
132
130
Prog.
Alert
Test
Delay
1
2
3
N
Sense
Appliance
150
162
102
100

FIG. 2A

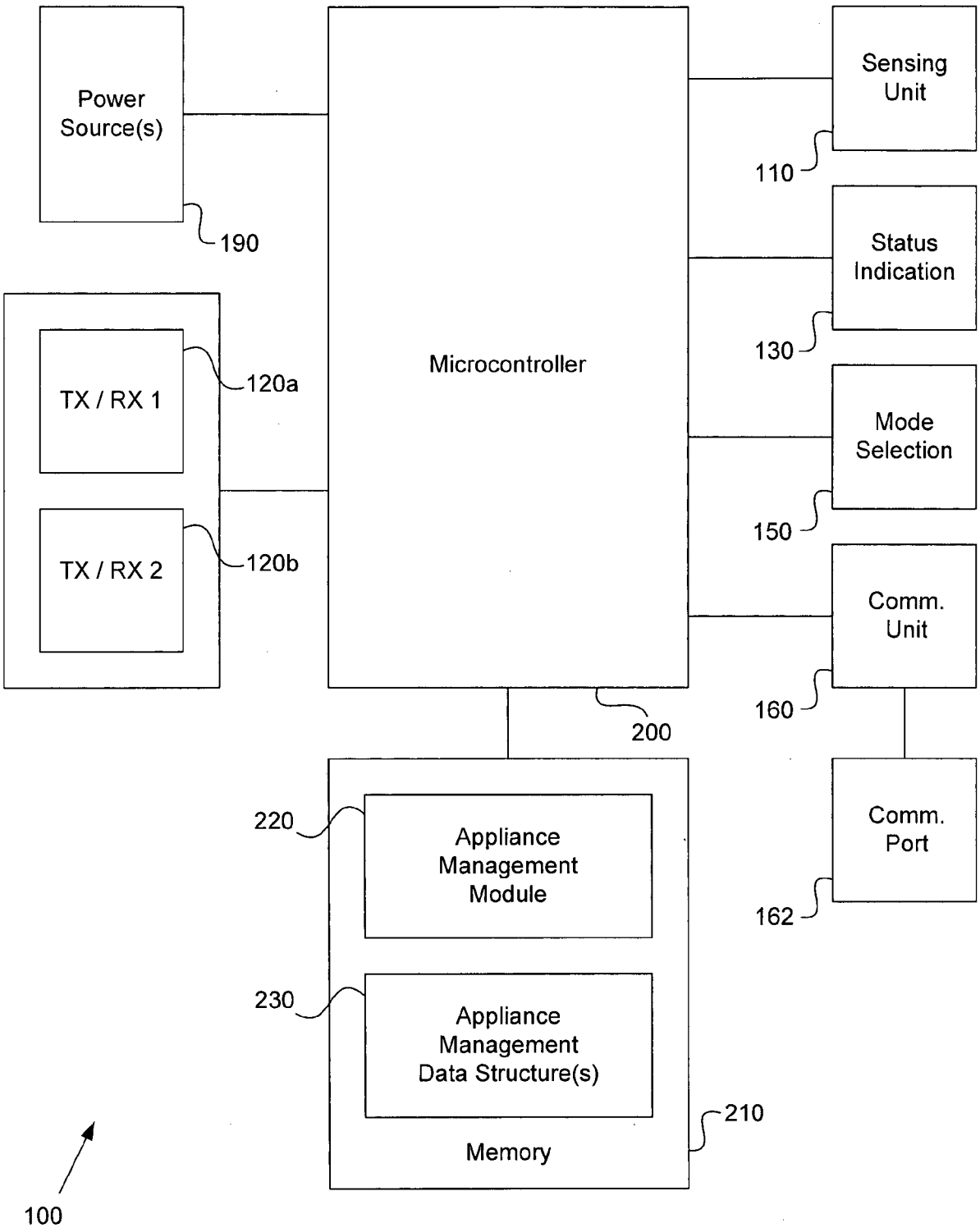
Power Source(s)
190
Microcontroller
Sensing Unit
110
Status Indication
130
Mode Selection
150
Comm. Unit
160
Comm. Port
162
TX / RX 1
120a
TX / RX 2
120b
200
220
Appliance Management Module
230
Appliance Management Data Structure(s)
Memory
210
100

FIG. 2B

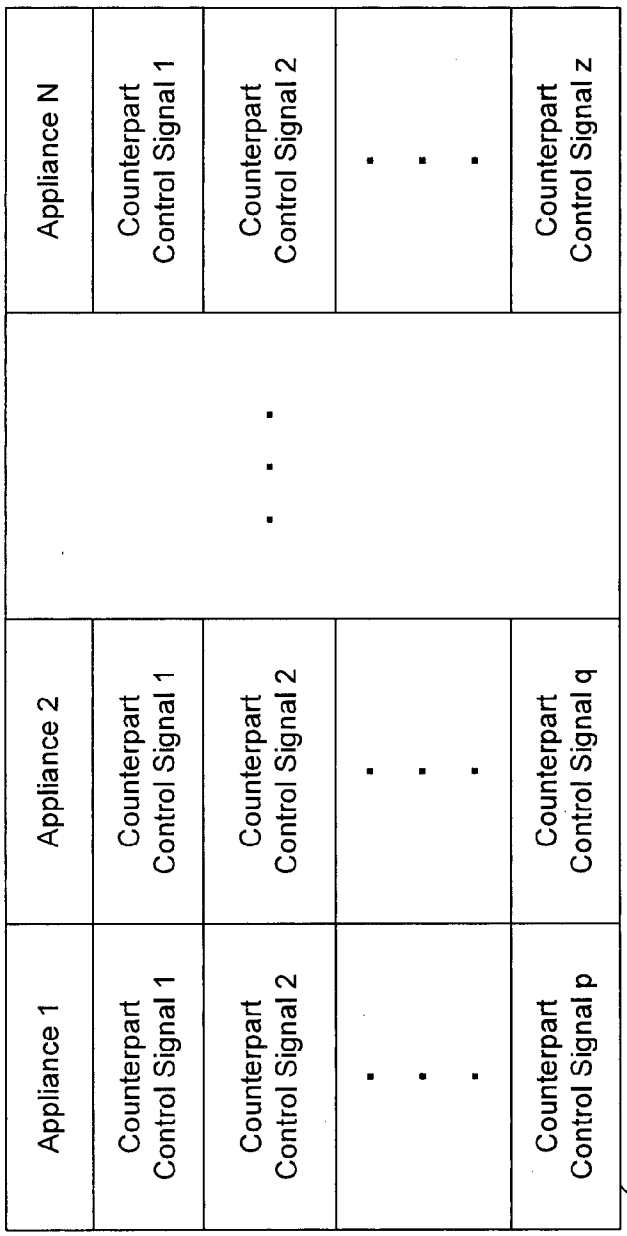
Appliance 1
Appliance 2
Appliance N
Counterpart Control Signal 1
Counterpart Control Signal 2
Counterpart Control Signal p
Counterpart Control Signal q
Counterpart Control Signal z
230a

