

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	WAC-10PROV
		Application Number	
Title of Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor	1				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Eric		Stefankiewicz			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Old Bethpage	State/Province	NY	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	14 Kingswood Circle					
Address 2						
City	Old Bethpage	State/Province	NY			
Postal Code	11804	Country	US			
Inventor	2				Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Shelley		Wald			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Manhasset	State/Province	NY	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	8 Fairway Lane					
Address 2						
City	Manhasset	State/Province	NY			
Postal Code	11030	Country	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.						
Add						

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	WAC-10PROV
		Application Number	
Title of Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		

☐ An Address is being provided for the correspondence information of this application.

Customer Number	149297		
Email Address	US_Docketing@straub-ip.com	Add Email	Remove Email

Application Information:

Title of the Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		
Attorney Docket Number	WAC-10PROV	Small Entity Status Claimed	☒
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	31	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:
☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	149297		

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	WAC-10PROV
		Application Number	
Title of Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	Remove
Additional Foreign Priority Data may be generated within this form by selecting the Add button.				Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	WAC-10PROV
		Application Number	
Title of Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	WAC-10PROV
		Application Number	
Title of Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1		Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
		Clear	
Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
☐ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	Wangs Alliance Corporation		
Mailing Address Information For Applicant:			
Address 1	44 Harbor Park Drive		
Address 2			
City	Port Washington	State/Province	NY
Country	US	Postal Code	11050
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	WAC-10PROV
		Application Number	
Title of Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		

Assignee	1			
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country i		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				Add

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Stephen T. STRAUB, Reg. No. 43,938/		Date (YYYY-MM-DD)	2018-01-12
First Name	Stephen	Last Name	Straub	Registration Number
				43938
Additional Signature may be generated within this form by selecting the Add button.				Add

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	WAC-10PROV
		Application Number	
Title of Invention	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1

Remove

Given Name

Middle Name

Family Name

City

State

Country i

Eric

Stefankiewicz

Old Bethpage

NY

US

Inventor 2

Remove

Given Name

Middle Name

Family Name

City

State

Country i

Shelley

Wald

Manhasset

NY

US

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.

Add

Title of Invention

METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES

Attorney Docket Number (if applicable)

WAC-10PROV

Correspondence Address

Direct all correspondence to (select one):

☒ The address corresponding to Customer Number☐ Firm or Individual Name

Customer Number

149297

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

Yes, the invention was made by an agency of the United States Government. The U.S. Government agency name is:

Yes, the invention was under a contract with an agency of the United States Government. The name of the U.S. Government agency and Government contract number are:

Entity Status**Applicant asserts small entity status under 37 CFR 1.27 or applicant certifies micro entity status under 37 CFR 1.29**

- ☒ Applicant asserts small entity status under 37 CFR 1.27
- ☐ Applicant certifies micro entity status under 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
- ☐ No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	Stephen T. STRAUB, Reg. No. 43,938/		Date (YYYY-MM-DD)	2018-01-12
First Name	Stephen	Last Name	Straub	Registration Number (If appropriate)
				43938

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that : (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

