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(54) **SMART HOME SYSTEM**

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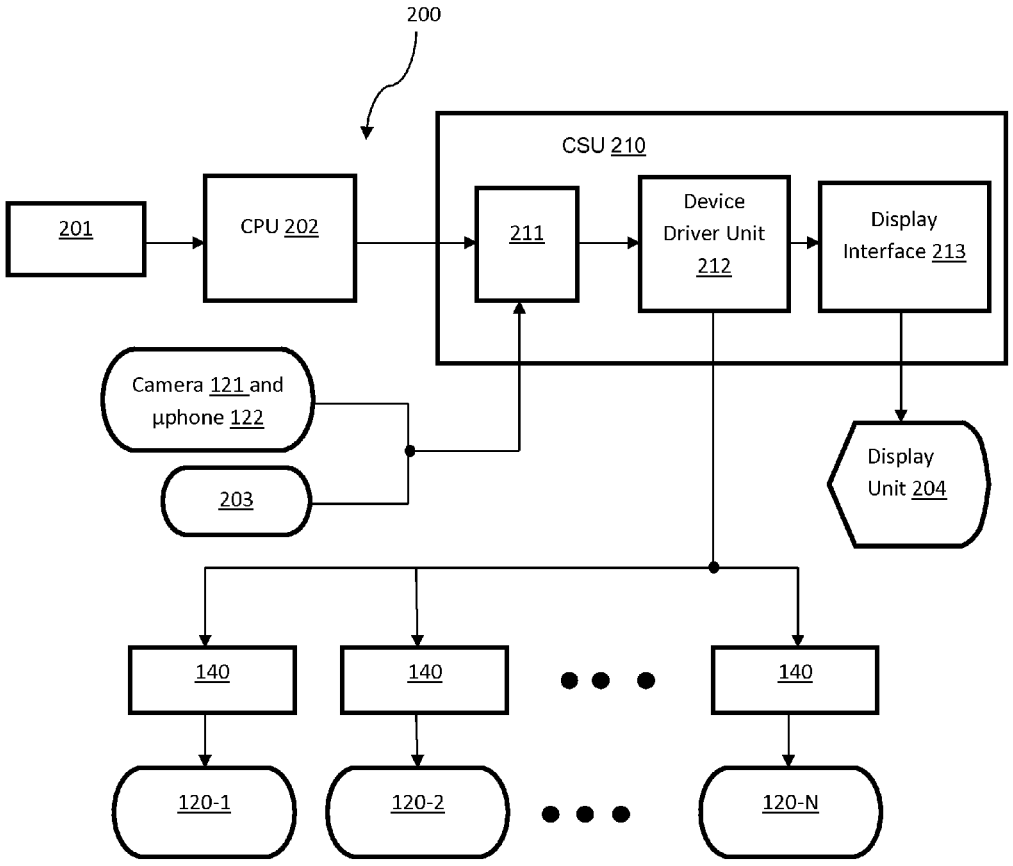
(57) **ABSTRACT**

A smart home system is disclosed which comprises a central camera system; a voice IP unit; a user identification system; a behavioral pattern data server; a plurality of sensors electrically coupled to operate each device based on the distance analysis with respect to each user; a central processing unit; a habit learning unit configured to analyze, interpret, and form a habitual usage profile for each user; and a central switching unit configured to operate each device following instructions from the central processing unit and the habit learning unit.



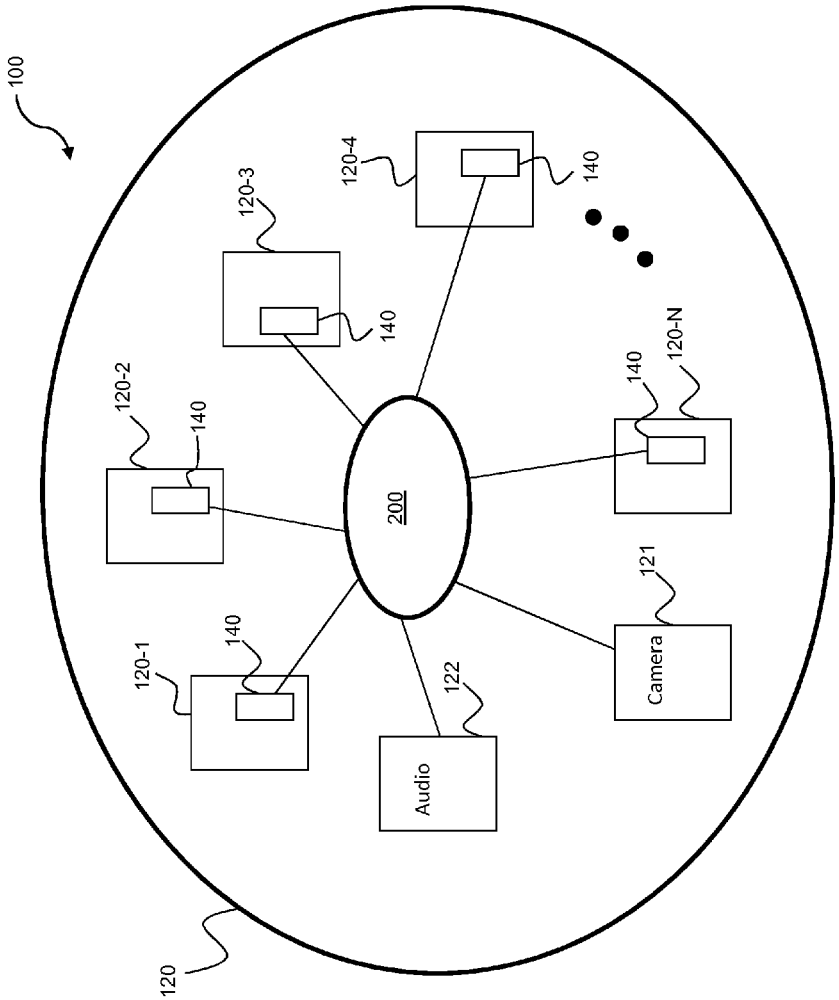

100
120-4
140
120-3
140
120-2
140
120-N
140
200
121
Camera
140
120-1
122
Audio
120