FIG. 2C

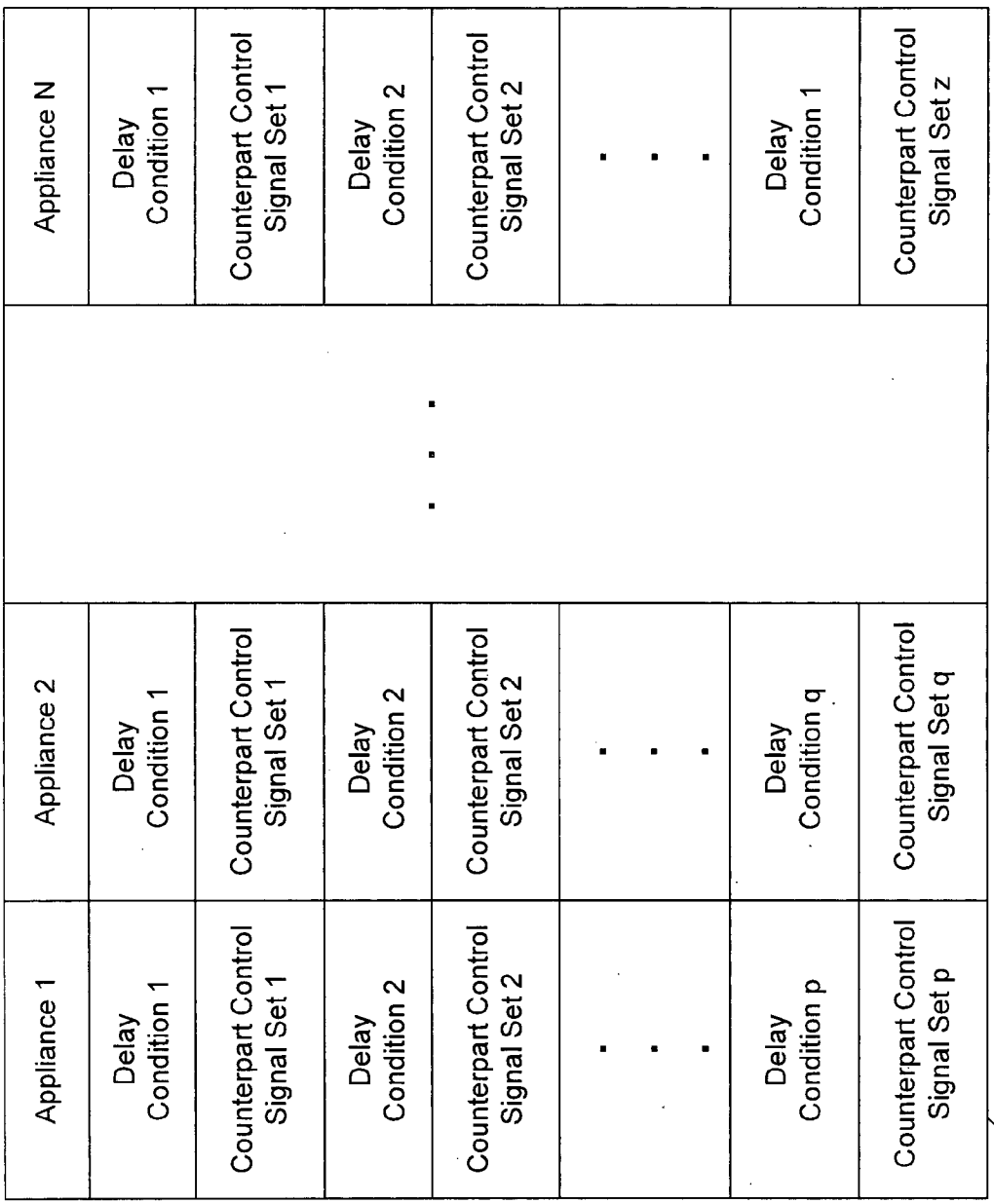
Appliance 1
Delay Condition 1
Counterpart Control Signal Set 1
Delay Condition 2
Counterpart Control Signal Set 2
Delay Condition p
Counterpart Control Signal Set p
Appliance 2
Delay Condition 1
Counterpart Control Signal Set 1
Delay Condition 2
Counterpart Control Signal Set 2
Delay Condition q
Counterpart Control Signal Set q
Appliance N
Delay Condition 1
Counterpart Control Signal Set 1
Delay Condition 2
Counterpart Control Signal Set 2
Delay Condition 1
Counterpart Control Signal Set z
230b