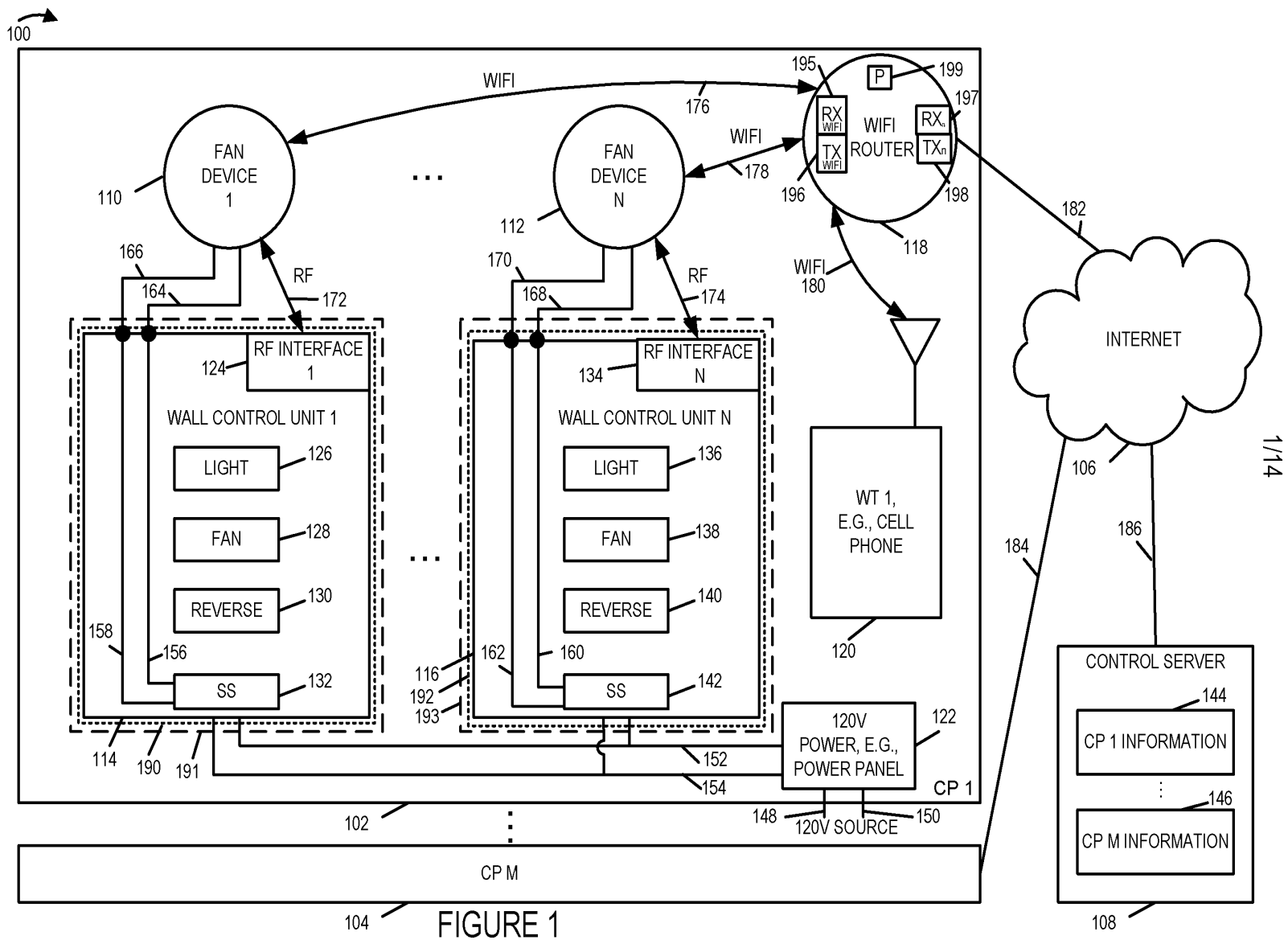


FIGURE 1

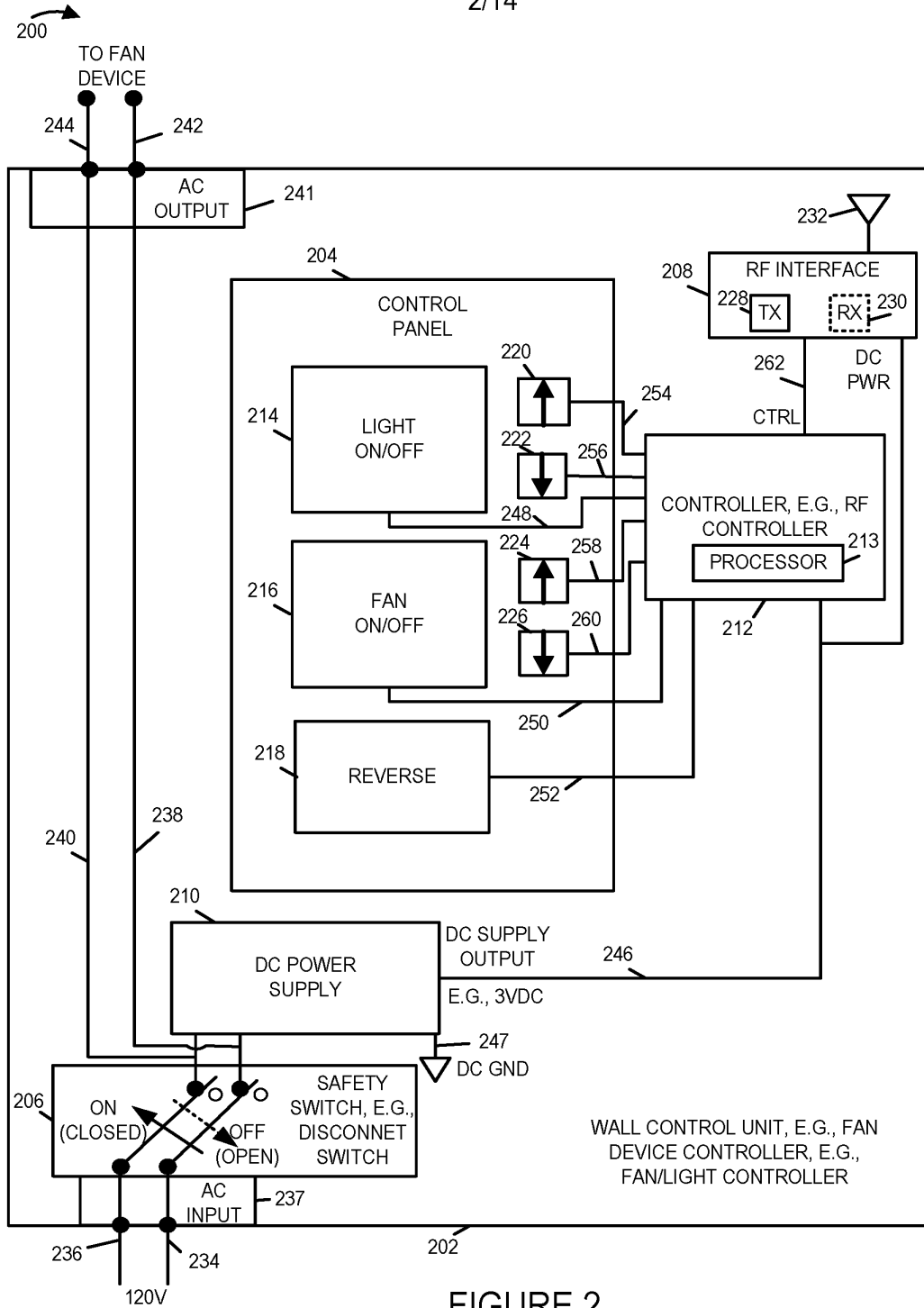