FIG. 1

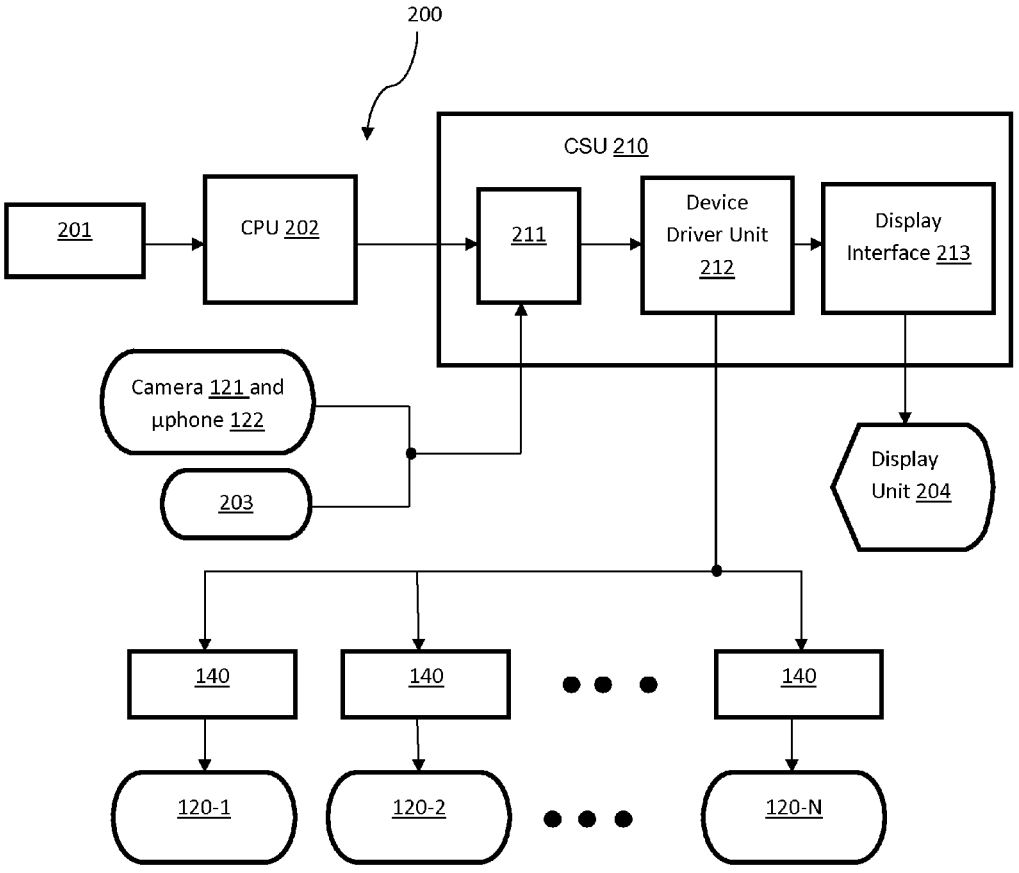

200
CSU 210
201
CPU 202
211
Device Driver Unit 212
Display Interface 213
Camera 121 and µphone 122
203
Display Unit 204
140
140
140
120-1
120-2
120-N