FIG. 2D

AAMD Identifier	
Occupancy Alert Message	
Mobile Number 1	E-mail Address 1
Mobile Number 2	E-mail Address 2
. . .	. . .
Mobile Number j	E-mail Address k

240a

FIG. 2E

AAMD Identifier	
Occupancy Alert Message	
Temperature Alert Message	
Threshold Temperature	
Mobile Number 1	E-mail Address 1
Mobile Number 2	E-mail Address 2
. . .	. . .
Mobile Number m	E-mail Address n

240b

FIG. 2F

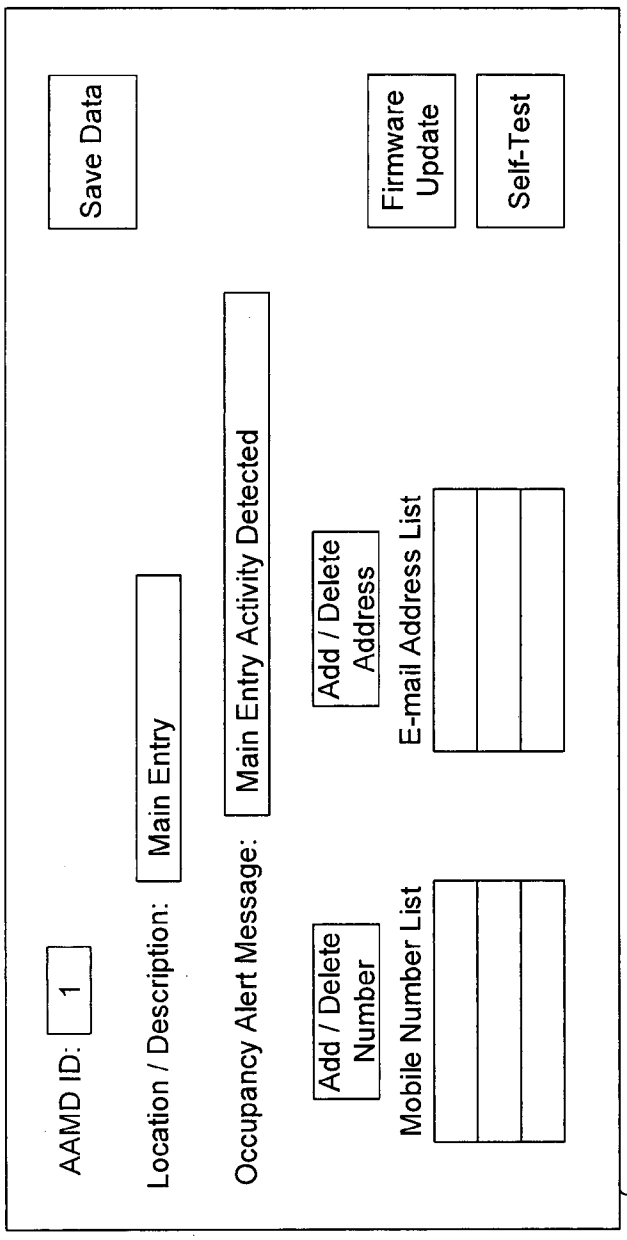
AAMD ID: 1
Location / Description: Main Entry
Occupancy Alert Message: Main Entry Activity Detected
Add / Delete Number
Mobile Number List
Add / Delete Address
E-mail Address List
Save Data
Firmware Update
Self-Test
250a

FIG. 2G

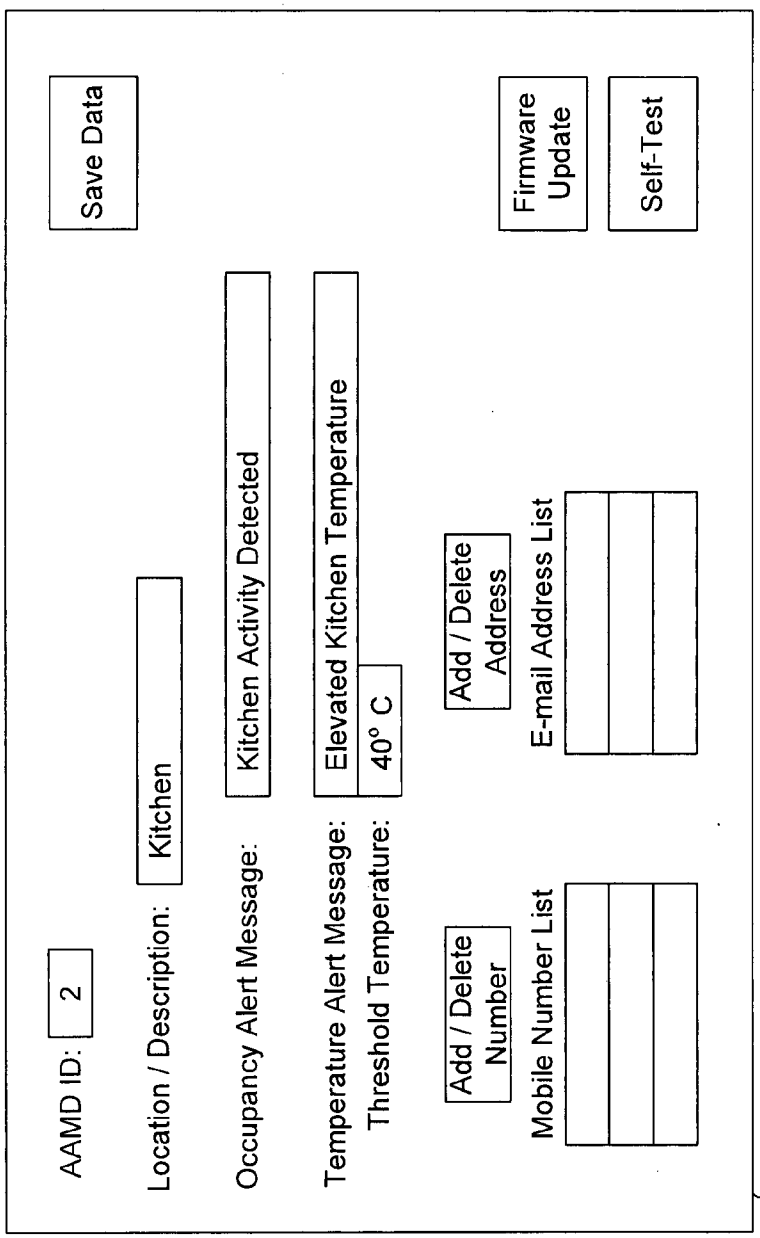
AAMD ID: 2
Save Data
Location / Description: Kitchen
Occupancy Alert Message: Kitchen Activity Detected
Temperature Alert Message: Elevated Kitchen Temperature
Threshold Temperature: 40° C
Add / Delete Number
Add / Delete Address
Mobile Number List
E-mail Address List
Firmware Update
Self-Test
250b