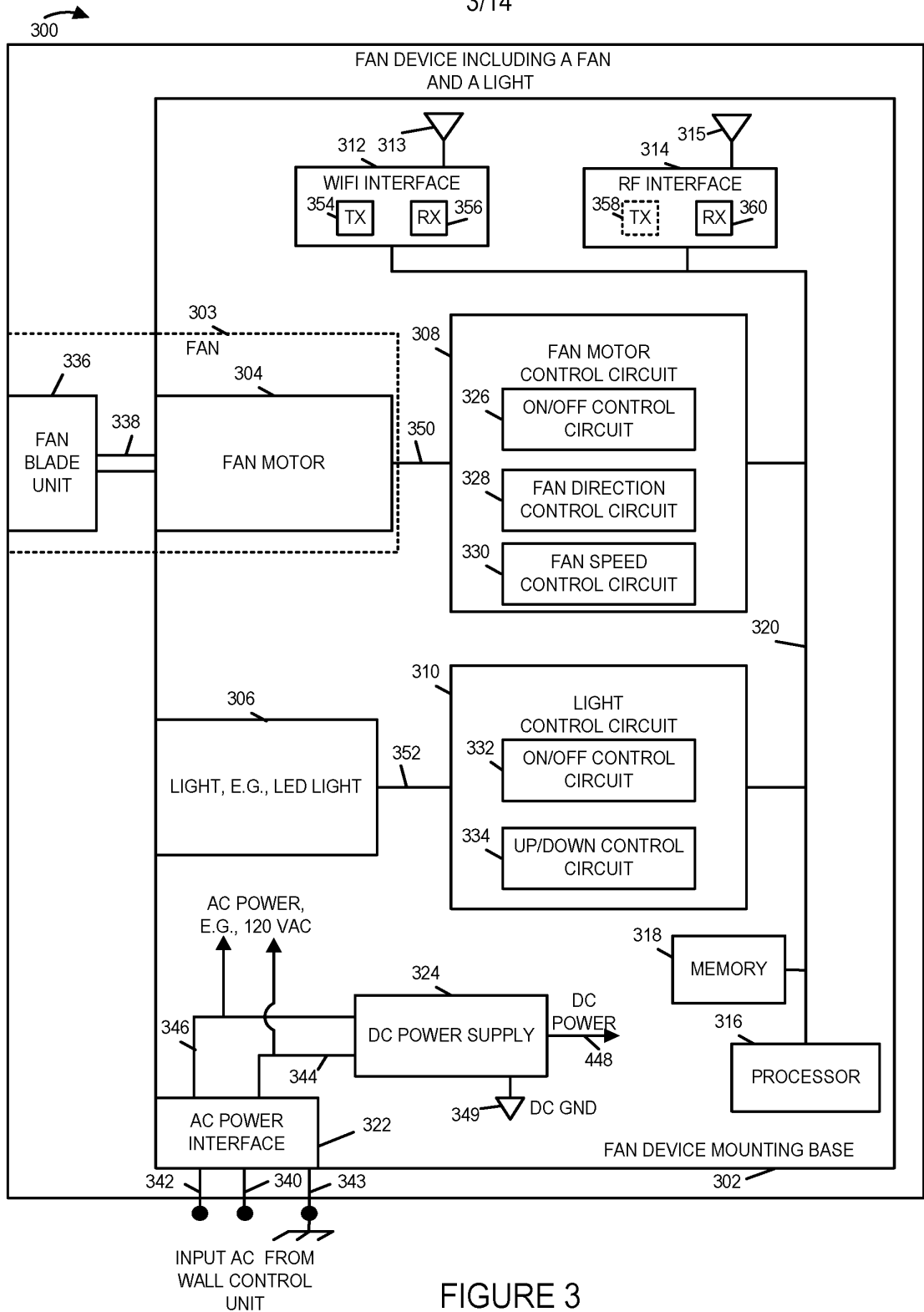
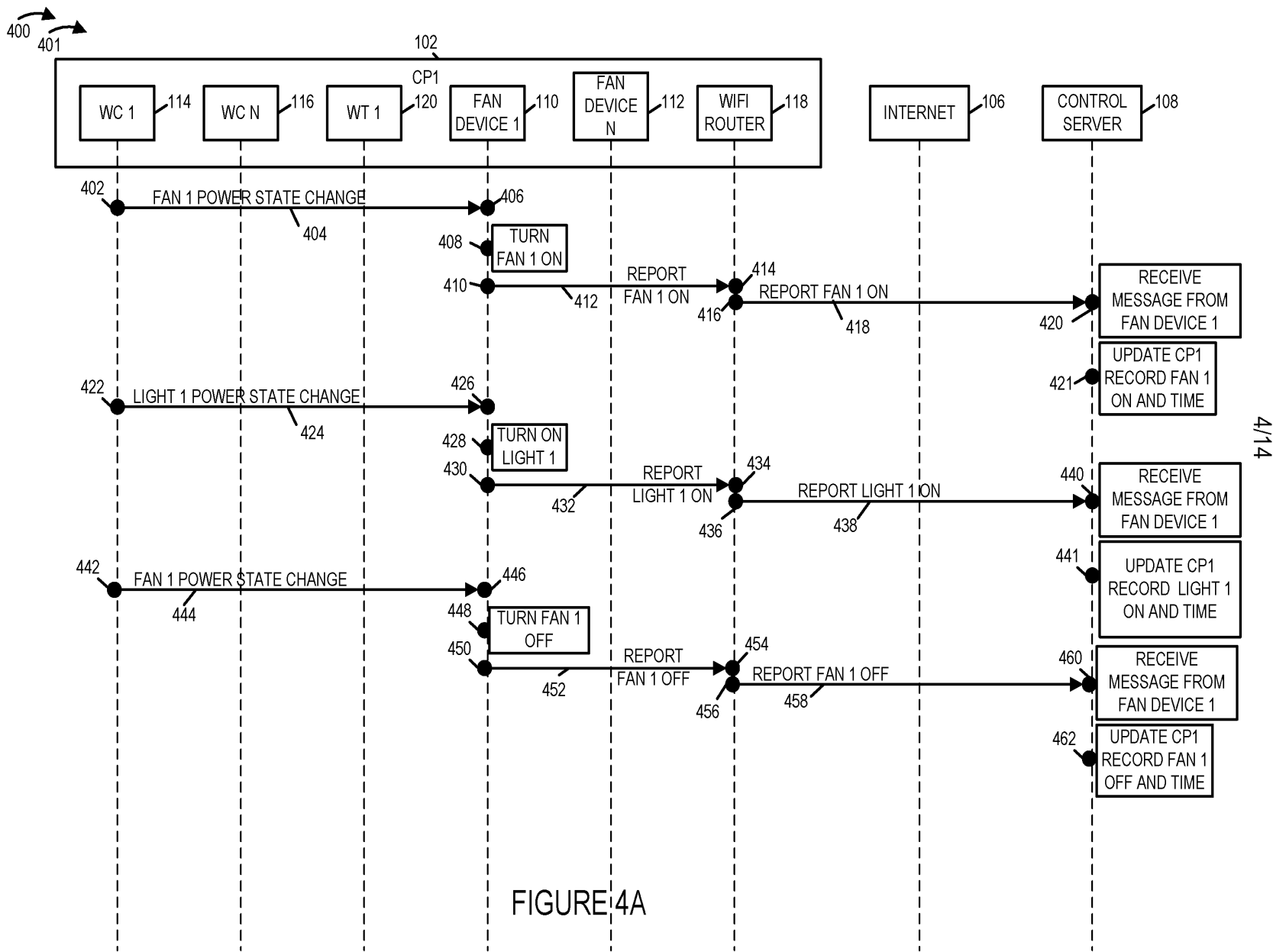