FIG. 2

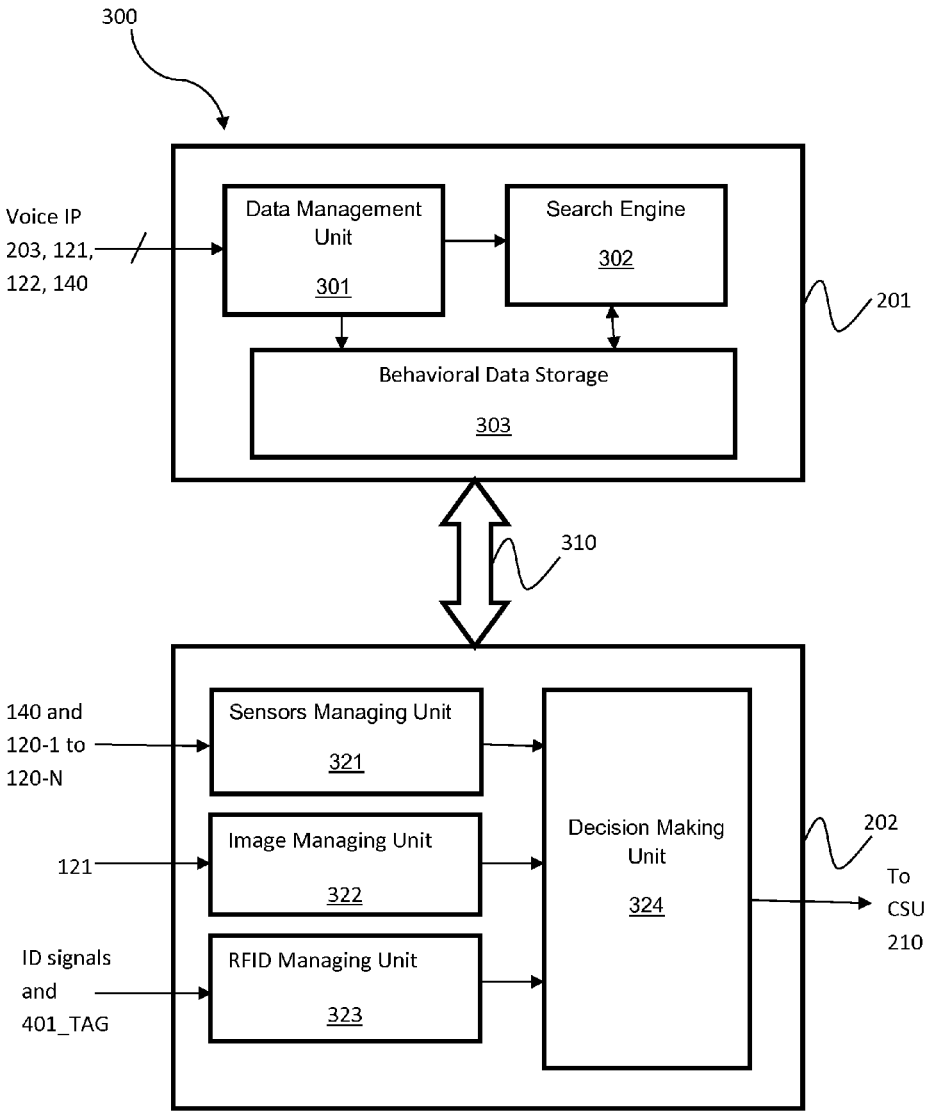

300
Voice IP
203, 121,
122, 140
Data Management Unit
301
Search Engine
302
Behavioral Data Storage
303
201
310
140 and
120-1 to
120-N
121
ID signals
and
401_TAG
Sensors Managing Unit
321
Image Managing Unit
322
RFID Managing Unit
323
Decision Making Unit
324
202
To
CSU
210

FIG. 3

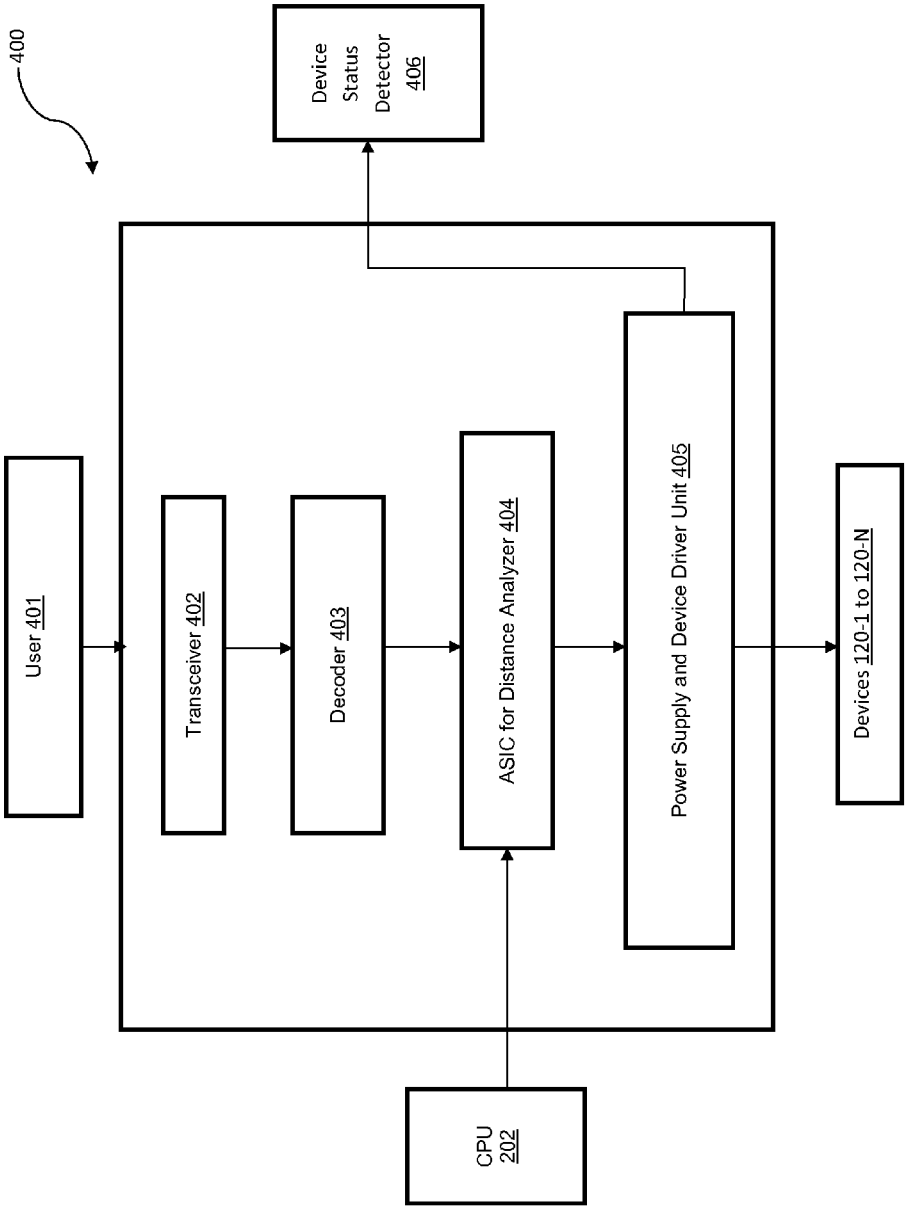

400
Device Status Detector 406
User 401
Transceiver 402
Decoder 403
ASIC for Distance Analyzer 404
Power Supply and Device Driver Unit 405
Devices 120-1 to 120-N
CPU 202

