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(54) HOME AUTOMATION USING A MOBILE DEVICE

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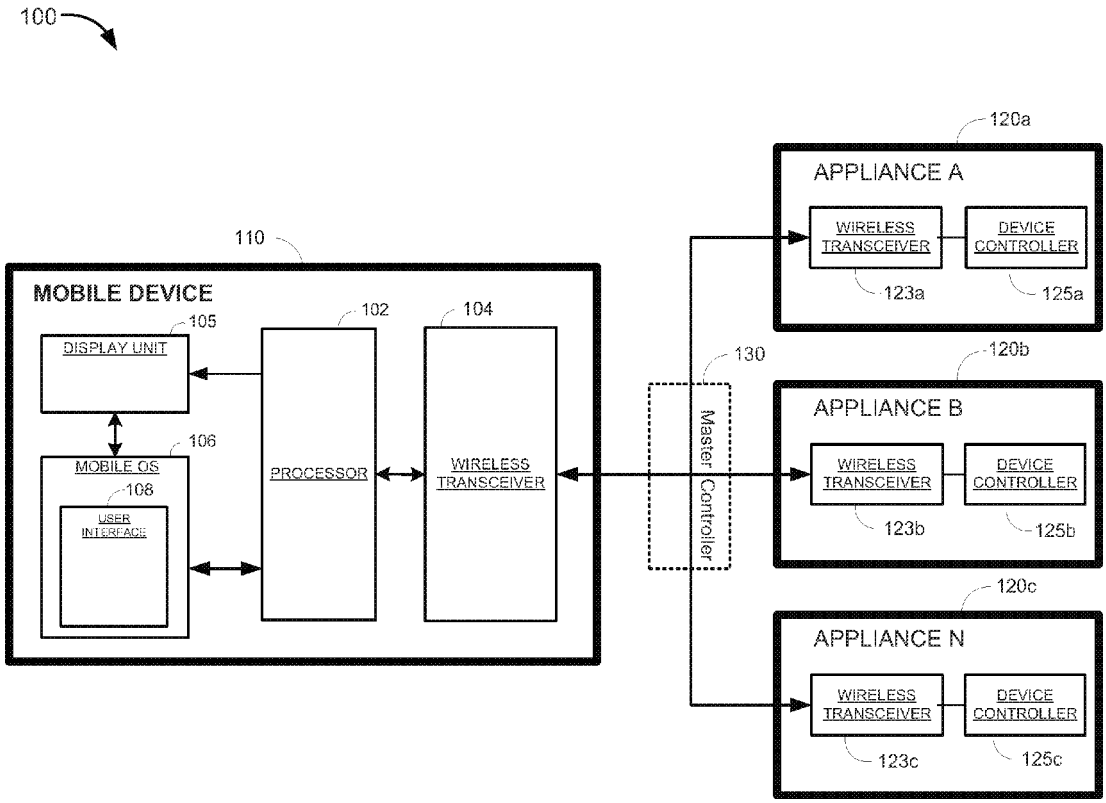
(57) **ABSTRACT**

Embodiments of the present invention disclose a system and method for providing home automation using a mobile device. According to one embodiment, communication is established between the mobile device and a home appliance device, and a process request is sent from the mobile device to the home appliance device. In response, an operation associated with the received process request is executed by the home appliance device.