FIGURE 2





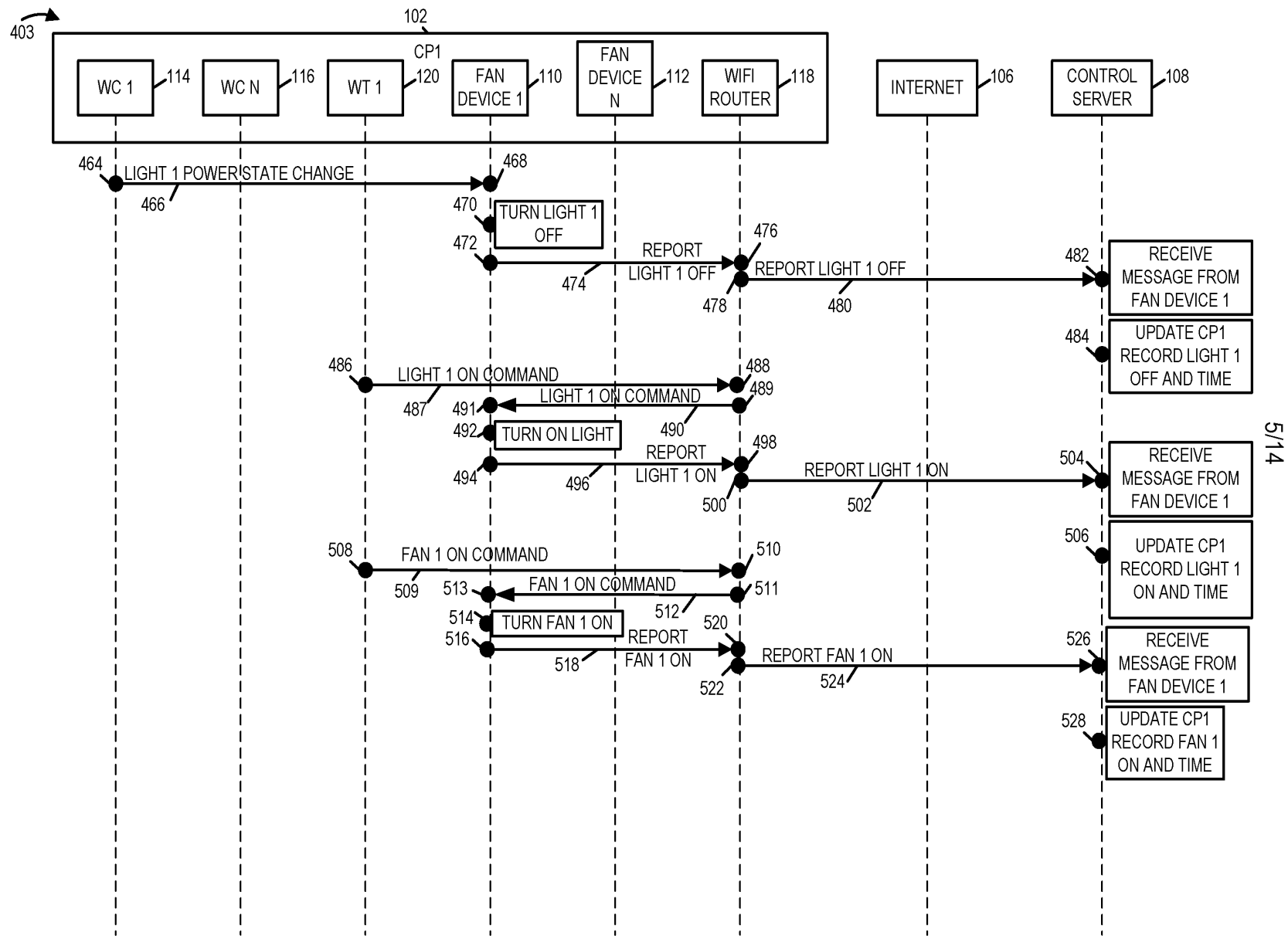
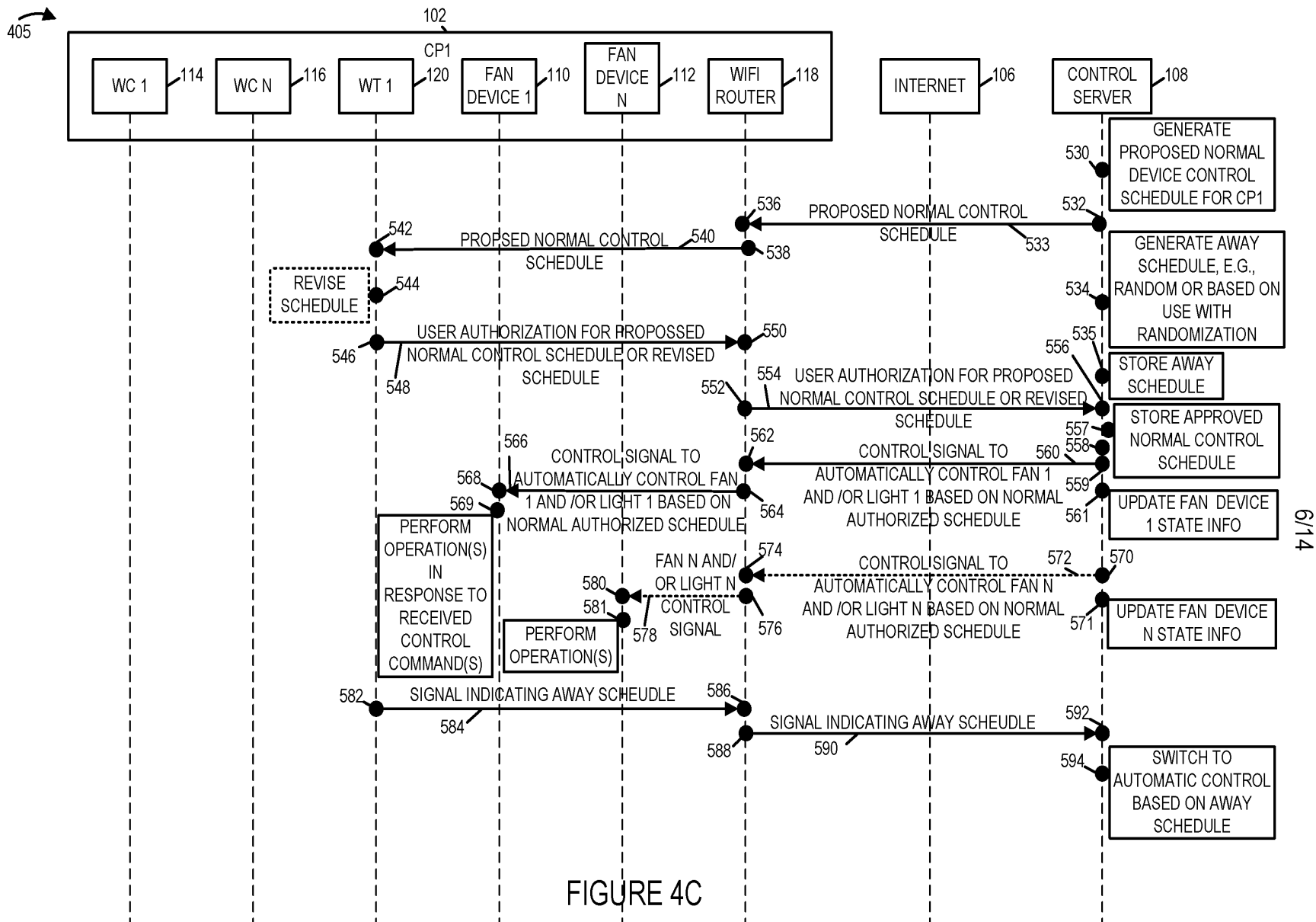