FIG. 4

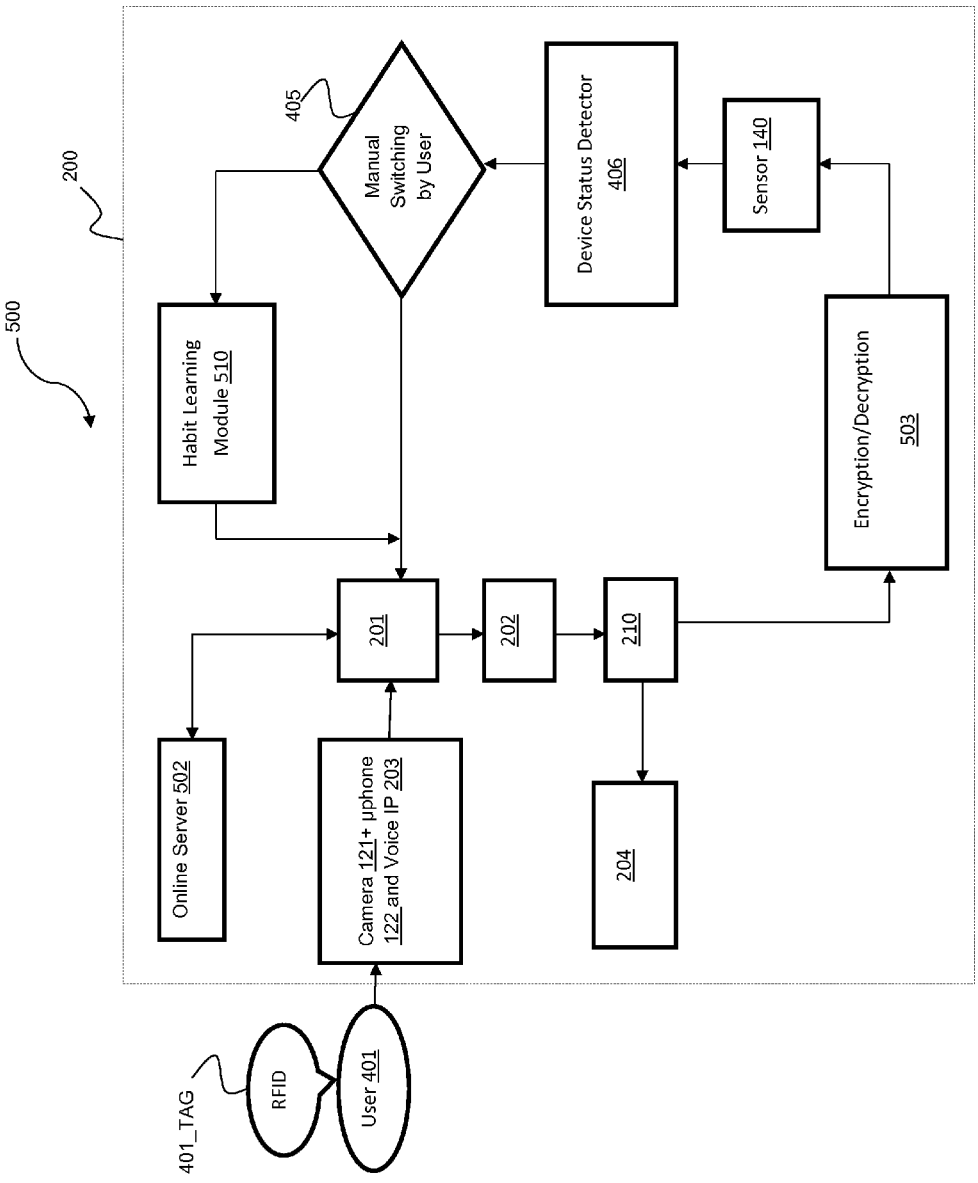

500
200
405
Manual Switching by User
Device Status Detector 406
Sensor 140
Habit Learning Module 510
Encryption/Decryption 503
201
202
210
Online Server 502
Camera 121+ μphone 122 and Voice IP 203
204
401_TAG
RFID
User 401