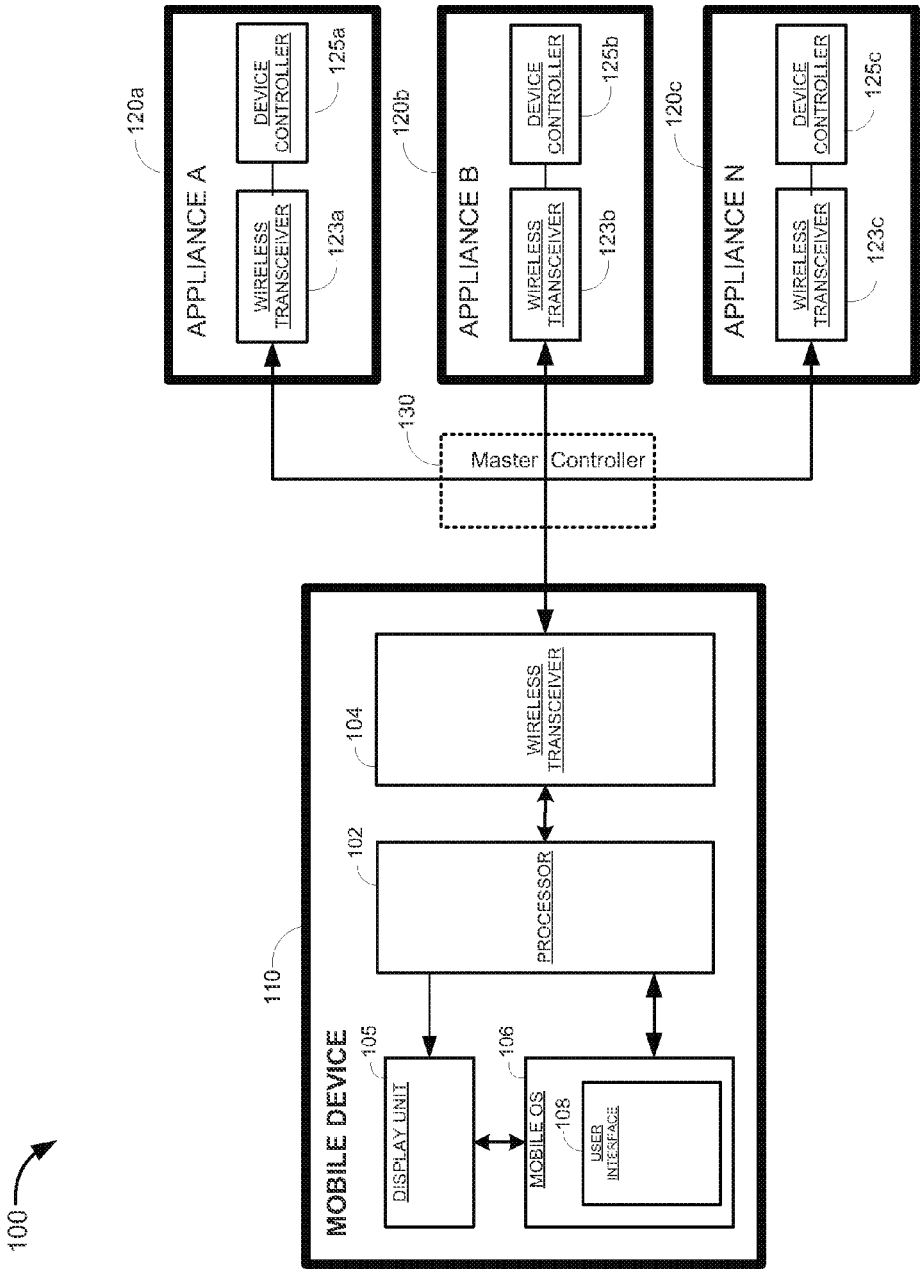

100
MOBILE DEVICE
110
DISPLAY UNIT
105
MOBILE OS
106
USER INTERFACE
108
PROCESSOR
102
WIRELESS TRANSCEIVER
104
Master Controller
130
APPLIANCE A
120a
WIRELESS TRANSCEIVER
123a
DEVICE CONTROLLER
125a
APPLIANCE B
120b
WIRELESS TRANSCEIVER
123b
DEVICE CONTROLLER
125b
APPLIANCE N
120c
WIRELESS TRANSCEIVER
123c
DEVICE CONTROLLER
125c