FIGURE 4B



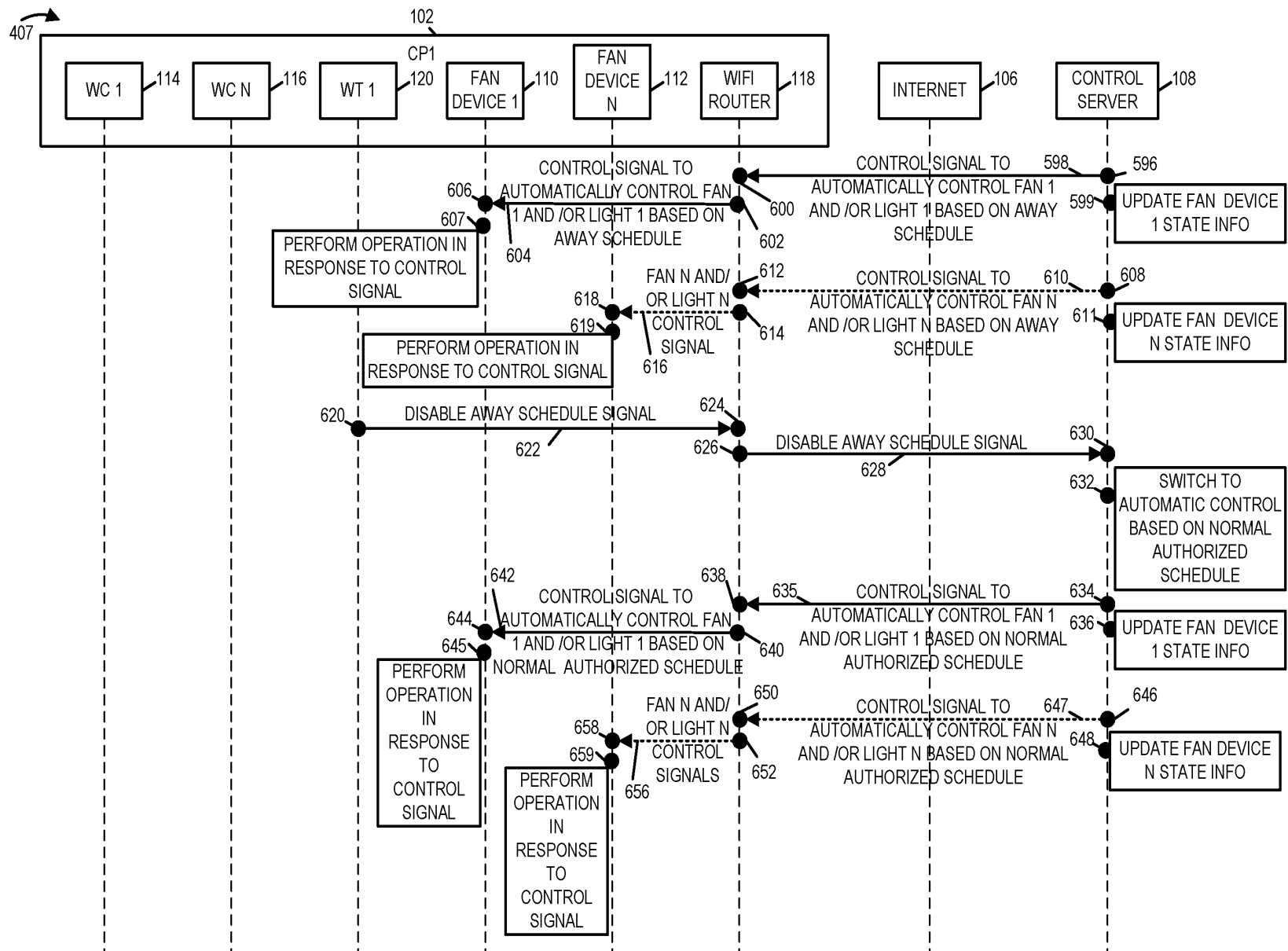


FIGURE 4D

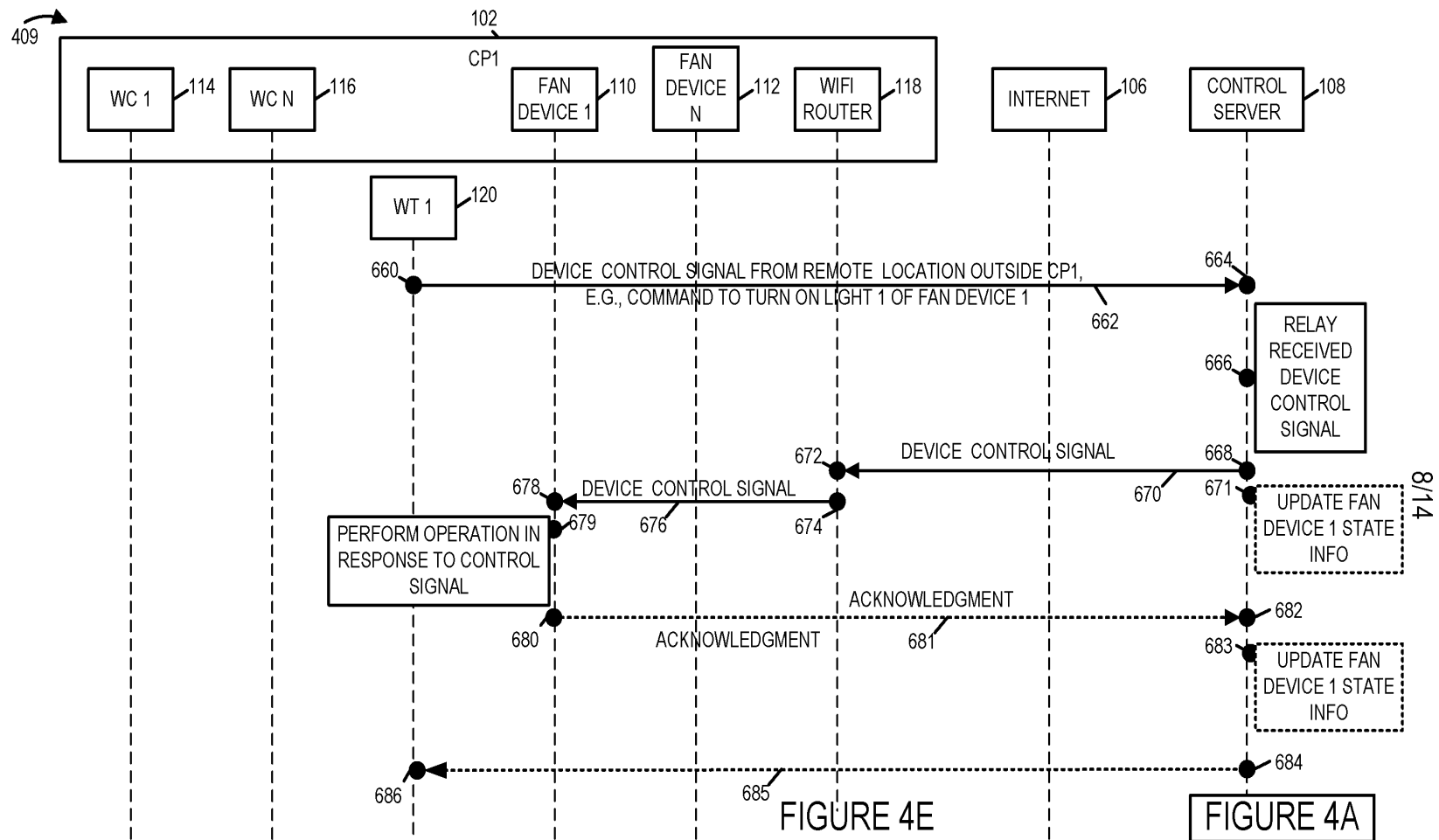
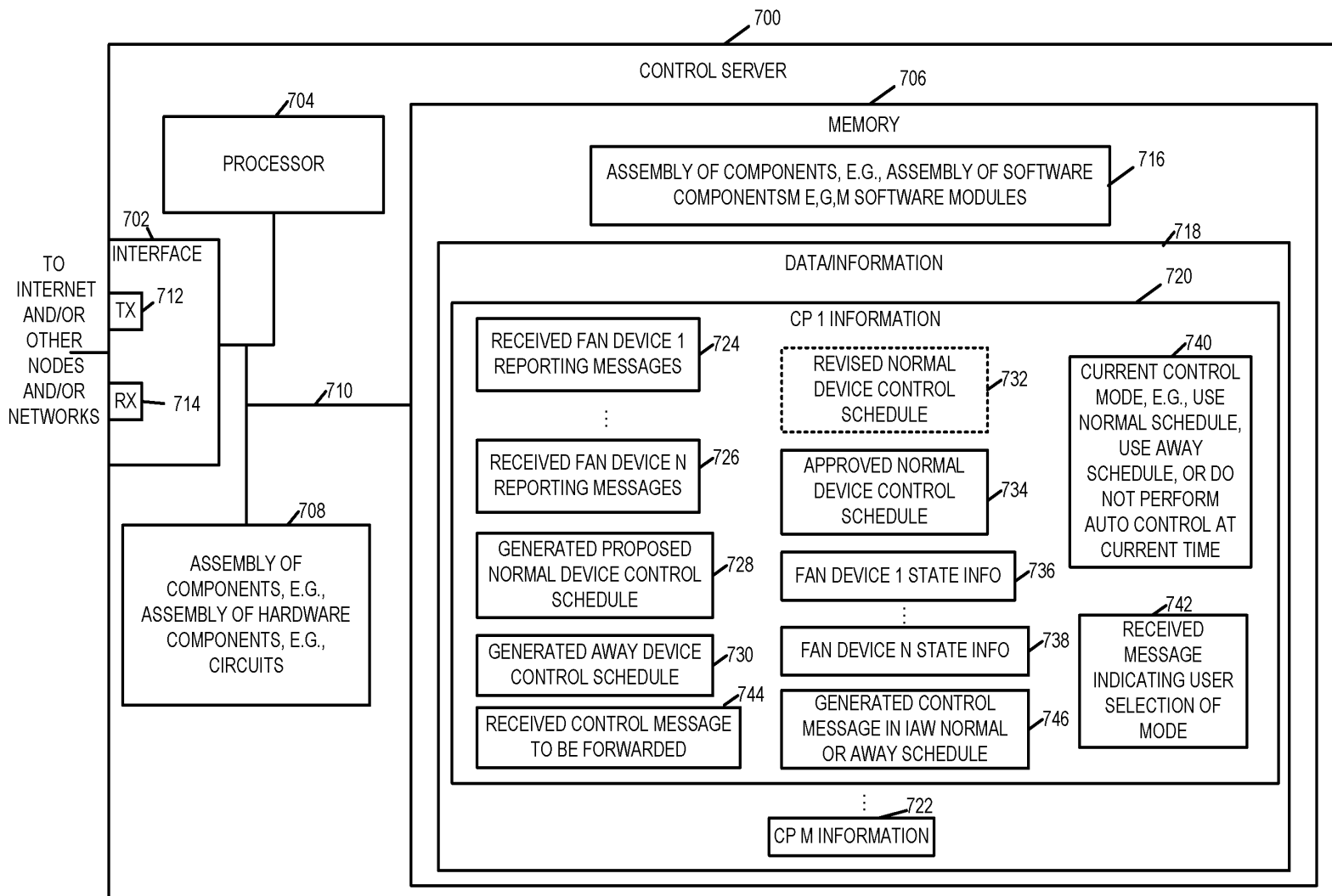