FIG. 5

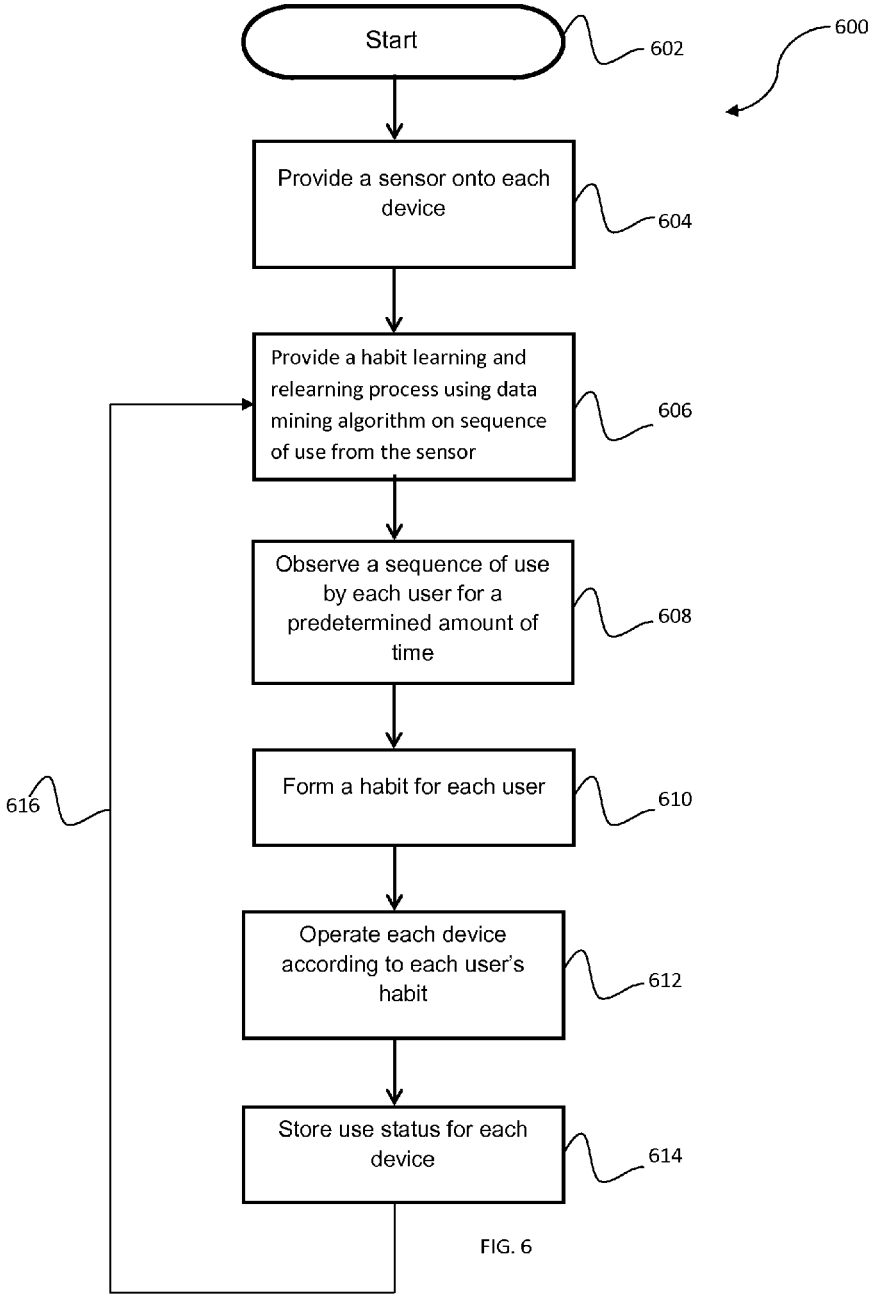

Start
602
600
Provide a sensor onto each device
604
Provide a habit learning and relearning process using data mining algorithm on sequence of use from the sensor
606
Observe a sequence of use by each user for a predetermined amount of time
608
Form a habit for each user
610
616
Operate each device according to each user's habit
612
Store use status for each device
614

FIG. 6

SMART HOME SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates generally to the field of electronic devices. More specifically, the present invention relates to a smart home system.

BACKGROUND ART

[0002] Since the beginning of the twentieth energy, energy saving has been critical for sustainable development because of the explosive population growth. The majority of energy consumption is from home or office uses. The government policy including charging penalties for excessive energy usage does not solve the problem due to continuing population growth. Therefore, building smart homes has become the trend for both convenient living and energy saving.

[0003] The current prior-art smart home systems are based on scheduling schemes. In the scheduling schemes, the prior-art smart home systems are programmed by users to provide a fixed schedule for turning on or off some devices in the house. For example, the current prior-art smart home systems are programmed to turn on the lights, a backyard watering system, or air conditioners, etc. at a specified time of the day.

[0004] However, the current prior-art smart home systems are too rigid to adapt to users' change in behaviors or work schedules. In other words, the prior-art smart home systems do not based on user's habit at all, they are based on a fixed schedule provided by users. Thus, the current prior art smart home systems lack the capability of learning and relearning new habits. This results in inconveniences for users, continuing energy waste. More particularly, devices are continued to be turned on according to the old schedule even when the users do not want to use them or when users are not even home due to unexpected events. Furthermore, the current prior-art smart home systems do not provide automatic operations for all devices in the house; only a few selected devices can be programmed by the current prior-art smart homes. Yet, in the current prior-art smart home systems, old devices must be replaced in order to be programmed. Thus, the current prior-art smart home systems are costly and do not provide flexibility, energy saving, and quality of life for users.

[0005] Therefore what is needed is a smart home system that is capable of adapting to each user's habit and relearning new habits.

SUMMARY OF THE INVENTION

[0006] Accordingly, an objective of the present invention is to provide a smart house that provides solutions to the problems described above. Thus, a method and a smart home system is disclosed which comprises a central camera system; a voice IP unit; a user identification system; a behavioral pattern data server; a plurality of sensors electrically coupled to operate each device based on the distance analysis with respect to each user; a central processing unit; a habit learning unit configured to analyze, interpret, and form a habitual usage profile for each user; and a central switching unit configured to operate each device following instructions from the central processing unit and the habit learning unit.

[0007] These advantages of the smart home of the present invention over the prior-art smart home systems can be listed in detail as followings:

[0008] Low costs.

[0009] Capability of operating each device in the house based on habit formed from data mining algorithm.

[0010] Capability of relearning and updating each user's newly formed habit.

[0011] Capability of using old devices without the need to buying new devices designed to be programmed by prior-art smart homes.

[0012] Capability of operating with all devices in the house.

[0013] These and other advantages of the present invention will no doubt become obvious to those of ordinary skill in the art after having read the following detailed description of the preferred embodiments, which are illustrated in the various drawing Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The accompanying drawings, which are incorporated in and form a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

[0015] FIG. **1** is a diagram illustrating a smart home system having a sensor connected to control each device and a habit learning unit in accordance with an embodiment of the present invention;

[0016] FIG. **2** is a system level schematic diagram illustrating a CPU, a central switching unit (CWU), and the sensors operating together to create the smart house system in accordance with an embodiment of the present invention;

[0017] FIG. **3** is a diagram illustrating the internal structure of the CPU and the behavior in accordance with an embodiment of the present invention;

[0018] FIG. **4** is a system level diagram illustrating the operation of the smart home system in accordance with an embodiment of the present invention;

[0019] FIG. **5**. is a diagram illustrating structure of the sensor in accordance with an embodiment of the present invention;

[0020] FIG. **6** is a flow chart illustrating a method for providing a smart home system based on users' habits in accordance with an embodiment of the present invention;

DETAILED DESCRIPTION OF THE INVENTION

[0021] Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, and circuits have not been described in detail so as not to unnecessarily obscure aspects of the present invention.

[0022] Referring now to FIG. **1** which illustrates a smart home **100** including devices **120-1** to **120**-N and a smart home system **200**. Each device, **120-1** to **120**-N, is equipped with a sensor **140**. Smart home system **200** is provided for a house **120**. In the present invention, smart home system **200** is configured to operate each device **120-1** to **120**-N according to each user's habit. In one example, devices **120-1** to **120**-N includes, but is not limited to, a washing/drying machine **120-1**, an air conditioner **120-2**, a flat screen **120-3**, a microwave oven **120-4**, a refrigerator **120-5**, a computer **120-6**, and a desk lamp **120-7**, etc. Sensor **140** is coupled to control each of the above-listed devices **120-1** to **120**-N. A central camera system **121** and a microphone system **122** are also installed in smart home **100** of the present invention.