FIG. 2H

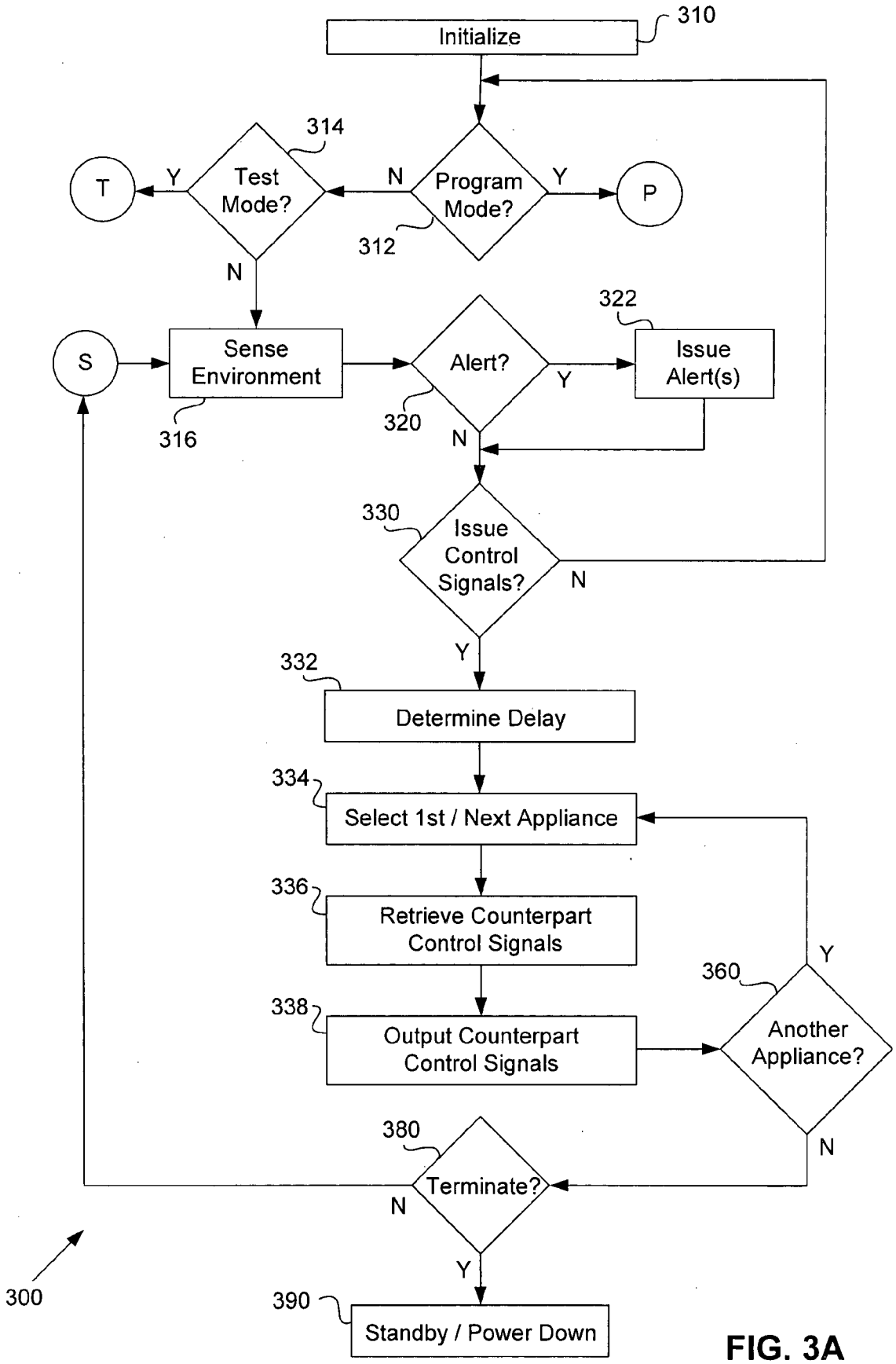
Initialize
310
Program Mode?
312
Y
P
N
Test Mode?
314
Y
T
N
Sense Environment
316
S
Alert?
320
Y
Issue Alert(s)
322
N
Issue Control Signals?
330
N
Y
Determine Delay
332
Select 1st / Next Appliance
334
Retrieve Counterpart Control Signals
336
Output Counterpart Control Signals
338
Another Appliance?
360
Y
N
Terminate?
380
N
Y
Standby / Power Down
390
300