FIG. 1

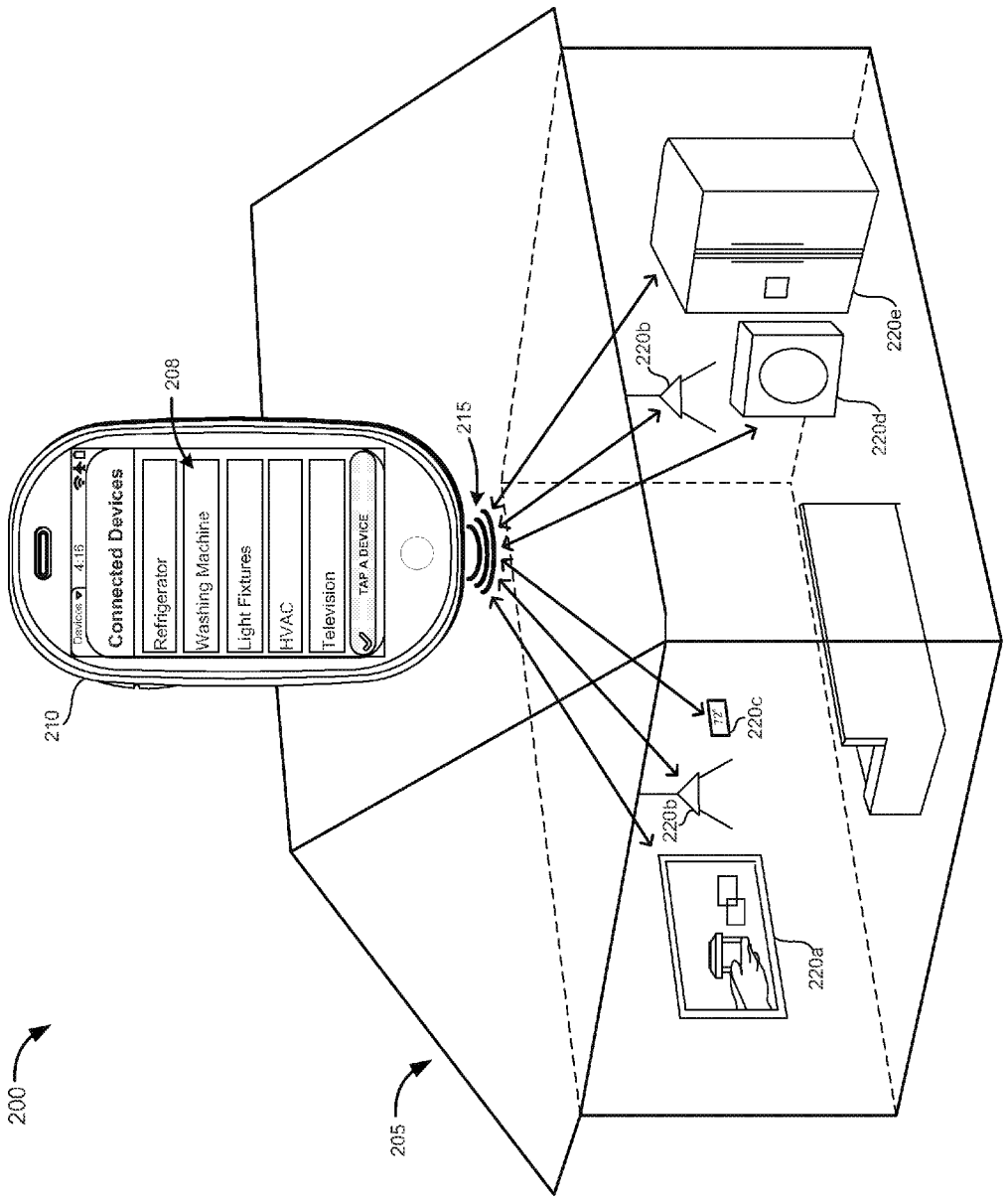

200
205
210
208
215
Devices
4:16
Connected Devices
Refrigerator
Washing Machine
Light Fixtures
HVAC
Television
TAP A DEVICE
220a
220b
220c
220b
220d
220e
TV