[0023] In on embodiment of the present invention, all electrically controlled water outlets, i.e., **120-7**, such as touched faucets and timed sprinklers are also equipped with sensor **140**. Smart home system **200** communicates to each sensor **140** to provide adaptive habitual usage profile for user and for each device **120-1** to **120**-N. A habitual usage profile is a set of data reflecting a pattern of device usage over time of a particular user.

[0024] Continuing with FIG. **1**, in operation, smart home system **200** observes and learns habitual usage profile of each user on each device. Then all devices **120-1** to **120**-N are automatically turned on or off according to such habitual usage profile. For example, if a user A has the habit of studying at 7 p.m. every day during the week after dinner. Smart home system **200**, after observing such habit of user A over a set period of time, automatically turns on desk lamp **120-6** and computer **120-5** for user A when he or she approaches those devices. If sensor **140** senses user A approaching at 7 p.m., sensor **140** sets device **120-5** and **120-6** to ready mode. In the ready mode, sensor **140** lets smart home system **200** takes control over devices **120-5** and **120-6** according to habitual usage profile of user A.

[0025] In another situation, for some reasons, if user A does not want to study and is not in the room at 7 p.m., sensor **140** is not connected to user A, sensor **140** thus takes control over smart home system **200** and keep those devices in the off states. In another exceptional situation, when user A comes home late and has dinner late. User A enters the study room 30 minutes late to study. Sensor **140** senses user A approaching and connected to devices **120-5** and **120-6**, setting them to ready mode. In this situation, because smart home system **200** does not register this situation in the habitual usage profile, it lets user A turn on those devices by his or herself.

[0026] Continuing with FIG. **1**, yet in another situation where user A has a habit of studying for 3 hours which is recorded in his or her habitual usage profile. Knowing this habitual usage profile, smart home system **200** automatically maintains those devices as long as user is still there. When user A leaves the room after 3 hours, devices **120-5** and **120-6** are set to a standby or sleep mode. Recognizing the stand-by mode, Smart home system **200** turns off devices **120-5** and **120-6** according to habitual usage profile of user A. However, in one exceptional case, user A leaves the room early because she or he does not have much homework that day, devices **120-5** and **120-6** are then set to stand-by mode and turned off before the specified hour (e.g., 11 p.m.) by sensor **140**. Thus, energy is saved because of the smart home system **200**.

[0027] Continuing again with FIG. **1**, smart home system **200** is capable of relearning and updating a user's habitual usage profile in accordance with an embodiment of the present invention. In the above example, if user A continually does not enter the room to study, smart home system **200** learns new behavior and updates user A's habitual usage profile. Accordingly, computer **120-5** and desk lamp **120-6** are not turned on by smart home system **200** at the specified 7 p.m. Instead other device such as a game console, i.e., **120-8**, is turned on at 7 p.m. in accordance with the new habitual usage profile of user A.

[0028] Please note that the above example is only an illustration of the habitual usage profile of user A on computer **120-5** and desk lamp **120-6**. The above example does not limit the scope and capability of the present invention. Smart home system **200** of the present invention is capable to applying to every device in house **120** including sprinkler and water faucets for every user in house **120**. Any device which can be controlled by sensor **140**—whose structure and operation will be described later, is within the scope of the present invention.

[0029] Next, referring to FIG. **2** which illustrates a system level schematic diagram of smart home system **200** in accordance with an embodiment of the present invention. Smart home system **200** includes a behavior pattern data server **201**, a central processing unit **202**, a central switching unit (CSU) **210**, a display **204**, central camera system **121**, and an voice IP unit **203**, all electrically connected together as shown in FIG. **2**. Behavior pattern data server **201** is a database which stores all the time series device usage history of a user. Attributes of a user such as voice, image, RF identification are also stored in behavior pattern data server **201**. In one embodiment, infrared profile of a user is also stored in behavior pattern data server **201**. These attributes are assigned to each user's device usage history to determine the habitual usage profile. In other words, all device usage history and attributes of a user is stored in behavior pattern data server **201**.

[0030] Continuing with the description of FIG. **2**, CPU **202** is the brain of smart home system **200** of the present invention. The detail description of CPU is described later in the following FIG. **3**-FIG. **6**. CPU **202** learns the behavioral usage profile of each user and issues habitual operation commands to central switching unit **210**. Upon receiving habitual operation commands, CSU **210** decodes these commands and switch these commands to appropriate devices **120-1** to **120**-N according to each user's habitual usage profile. Next, based upon each device status set by sensor **140**, CSU **210** turns on or turns off each device, **120-1** to **120**-N, in accordance with habitual operation command from CPU **202**. CSU **210** also includes a display interface **213** coupled to display system **204** to display the status of use for each device in house **120**.

[0031] Next, referring to FIG. **3**, a system level structure **300** of behavior pattern data server **201** in communication with CPU **202** is illustrated. Behavioral pattern data server **201** includes a data management unit **301**, a search engine **302** and a memory **303**. In one embodiment, memory **303** is flash memory. Data management unit **301** manages all data including user's attributes and device usage history. Data management unit **301** functions to organize and associate which device **120-1** to **120**-N is used by which user. Data management unit **301** also maintains these data records in chronological order. Search engine **302** receives a search

string from CPU **202**. Search engine **302** looks into behavior data storage **303** to retrieve specific information for CPU **202**.

[0032] Continuing with FIG. **3**, CPU **202** includes sensors managing unit **321**, image managing unit **322**, RFID managing unit **323**. CPU **202** then feeds these data into a decision making unit **324**. In one embodiment, decision making unit **324** also includes a habit forming module which will be discussed in details later. As shown in FIG. **3**, sensors managing unit **321** receives current usage information from devices **120-1** to **120**-N and sensors **140**. Similarly, image managing unit **322** receives and manages image pictures from each user in each room of house **120**. RFID managing unit **323** receives and manages identification signals from each user. All of the information are fed into decision making unit **324** to learn the habit of a user and to formulate a behavior usage profile therein. Past usage history and attributes from each user are retrieved by CPU **202** from behavior pattern data server **201** via communication channel **310**. CPU **202** and particularly decision making unit **324** combine past and present data usage for each user to formulate habit and/or update habit.