FIGURE 4A
FIGURE 4B
FIGURE 4C
FIGURE 4D
FIGURE 4E
FIGURE 4



9/14

FIGURE 5

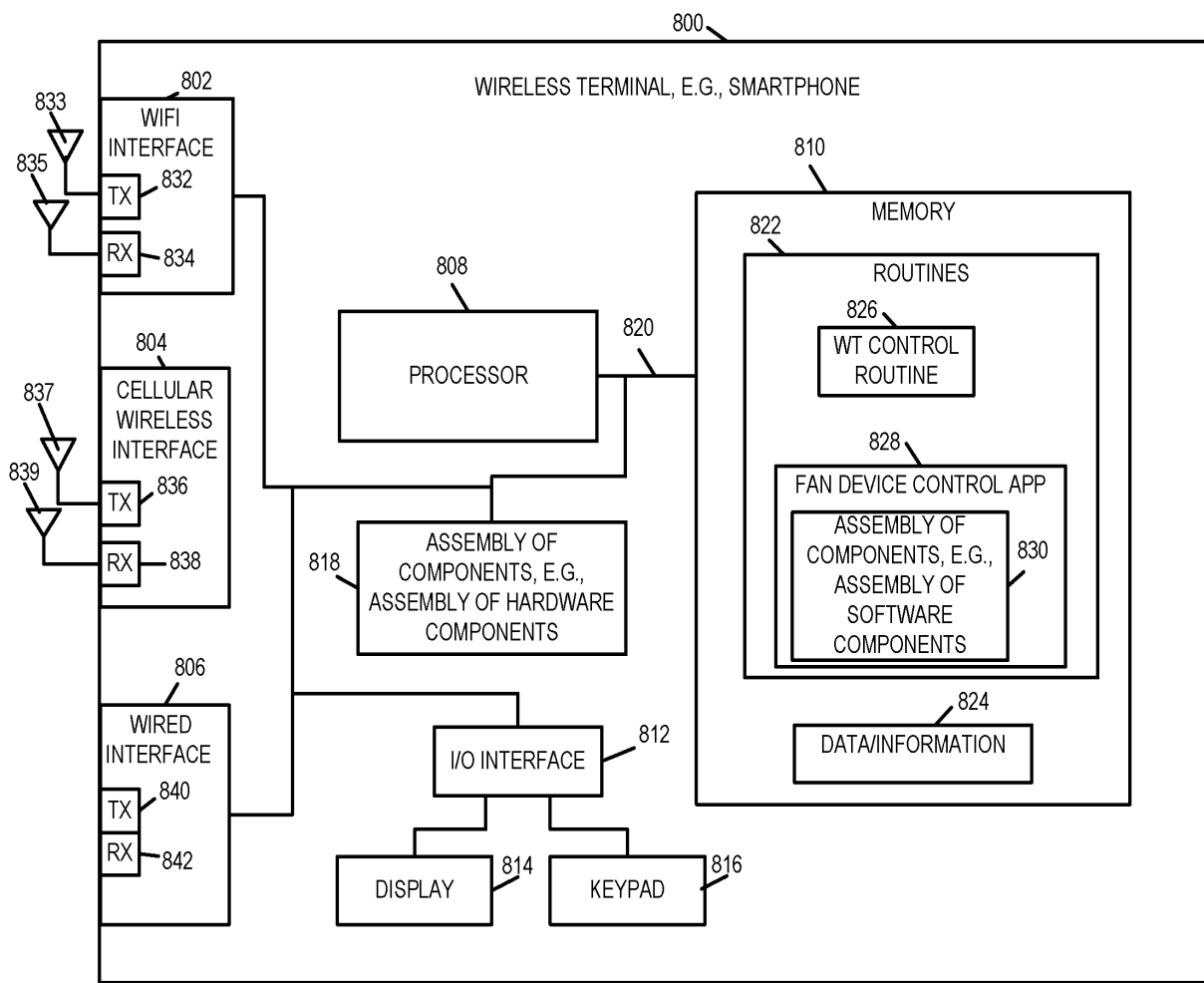


FIGURE 6

10/14

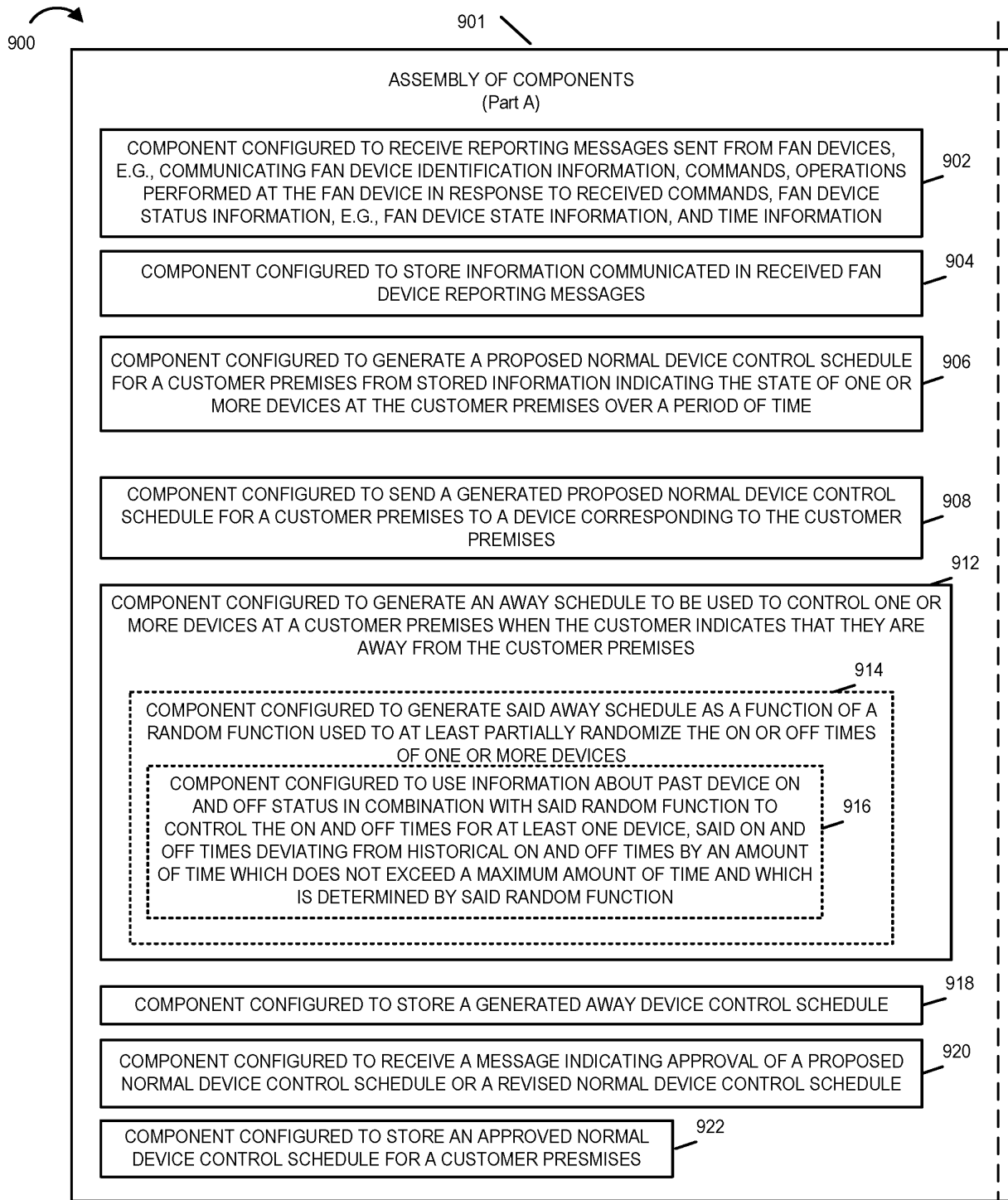


FIGURE 7A

12/14

903

ASSEMBLY OF COMPONENTS
(Part B)

COMPONENT CONFIGURED TO CONTROL ONE OF MORE DEVICES AT A CUSTOMER PREMISES BASED ON THE STORED APPROVED NORMAL DEVICE CONTROL SCHEDULE CORRESPONDING TO THE CUSTOMER PREMISES

COMPONENT CONFIGURED TO IDENTIFY AND SEND A COMMAND TO A FAN DEVICE AT THE CUSTOMER PREMISES VIA THE INTERNET AND A WIFI ROUTER TO CONTROL THE FAN DEVICE BASED ON THE STORED APPROVED NORMAL DEVICE CONTROL SCHEDULE

924

926

COMPONENT CONFIGURED TO CONTROL ONE OF MORE DEVICES AT A CUSTOMER PREMISES BASED ON THE STORED AWAY DEVICE CONTROL SCHEDULE CORRESPONDING TO THE CUSTOMER PREMISES

930

928