FIG. 2

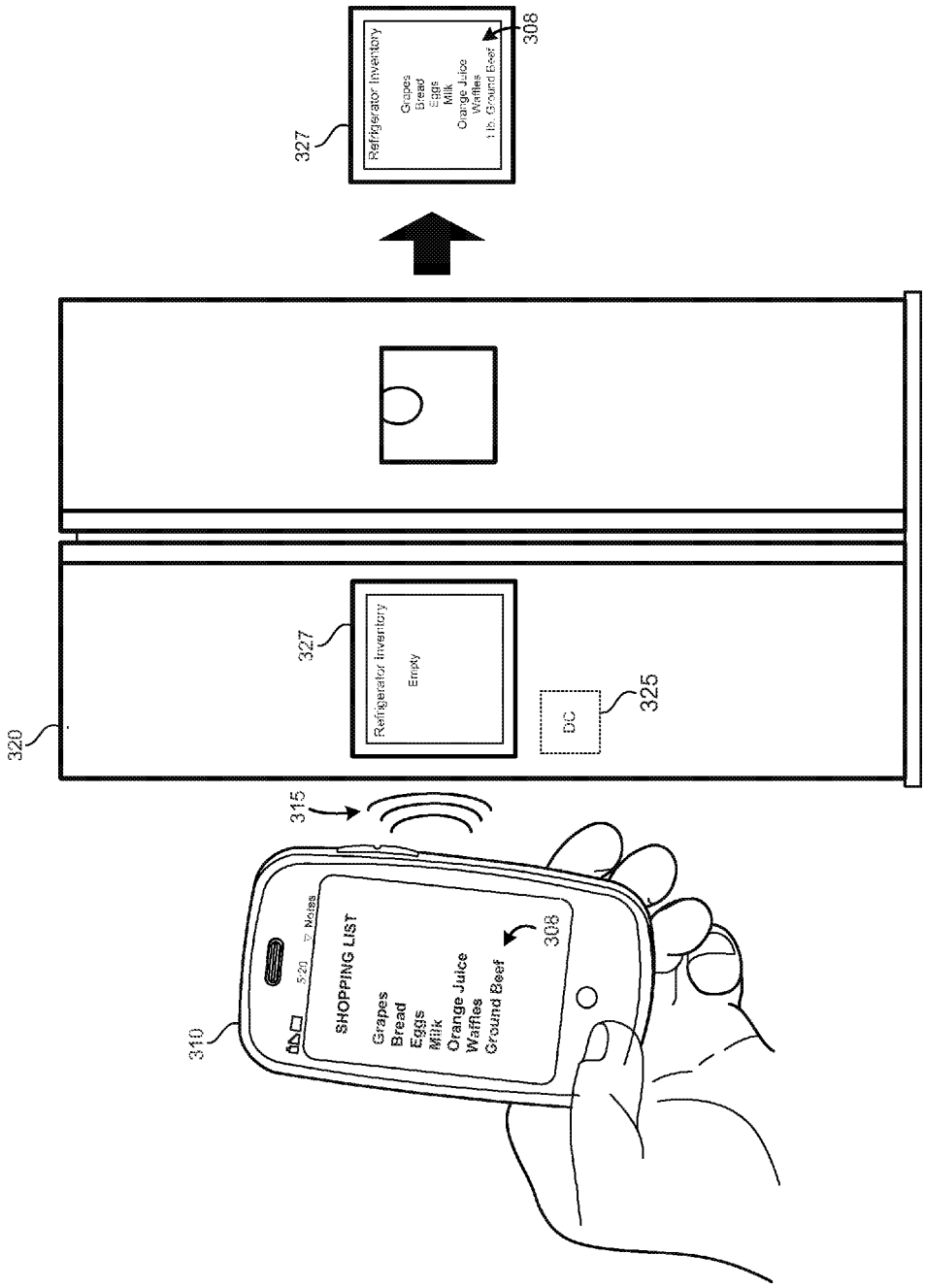

310
SHOPPING LIST
Grapes
Bread
Eggs
Milk
Orange Juice
Waffles
Ground Beef
308
315
320
327
Refrigerator Inventory
Empty
DC
325
327
Refrigerator Inventory
Grapes
Bread
Eggs
Milk
Orange Juice
Waffles
1 lb. Ground Beef
308