[0033] Referring now to FIG. **4** which illustrates the internal structure of sensor **140**. More particularly, FIG. **4** depicts the relationship **400** between sensor **400** and CPU **202**, devices **120-1** to **120**-N, user **401** and a device status detector **406**. Sensor **140** includes a transceiver **402** for receiving identification signal from user **401**. Next, a decoder **403** receives the identification signal and assigns it to a particular user. Application Specific (ASIC) for distance analyzer **404** (hereinafter referred to as "ASIC **400**") measures the distance between user **401** and a device **120-1** to **120**-N and then performs an analysis in order to set one of more modes for that particular device. Finally, ASIC **404** sends a command to a device driver unit **405** to either turn on or turn off that device. Device status detector **406** records how a particular device, **120-1** to **120**-N, is used.

[0034] Continuing with FIG. **4**, in operation, sensor **140** measures the distance between user **401** and device, **120-1** to **120**-N via transceiver **402**. Then, ASIC **404** compares this distance to a threshold distance d_0. The operating status of each device versus user **401** is summarized as follows.

[0035] When d is less than or equals to d_0 ($d \leq d_0$), device, **120-1** to **120**-N, is connected to user **401**. If that particular device (i.e., **120**-*m*, where $1 \leq m \leq N$) is ON, then sensor **140** sets device **120**-*m* to an ON mode. On the other hand, if device **120**-*m* is OFF, sensor **140** sets device **120**-*m* to a READY mode. In the connected mode, user **401** has control over device **120**-*m* in the ON mode and CPU **202** has control in the OFF mode.

[0036] When distance d is greater than d_0 ($d > d_0$), device **120**-*m* is said to be disconnected to user **401**. In this situation, if device **120**-*m* is ON, sensor **140** sets device **120**-*m* to a stand-by or sleep mode. Finally, if device **120**-*m* is OFF, sensor **140** sets device **120**-*m* to an OFF mode. In the "disconnected state", sensor **140** always has priority and takes over the control of device **120**-*m*. The above distance analysis is performed by ASIC **405** of the present invention.

[0037] Next, referring to FIG. **5**, a complete system level **500** of smart home system **200** interacting with user **401** wearing a RFID tag **401**_TAG is illustrated. In one embodiment of the present invention, smart home system **200** includes a voice online server **502**, a habit learning module **510**, and a device status detector **406**. Online voice server **502** is used to receive a user's voice command and transform it into a machine command that device **102-1** to **120**-N can understand.

[0038] Referring again to FIG. **5**, habit learning module **510** records a sequence of signals S_0 or S_1 from device status detector **406**. S_0 represents a sequence of actions where the habitual operation command is performed according to habitual usage profile for each user, and S_1 represents a sequence of actions where the habitual operation commands from CPU **202** are overridden.

[0039] Continuing with FIG. **5**, habit forming module **510** forms or modifies each user's habitual usage profile by counting and comparing the sequence S_1 with a preset constant K. If

$$\sum_i S_{1ij} > K,$$

where j is an integer representing a user in house **120** and i is an integer representing the time a user j uses an device, then habit forming module **510** recognizes such action as a new habit. Thus, the habitual usage profile is reset. Then, CPU **202** issues a new habitual operation command series to central switching unit (CWU) **210** for that particular user j. On the other hand, if

$$\sum_i S_{1ij} < K,$$

then habit forming module **510** maintains the same habitual usage profile for user j.

[0040] Now referring to FIG. **6**, a method **600** for provide a smart home system **200** as described above is illustrated. Basically, method **600** provides sensor **140** to each device **120-1** to **120**-N in smart home system **200**. Then a data mining algorithm using a sequence of usage S_0 and S_1 is provided to learn and continually update habitual usage profile for each user **401**.

[0041] At step **602**, smart home system **200** in accordance with the present invention is started. Please note that smart home system **200** has the capability to use with all current devices **120-1** to **120**-N without the need to purchase new devices. Step **602** is realized by collecting all the parts specified above for smart home system **200**.

[0042] Then at step **604**, a sensor is coupled to each device **120-1** to **120**-N. Step **604** is realized by sensor **140** described in details above.

[0043] At step **606**, a habit learning and relearning process using data mining algorithm performed on sequence of use by a user is provided. Step **606** is realized by CPU **202** in connection with central switching unit (CSU) **210**, device status detector **406**, habit forming module **510**, and sensor **140** as described in FIG. **5** above.

[0044] At step **608**, a sequence of device usage by each user is observed for a predetermined amount of time is provided. Step **608** is realized by behavioral pattern data server **201**. In one embodiment, the predetermined time for observing a user's device usage is set to be 3 months.

[0045] Next, at step **610**, a habit for each user is formed base on step **608** to establish a behavioral usage profile for

each user. Step **610** is realized by data mining techniques on sequences S_0 and S_1 described in FIG. **5** above.

[0046] At step **612**, each device, **120-1** to **120**-N is operated based on habitual usage profile established in step **610** above. In practice, step **612** is realized by habitual operation commands issued by CPU **202** to central switching unit (CSU) **210**.

[0047] Following is step **614**, each time a user uses a device, such usage is recorded to establish new habitual usage profile. In other words, to learn a new habit from each user. Step **614** is realized by behavior pattern data server **201** described above.

[0048] Finally, steps **606** and **614** are repeated by means of step **616** in order to establish a habit for a user. Step **616** is realized and performed by smart home system **200** described above.

[0049] The foregoing description details certain embodiments of the invention. It will be appreciated, however, that no matter how detailed the foregoing appears in text, the invention can be practiced in many ways. As is also stated above, it should be noted that the use of particular terminology when describing certain features or aspects of the invention should not be taken to imply that the terminology is being re-defined herein to be restricted to including any specific characteristics of the features or aspects of the invention with which that terminology is associated. The scope of the invention should therefore be construed in accordance with the appended claims and any equivalents thereof.