COMPONENT CONFIGURED TO IDENTIFY AND SEND A COMMAND TO A FAN DEVICE AT THE CUSTOMER PREMISES VIA THE INTERNET AND A WIFI ROUTER TO CONTROL THE FAN DEVICE BASED ON THE STORED AWAY DEVICE CONTROL SCHEDULE

COMPONENT CONFIGURED TO UPDATE INFORMATION ABOUT THE STATE OF A FAN DEVICE AT A CUSTOMER PREMISES BASED ON A COMMAND COMMUNICATED TO THE FAN DEVICE IN ACCORDANCE WITH AN APPROVED NORMAL DEVICE CONTROL SCHEDULE OR AN AWAY DEVICE CONTROL SCHEDULE

932

COMPONENT CONFIGURED TO UPDATE INFORMATION ABOUT THE STATE OF A FAN DEVICE AT A CUSTOMER PREMISES BASED ON A COMMAND, E.G., A RECEIVED COMMAND FROM A USER DEVICE WHICH IS BEING FORWARDED, TO THE FAN DEVICE

934

COMPONENT CONFIGURED TO RECEIVE A SIGNAL FROM A USER INDICATING AN AWAY STATUS CORRESPONDING TO A CUSTOMER PREMISES

936

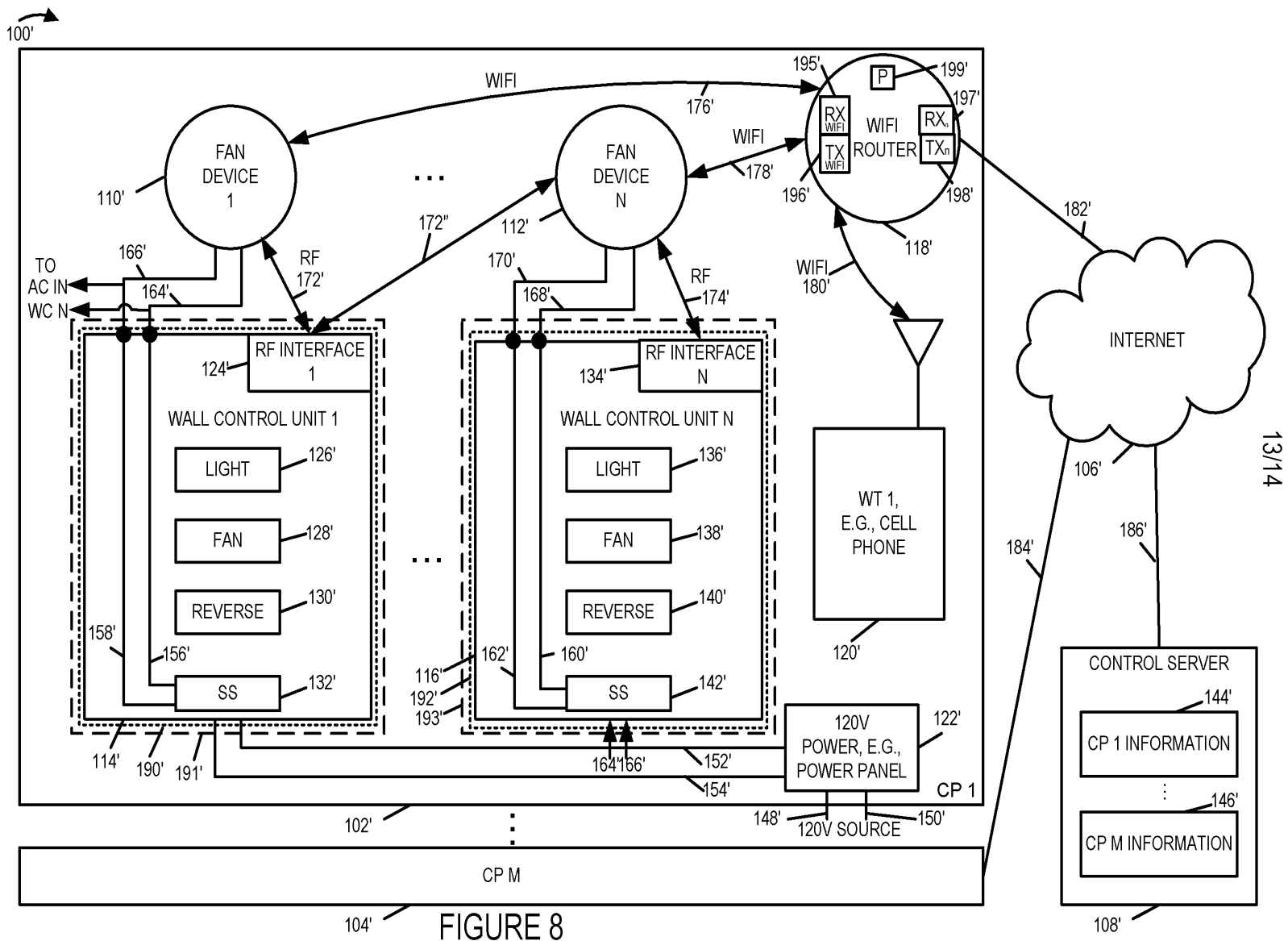
COMPONENT CONFIGURED TO SWITCH FROM USING A STORED NORMAL DEVICE CONTROL SCHEDULE TO USING A STORED AWAY DEVICE CONTROL SCHEDULE BASED ON THE RECEIVED AWAY STATUS INDICATOR