FIG. 3

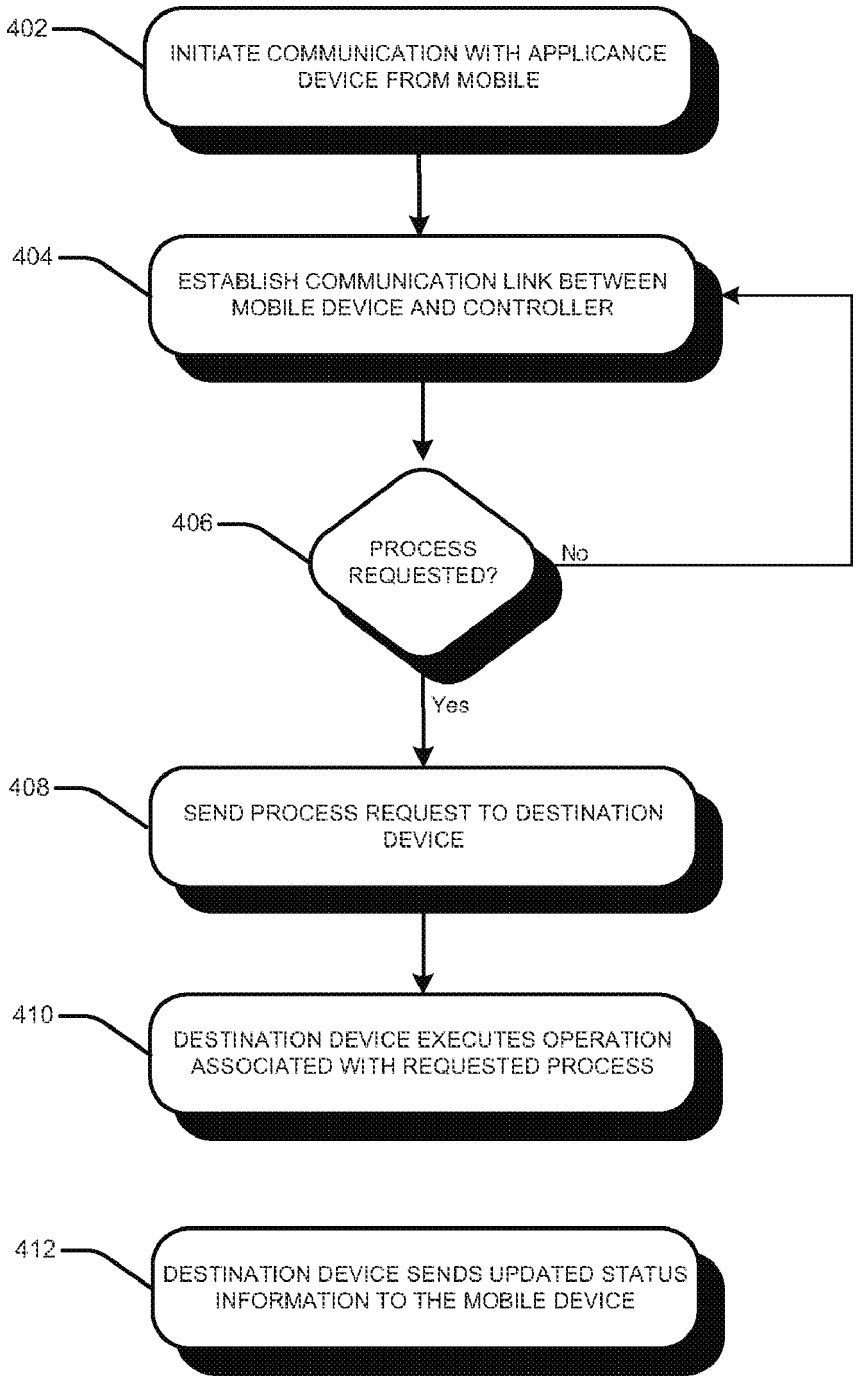

402
INITIATE COMMUNICATION WITH APPLICANCE DEVICE FROM MOBILE
404
ESTABLISH COMMUNICATION LINK BETWEEN MOBILE DEVICE AND CONTROLLER
406
PROCESS REQUESTED?
No
Yes
408
SEND PROCESS REQUEST TO DESTINATION DEVICE
410
DESTINATION DEVICE EXECUTES OPERATION ASSOCIATED WITH REQUESTED PROCESS
412
DESTINATION DEVICE SENDS UPDATED STATUS INFORMATION TO THE MOBILE DEVICE

FIG. 4

HOME AUTOMATION USING A MOBILE DEVICE

BACKGROUND

[0001] The emergence and popularity of mobile computing has made portable electronic devices—due to their compact design and light weight—a staple in today's marketplace. Mobile devices such as smartphones involve advance computing functionality and are utilized for common tasks including email, internet surfing, gaming, and media capture/playback. Meanwhile, home automation systems provide centralized control for lighting, HVAC (heating, ventilation and air conditioning), appliances (such as refrigerators and dishwashers), and similar systems. However, these systems are difficult to upgrade as they typically have product lifecycles of approximately ten years. As a result, home automation technology is usually many years behind the technology of the latest mobile device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] The features and advantages of the inventions as well as additional features and advantages thereof will be more clearly understood hereinafter as a result of a detailed description of particular embodiments of the invention when taken in conjunction with the following drawings in which:

[0003] FIG. **1** is a high level block diagram of a home automation system using a mobile device according to an example of the present invention.

[0004] FIG. **2** is a three-dimensional perspective view of a home automation system using a mobile device according to an example of the present invention.

[0005] FIG. **3** is an illustration of a mobile device communicating with a home appliance device according to an example of the present invention.

[0006] FIG. **4** is a simplified flow chart of the processing steps for implementing home automation using a mobile device according to an example of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0007] The following discussion is directed to various embodiments. Although one or more of these embodiments may be discussed in detail, the embodiments disclosed should not be interpreted, or otherwise used, as limiting the scope of the disclosure, including the claims. In addition, one skilled in the art will understand that the following description has broad application, and the discussion of any embodiment is meant only to be an example of that embodiment, and not intended to intimate that the scope of the disclosure, including the claims, is limited to that embodiment. Furthermore, as used herein, the designators "A", "B" and "N" particularly with respect to the reference numerals in the drawings, indicate that a number of the particular feature so designated can be included with examples of the present disclosure. The designators can represent the same or different numbers of the particular features.

[0008] The figures herein follow a numbering convention in which the first digit or digits correspond to the drawing figure number and the remaining digits identify an element or component in the drawing. Similar elements or components between different figures may be identified by the user of similar digits. For example, **143** may reference element "**43**" in FIG. **1**, and a similar element may be referenced as **243** in FIG. **2**. Elements shown in the various figures herein can be added, exchanged, and/or eliminated so as to provide a number of additional examples of the present disclosure. In addition, the proportion and the relative scale of the elements provided in the figures are intended to illustrate the examples of the present disclosure, and should not be taken in a limiting sense.