FIG. 3A

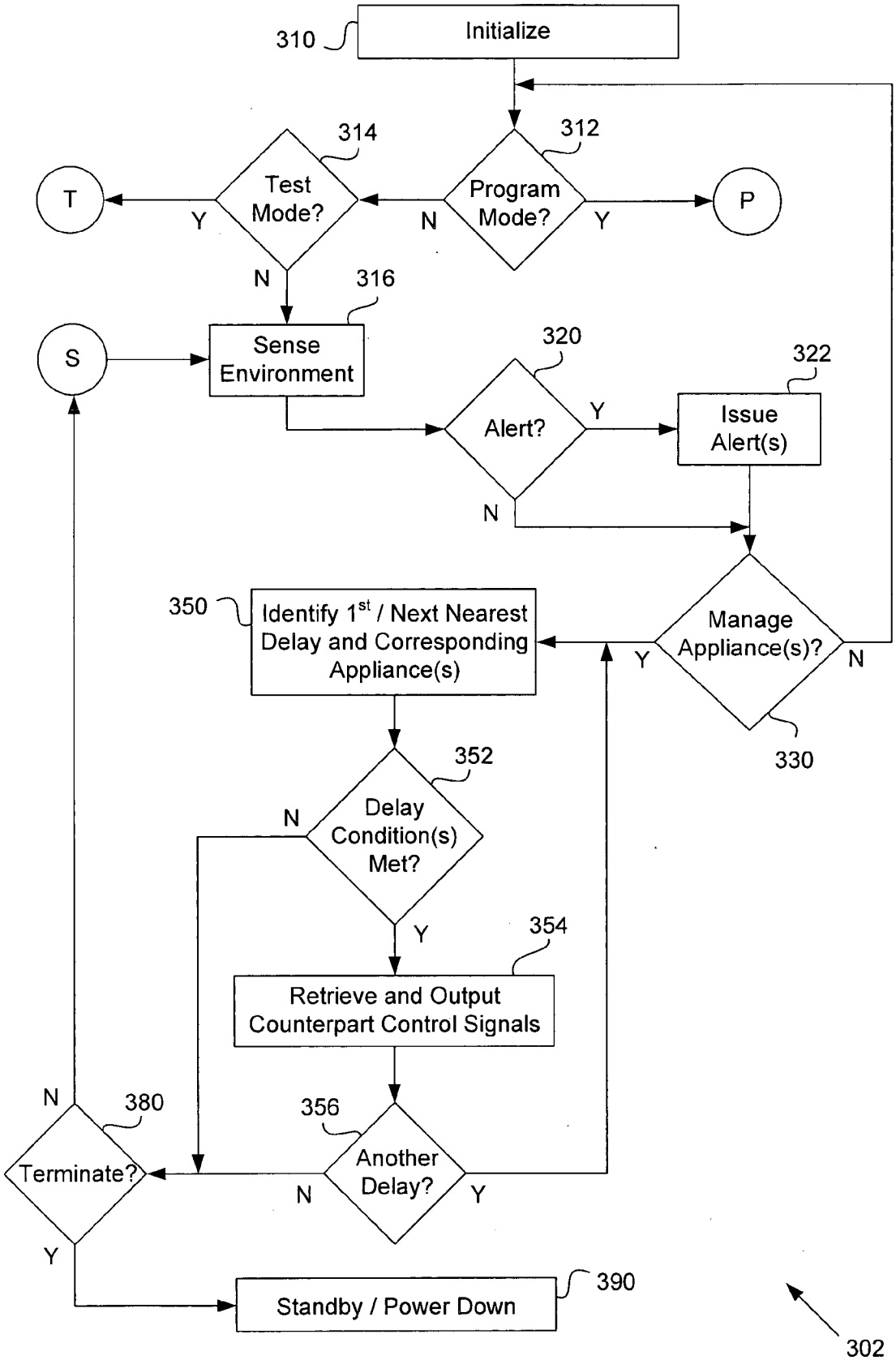
310
Initialize
312
Program Mode?
314
Test Mode?
T
P
Y
N
316
Sense Environment
S
320
Alert?
322
Issue Alert(s)
350
Identify 1st / Next Nearest Delay and Corresponding Appliance(s)
Manage Appliance(s)?
330
352
Delay Condition(s) Met?
354
Retrieve and Output Counterpart Control Signals
356
Another Delay?
380
Terminate?
390
Standby / Power Down
302