What is claimed is:

1. A smart home system, comprising:

a central camera system, located in different locations in a house, capable of observing each user in the house;

a user identification system, electrically coupled to said central camera system and said voice IP unit, configured to identify each user in the house;

a behavioral pattern data server configured to store usage pattern and attributes of each user;

a plurality of sensors, electrically coupled to the control circuit of each device in the house, operative to sense the distance between each user and a particular device, if the distance is smaller than a threshold distance, said plurality of sensors set that particular device to either a stand-by mode ready to be used by a user, and wherein if the distance is greater than said threshold distance, said plurality of sensors turns off that particular device;

a central processing unit, electrically coupled to said behavioral pattern data server, further comprising a habit learning module configured to analyze, interpret, and form a habitual usage profile for each user, wherein said central processing unit is operative to send out habitual operation commands according to said habitual usage profile; and

a central switching unit, electrically coupled to said central processing unit and each of device in the house, operative to either turn on or turn off particular devices according said habitual operation commands from said central processing unit, wherein said plurality of sensors override said habitual operation commands of said central processing unit and said central switching unit when the distance between said particular user and said device is greater than said threshold distance, and wherein in such instance said habit learning module relearns the habit and updates said habitual usage profile of each user if such overriding instance becomes a new habit of said user.

2. The smart home system of claim **1** further comprising a display unit electrically coupled to said central switching unit, configured to display and to monitor usage activities of each device in the house.

3. The smart home system of claim **1** further comprising a encryption/decryption unit, electrically coupled to said central switching unit, operative to inform said plurality of sensors an operating status of each device so that said plurality of sensors decide whether to override said operation commands from said central processing unit.

4. The smart home system of claim **3** wherein said user identification system further comprises an identification tag worn by each user.

5. The smart home system of claim **3** wherein said user identification system transmits an identification signal once every three seconds.

6. The smart home system of claim **1** wherein said habit learning module forms said habitual usage pattern for each user by using sequence pattern mining algorithm.

7. The smart home system of claim **1** wherein each of said plurality of sensors further comprises:

a transceiver for receiving said identification signal from a user;

a decode for recognizing said identification signal emitted from said user;

an application specific integrated unit (ASIC) including a distance measuring unit for measuring the distance between said user and said particular device using identification signals from said user, and a comparator for comparing the distance with said threshold distance; and

an device driver unit, electrically coupled to said control circuit of each device, operative to cause said device to said stand-by mode when the distance is less than said threshold distance, and to turn off said device vice versa.

9. The smart home system of claim **1** further comprising a device status detector electrically coupled to said plurality of sensors, operative to detect whether said habitual operation commands from said central processing unit are overridden.

10. The smart home system of claim **9** wherein said habit learning module records a sequence of signals S_0 or S_1 from said device status detector to form or modify said habitual usage pattern, wherein S_0 represents a sequence of actions where said operation command signal is performed according to said habitual usage profile for each user and S_1 represents a sequence of actions by a particular user where said habitual operation commands are overridden.

11. The smart home system of claim **10** wherein said sequence S_0 and S_1 further comprise number of usage per day, location of usage, and time of usage.

12. The smart home system of claim **11** wherein said habit forming module forms or modifies each user's habitual usage profile by counting and comparing said sequence S_1 with a preset constant K, if

$$\sum_i S_{1ij} > K,$$

where j is an integer representing a user in the house and i is an integer representing each time a user j uses an device, then said habit forming module recognizes such action as new habit, resets said habitual usage profile, and issues a new habitual operation command series for that particular user j, and wherein if

$$\sum_i S_{1ij} < K,$$

then said habit forming module maintains said habitual usage profile for said user j.

13. The smart home system of claim **1** wherein said central switching unit further comprises:

a receiving and filtering unit, electrically coupled to receive said habitual operation commands from said central processing unit, said image signals from said central camera system, or said commands from said voice IP unit;

a driver circuit, electrically coupled to turn on or turn off each device in the house in accordance with said operation commands from said central processing unit; and

a display interface, electrically coupled to said driver circuit, operable to enable said display unit to display all devices that are currently turned on by said driver circuit.

14. The smart home system of claim **1** wherein said behavior pattern data server further comprises:

a data management unit, electrically coupled to said central switching unit, operative to receive said image signals from said central camera system and said plurality of sensors;

a search engine, operable to said data management unit, operable to search for operation data from each user on each device; and

a data storage, electrically coupled to said data management unit, operative to store operation data and attributes of each user on each device.

15. The smart home system of claim **1** wherein said central processing unit further comprises:

an image signal management unit, electrically coupled to said central camera unit, operative to analyze image information from each user;

an identification signal management unit, electrically coupled to said identification unit, operable to identify each user;

a sensor management unit, electrically coupled to said device status detector, operable to record usage information from each user on different devices; and

decision making unit, electrically coupled to said image signal management unit, said identification signal management unit, and said sensor management unit, operable to decide whether to issue said habitual operation commands.

16. The smart home system of claim **1** wherein said plurality of sensors uses Bluetooth signals.

17. The smart home system of claim **1** further comprises a voice IP unit configured to transform each user's vocal commands into commands recognized by each device.

18. A method of providing a smart home capable of learning and updating user's habits, comprising:

providing a sensor on each device in the house;

providing a habit learning and relearning procedure based on outputs of said sensor;

observing a sequence of use by a particular for a predetermined amount of time;

forming a habit for each user; and

operating every device in the house in accordance with said habit.

19. The method of providing a smart home of claim **18** wherein said step of providing a sensor on each device further comprising:

electrically coupling said sensor to a control circuit of each device in the house;

sensing the distance between each user and said particular device, if the distance is smaller than a threshold distance, said sensor sets that particular device to on the stand-by mode ready to be used by a user, and wherein if the distance is greater than said threshold distance, said plurality of sensors turns off that particular device.

20. The method of providing a smart home wherein said step of providing a habit learning procedure based on outputs of said sensor further comprises updating said habitual usage profile based a sequence of state of use of each device by each user.

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