[0009] Traditional home automation systems involve the use of a number of complex controllers and sensors. Prior solutions include implementation of a power line control protocol that allows communication between transmitters and receivers of various appliances by sending signals over existing house wiring. Still further, other systems utilize motion-activated sensors such that a light turns on or a surveillance camera activates upon someone entering a room or area. Such systems require the user to plug the appliance device or system into a proprietary module and undertake a timely and sometimes complex pairing process for interfacing the devices with a separate remote controller. Moreover, each system simply involves one-way communication between the remote controller and module and does allow for status updates or similar information to be transmitted from the appliance device/system back to the remote controller. Therefore, there is a need in the art for a simplified and robust home automation that offers two-way communication between devices.

[0010] Examples of the present invention disclose a system and method for home automation using a mobile device. According to one example embodiment, near filed communication (NFC) or any other short-ranged wireless communication protocol is utilized for allowing a mobile device to interact with various systems and appliances within the home environment. For instance, the mobile device may send process requests to an intermediary device controller installed within a target home appliance device. The process request may be executed locally on the device with status update information transmitted back to the mobile device.

[0011] Referring now in more detail to the drawings in which like numerals identify corresponding parts throughout the views, FIG. **1** is a high level block diagram of a home automation system using a mobile device according to an example of the present invention. As shown in this example, the system **100** includes a mobile device in communication with a number (N) of home appliance devices **120***a*-**120***c*. The mobile device **110** includes a processor **102** coupled to a display unit **105**, a mobile operating system **106**, and a wireless transceiver **104**. In one example embodiment, processor **102** represents a central processing unit (CPU), microcontroller, microprocessor, or logic configured to execute programming instructions associated with the mobile device **110**. The display unit **105** of the mobile device represents an electronic visual display configured to display images and graphics for viewing by an operating user. The mobile operating system **106** includes a graphical user interface **108** for enabling input interaction **109** between an operating user and the mobile device **110**. More particularly, the user interface **108** allows for the user to access and manage individual home application devices from the mobile device **110**. To accomplish this functionality, the mobile device **110** includes a wireless transceiver for sending and receiving data to/from a particular home appliance device. According to one example embodiment, the mobile device **110** communicates with each home appliance device **120***a*-**120***c* through a wireless communica-

tion means such as NFC or similar communication protocol that enables short-range wireless transfer of data between devices.

[0012] Still further, each home appliance device **120***a*-**120***c* includes a wireless transceiver **125***a*-**125***c* and device controller **125***a*-**125***c* for facilitating communication with the mobile device. As will be used herein, home appliance devices represent any electrical or mechanical appliance, system, or machine used to perform a household function (e.g., oven for cooking, dishwasher for cleaning, light fixtures for illumination, refrigerator for storage, and HVAC for cooling/heating the home environment, etc.). Device controller **125***a*-**125***c* may be a device or module electronically coupled to the home appliance device **120***a*-**120***c* or an integrated unit of the home appliance device **120***a*-**120**, and is configured to execute programming instructions and control operations on the home appliance device such as controlling the temperature of a HVAC or toggling the light system on and off. According to one example embodiment, the mobile device **110** may establish communication with the device controller **125***a*-**125***c* of an associated home appliance device **120***a*-**120***c* respectively, via data transmission from the wireless transceiver **104** of the mobile device **110** to the wireless transceiver **123***a*-**123***c* of an associated home appliance device **123***a*-**123***c*.

[0013] According to one example, the wireless transceivers **123***a*-**123***c* may be implemented within the device controller **125***a*-**125***c* of the associated home appliance device **120***a*-**120***c*. Additionally, a master controller **130** may be implemented between the mobile device **110** and device controller **125***a*-**125***c* of each home appliance device **120***a*-**120***c*. In such a configuration, the mobile device **110** would communicate directly with the master controller **130**. Based on the information received from the mobile device **110**, the master controller **130** would then manage the transmission of data to/from each home appliance device **120***a*-**120***c* and device controller **125***a*-**125***c* respectively. Furthermore, communication between the individual device controllers **125***a*-**125***c* and the master controller **130** could be accomplished via radio frequency (RF), power lines, wireless fidelity, or any other communication interface scheme.