FIG. 3B

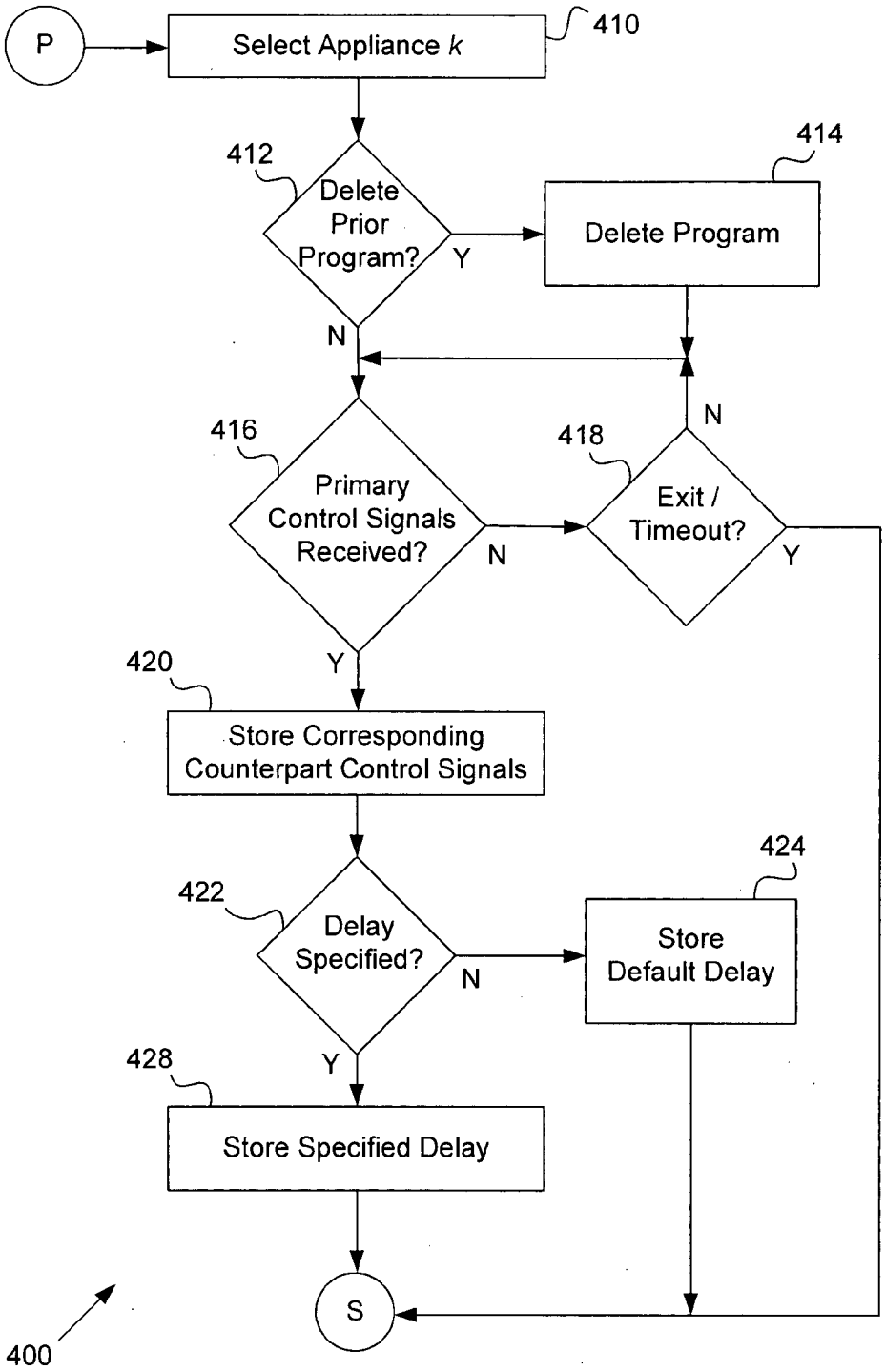
P
Select Appliance k
410
412
Delete Prior Program?
Y
414
Delete Program
N
416
Primary Control Signals Received?
N
418
Exit / Timeout?
N
Y
Y
420
Store Corresponding Counterpart Control Signals
422
Delay Specified?
N
424
Store Default Delay
Y
428
Store Specified Delay
S
400

FIG. 4A

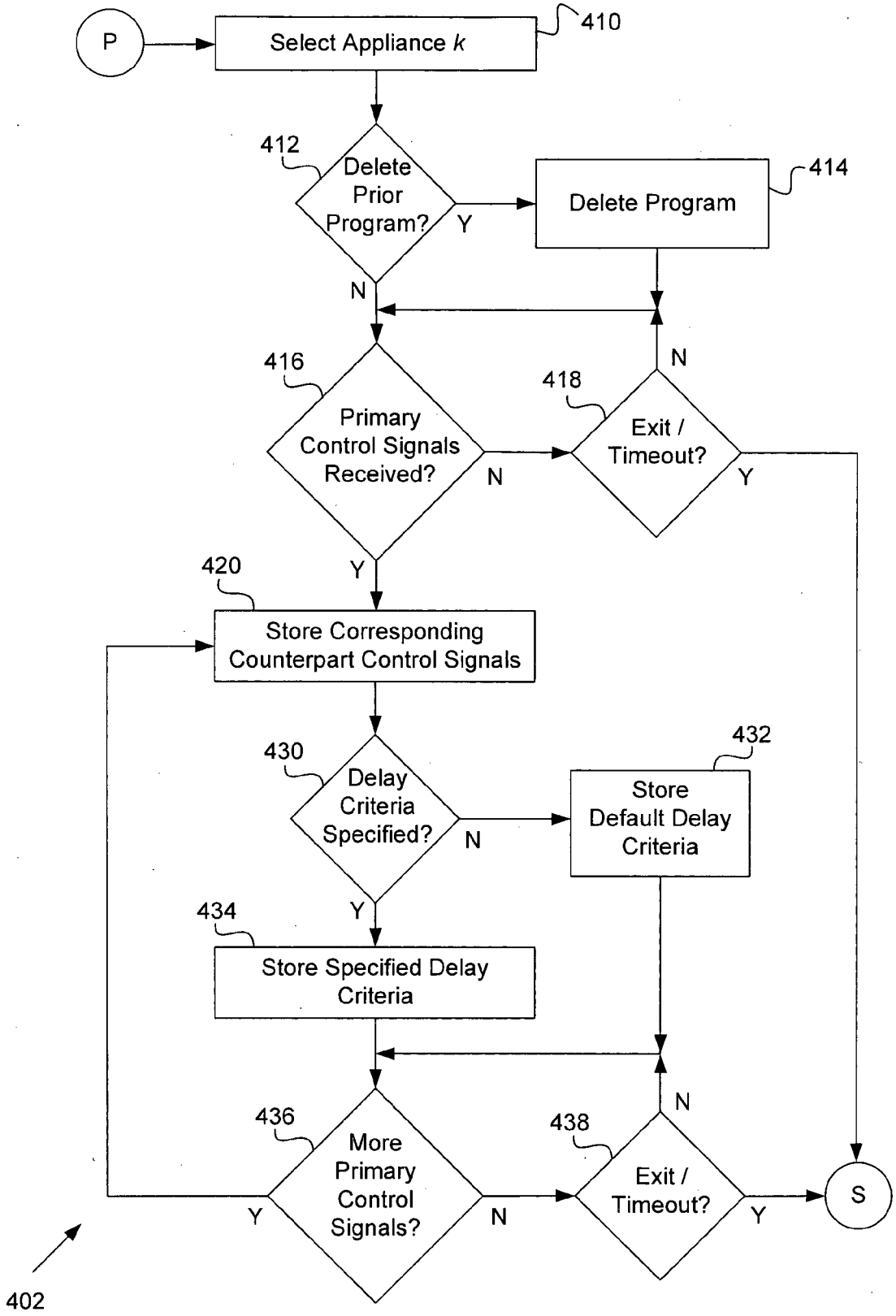
P
Select Appliance k
410
412
Delete Prior Program?
Y
Delete Program
414
N
416
Primary Control Signals Received?
N
418
Exit / Timeout?
N
Y
Y
420
Store Corresponding Counterpart Control Signals
430
Delay Criteria Specified?
N
432
Store Default Delay Criteria
Y
434
Store Specified Delay Criteria
436
More Primary Control Signals?
Y
N
438
Exit / Timeout?
N
Y
S
402