[0014] FIG. **2** is a three-dimensional perspective view of a home automation system using a mobile device according to an example of the present invention. In the present example embodiment, the home automation system **200** includes a mobile device **210** in communication with a number of home appliance devices **220***a*-**220***e* within a house **205**. As mentioned above, home appliance devices **220***a*-**220***e* represent any electrical or mechanical appliance, system, or machine used to perform a household function. In the present example of FIG. **2**, home appliance devices include a television **220***a*, light fixtures/system **202***b*, HVAC **120***c*, a smart dish washer or washing machine **220***d*, and a smart refrigerator **220***e*. According to one example embodiment, the mobile device **210** communicates with each device through a wireless communication means **215** such as NFC or similar communication protocol that enables short-range wireless transfer of data between two devices. As explained above, each home appliance device **220***a*-**220***e* includes a device controller for executing process requests received from the mobile device **210**. Moreover, execution of the process requests by the device controller could occur automatically based on a user entering a particular area of the home. In accordance with one example embodiment, the lighting, temperature, and/or television channel may change based on the location of the user, day of the week, and/or the time of day.

[0015] As an example of home automation with respect to a lighting system, a device controller may be included with or connected to each lighting fixture **220***c*. The device controller could be integrated with the lighting system or placed in electrical contact (e.g., power cord interface) with each lighting fixture **220***c*. According to one example, the operating user could program the lighting through the mobile device **210** enabled with wireless communication (e.g., near field communication). Specifically, the associated device controllers are configured to turn the lights **220***c* on and off based on process requests or instructions received from the mobile device **210** or master controller. When the mobile device **210** is present within a communicable field of the controller (master controller or device sub-controller) or physically tapped against a controller, the mobile device would gain access to the home appliance device thus allowing the user to set the brightness of the lighting fixture using the mobile device **210**. Moreover, settings of the lighting system **220***b* could be automated such that lights automatically come on or turn off whenever the mobile device **210** and operating user enter or exit a room.

[0016] Similarly, the HVAC or thermostat **220***c* of the house **205** may also be controlled via the mobile device **210**. In one example, thermostat control could be given to the operating user whenever the mobile device is physically tapped against the thermostat, or whenever the mobile device is placed within a communicable distance with the HVAC system such that credentials may be exchanged between the two devices (mobile device **210** and HVAC **220***c*). According to one example, the temperature of each room could be set intelligently according to preset preferences and the location of the mobile device **210** and operating user. For example, the device controller may automatically cause the thermostat to set to a temperature of 72° upon detecting the presence of the mobile device within a communication field (e.g., less than 20 cm) of the device controller or master controller.

[0017] FIG. **3** is an illustration of a mobile device communicating with a home appliance device according to an example of the present invention. Here, the home automation system of the present example is used to track inventory information of a smart refrigerator **320** including an inventory display **327**, which identifies the items residing within the refrigerator. The user may manually maintain a grocery list or have the mobile device **310** download information on purchased items via grocery store frequent shopper card information, credit card information, or the like. When the user returns home, the grocery information **308** may be transferred from the mobile device **310** to the refrigerator **320** through wireless communication means **315** (physical tap or when within near field). The device controller **323** of the refrigerator **320** could then update the inventory and display **327** based on the received grocery information. As shown in FIG. **3**, the inventory list shown in display **327** is updated with the latest grocery information **308**. Thus, examples of the present invention allow users to easily and accurately track the contents of their refrigerator using a mobile device.

[0018] FIG. **4** is a simplified flow chart of the processing steps for implementing home automation using a mobile device according to an example of the present invention. In step **402**, the mobile device initiates communication with the home appliance device. Communication initiation between devices may occur by positioning of the mobile device with a

communicable distance or within the near field of the home automation device or master controller, or via a physical tap of the mobile device on the home appliance device or master controller. Furthermore, ether the mobile device or home appliance device may initiate said communication. For instance, a home appliance device such as a smart refrigerator may initiate communication with the mobile device to indicate the absence of certain inventory items (e.g., out of milk). According to one example, the mobile device may include a near field communication protocol that can be utilized for imitating and establishing connection with another wireless communication protocol (e.g., WiFi or Bluetooth) associated with the home appliance device. Next, in step **404** the master controller or device controller of the home appliance device establishes the communication link and pairing of the two devices.

[0019] If a service or process request is made by the user operating the mobile device in step **406**, then the process request is sent to a destination appliance device via the wireless communication means in step **408**. As used herein, a process request represents an action or operation to be executed by the home appliance device such as updating the inventory data of a refrigerator, changing the environment temperature of a HVAC, changing the cooking time of an oven, or simply turning a particular light fixture on or off. Thereafter, in step **410** the destination home appliance device executes an operation associated with the received process request and then updates the status information, which may be sent to the mobile device in step **412**. For example, upon establishing communication between the mobile device and a smart oven, the user may send a process request to adjust the baking temperature from 375° to 425°. The device controller of the smart oven will execute an operation (i.e., temperature adjustment) associated with the received request and may then send the user an update of the estimated cook time (status information) based on the new temperature.

[0020] Embodiments of the present invention provide method and system for providing home automation using a mobile device. Moreover, many advantages are afforded by the home automation system and method in accordance with examples of the present invention. In particular, the home automation system can help integrate several home appliance devices with one centralized control interface (i.e., mobile device) while contemporaneously providing two-way communication between the device and central interface. Due to the accessibility of the walls, power outlets, storage rooms and the ability to make design changes specifically to accommodate the desired automation functionality, home automation was generally only implemented within a new home during construction. However, the configuration of the present examples allows for home automation integration in existing homes with minimal effort and little to no technical expertise. Furthermore, a simplified and efficient home automation system will provide increased quality of life for the elderly, disabled, and other persons who might otherwise require caregivers or institutional care.

[0021] Furthermore, while the invention has been described with respect to exemplary embodiments, one skilled in the art will recognize that numerous modifications are possible. For example, although exemplary embodiments depict a smartphone as the mobile device, the invention is not limited thereto. For example, the mobile device may be a netbook, a tablet personal computer, or any other portable electronic device enabled with short range wireless communication.

[0022] Furthermore, the home appliance devices available for control via the mobile device may include numerous additional devices than those discussed above and depicted in the accompanying figures. Thus, although the invention has been described with respect to exemplary embodiments, it will be appreciated that the invention is intended to cover all modifications and equivalents within the scope of the following claims.

What is claimed is:

1. A method for providing home automation using a mobile device, the method comprising:

establishing communication between the mobile device and a home appliance device;

sending, via the mobile device, a process request to the home appliance device;

executing, via the home appliance device, an operation associated with the received process request.

2. The method of claim **1**, further comprising:

sending, via the home appliance device, status update information to the mobile device in response to the executed operation.

3. The method of claim **1**, wherein the home appliance device includes a device controller and wireless transceiver configured to communicate with the mobile device.

4. The method of claim **1**, wherein the mobile device and the home appliance device communicate via a near field communication protocol.

5. The method of claim **4**, wherein the near filed communication protocol is utilized to establish a second wireless communication protocol.

6. The method of claim **5**, wherein the home appliance device is a smart device enabled with a wireless communication protocol and includes a smart refrigerator, a smart oven, HVAC, or lighting system.

7. The method of claim **6**, wherein the process request includes turning the lights of a lighting appliance on or off.

8. The method of claim **6**, wherein the process request includes determining or updating an inventory list of the smart refrigerator.

9. The method of claim **6**, wherein the process request includes changing the temperature of the HVAC from a current temperature to a new temperature.

10. The method of claim **1**, wherein the step of sending the process request by the mobile device and executing the process request by the home appliance device is accomplished automatically.

11. A home automation system comprising:

at least one home appliance device having a device controller;

a mobile device configured to communicate with the device controller of the home appliance device and send a process request thereto;

wherein an operation associated with the process request sent from the mobile device is capable of being executed at the home appliance device via the device controller.

12. The system of claim **11**, further comprising:

a master controller configured to communicate with the mobile device and the device controller of the home appliance device.

13. The system of claim **11**, wherein status update information is transmitted from the home appliance device to the mobile device in response to the received process request.

14. The system of claim **11**, wherein the home appliance device includes a wireless transceiver configured to communicate with the mobile device.

15. The system of claim **11**, wherein the mobile device and the home appliance device communicate via a near field communication protocol.

16. The system of claim **15**, wherein the near field communication protocol is utilized to establish a second wireless communication protocol.

17. The system of claim **16**, wherein the home appliance device is a smart device enabled with a wireless communication protocol and includes a smart refrigerator, HVAC, or lighting appliance system.

18. The system of claim **17**, wherein the process request includes turning the light of a lighting appliance system on or off, determining or updating an inventory list of the smart refrigerator, or changing the temperature of the HVAC from a current temperature to a new temperature.

19. The system of claim **11**, wherein the device controller is integrated within the home appliance device.

20. A method for providing home automation using a mobile device, the method comprising:

initiating, via the mobile device, communication with at least one home appliance device of a plurality of home appliance devices;

sending, via the mobile device, a process request to the at least one home appliance device;

executing, via the at least one home appliance device, an operation based on the received process request.

sending, via the least one home appliance device, status update information to the mobile device in response to executed operation.

wherein the mobile device and the plurality of home appliance devices communicate via near field communication.

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