FIG. 4B

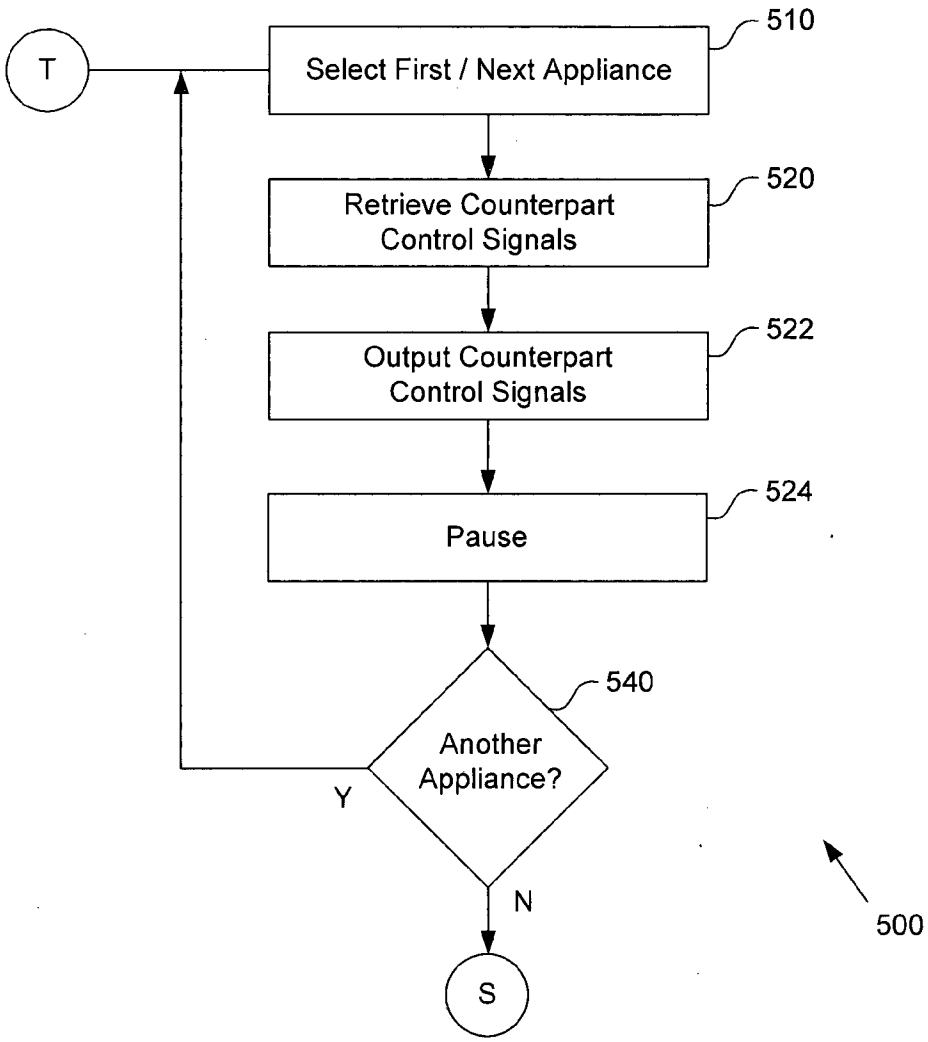
T
Select First / Next Appliance
510
Retrieve Counterpart Control Signals
520
Output Counterpart Control Signals
522
Pause
524
Another Appliance?
540
Y
N
S
500

FIG. 5A

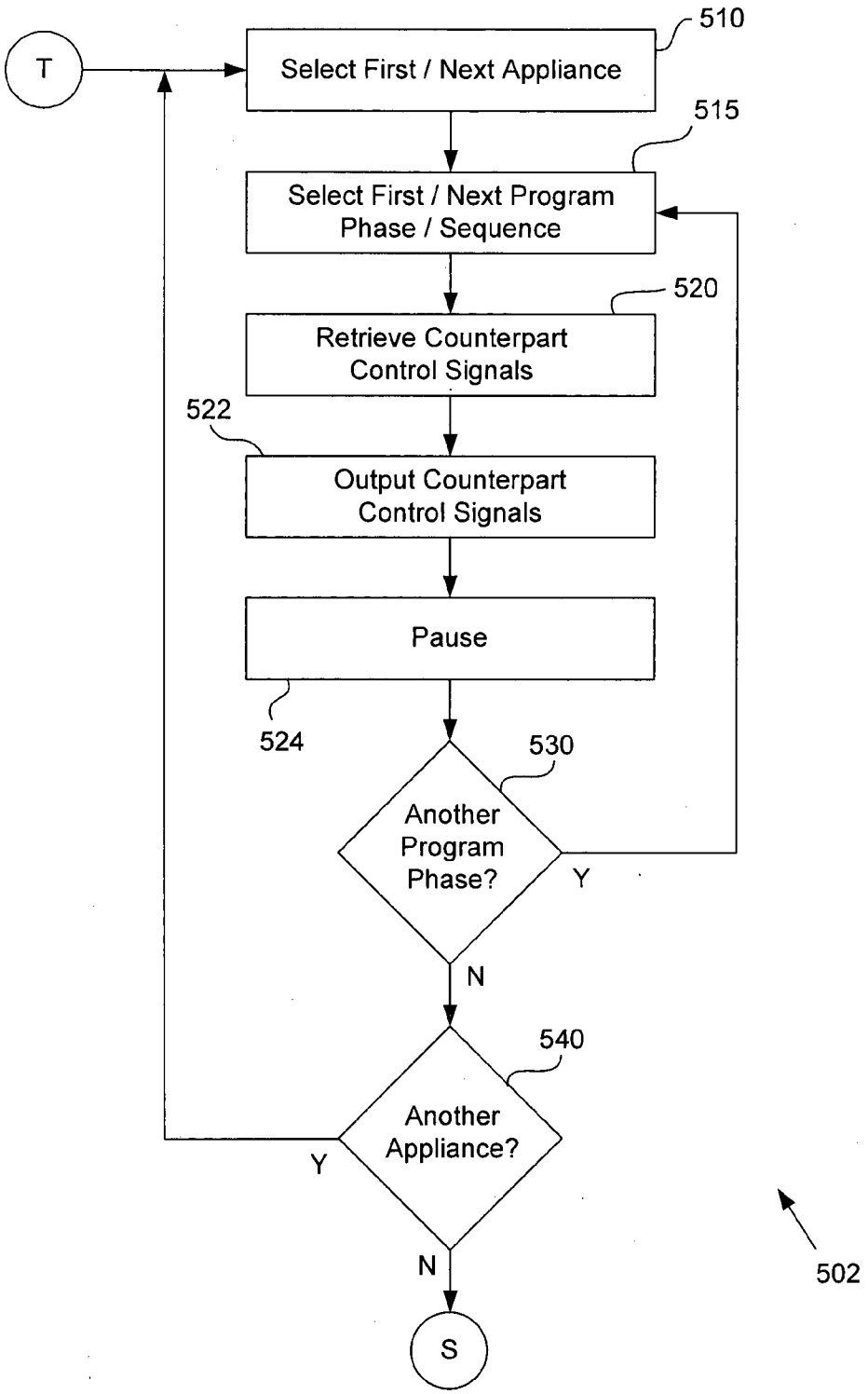
T
Select First / Next Appliance
510
515
Select First / Next Program Phase / Sequence
520
Retrieve Counterpart Control Signals
522
Output Counterpart Control Signals
Pause
524
530
Another Program Phase?
Y
N
540
Another Appliance?
Y
N
S
502

FIG. 5B

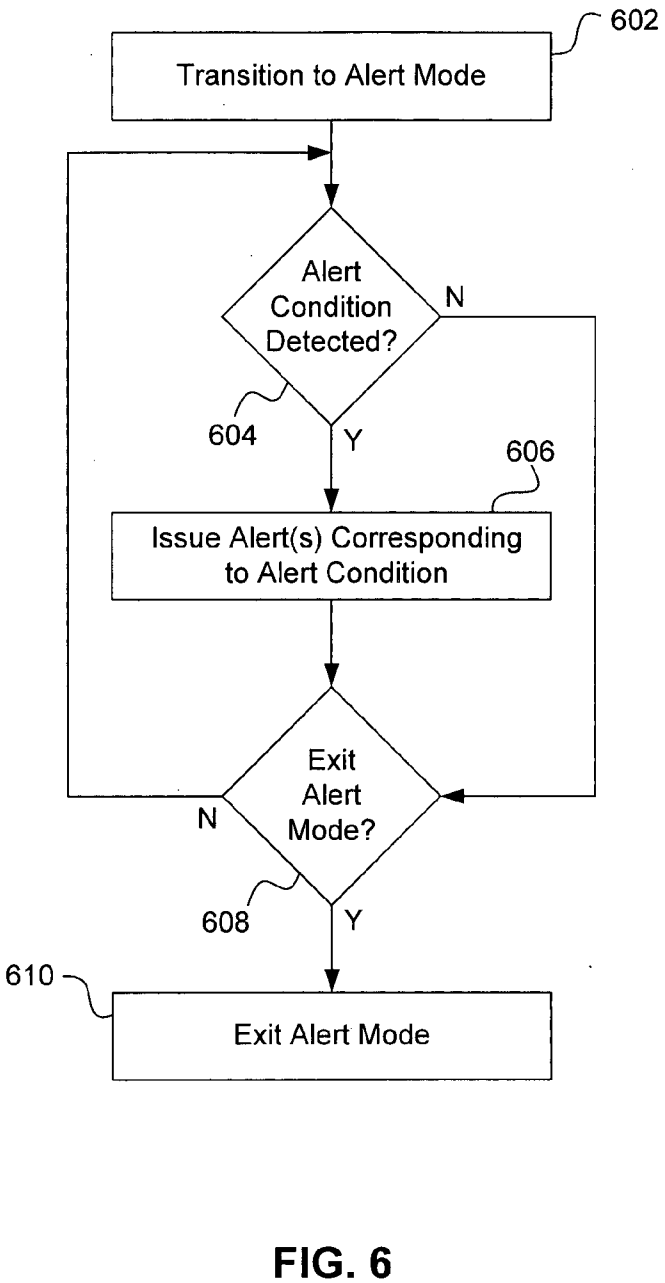
602
Transition to Alert Mode
Alert Condition Detected?
N
604
Y
606
Issue Alert(s) Corresponding to Alert Condition
Exit Alert Mode?
N
608
Y
610
Exit Alert Mode
600

FIG. 6