938

FIGURE 7B

FIGURE 7A | FIGURE 7B

FIGURE 7



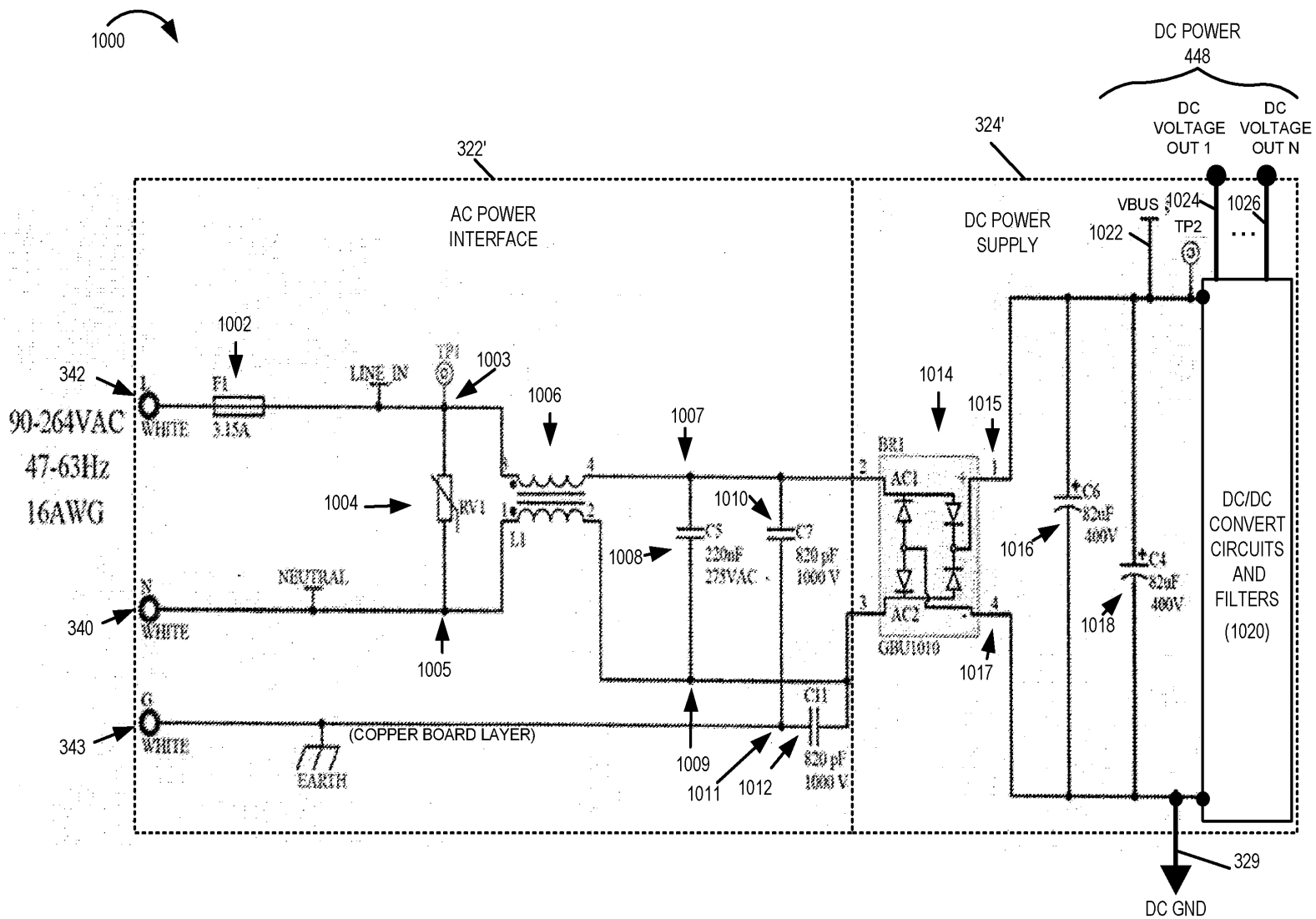


FIGURE 9

14/14

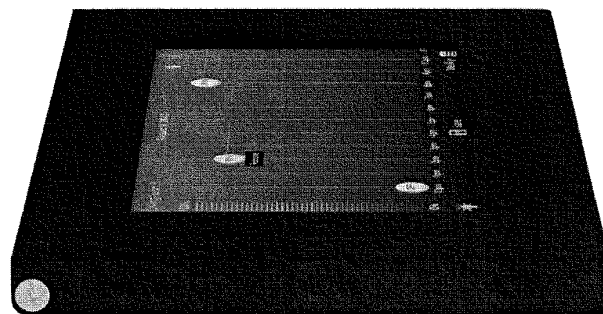
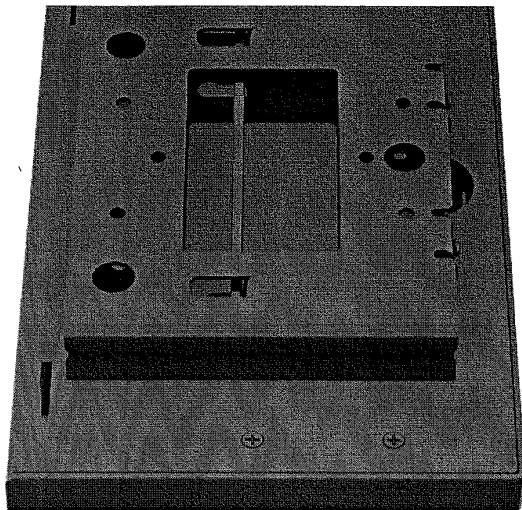
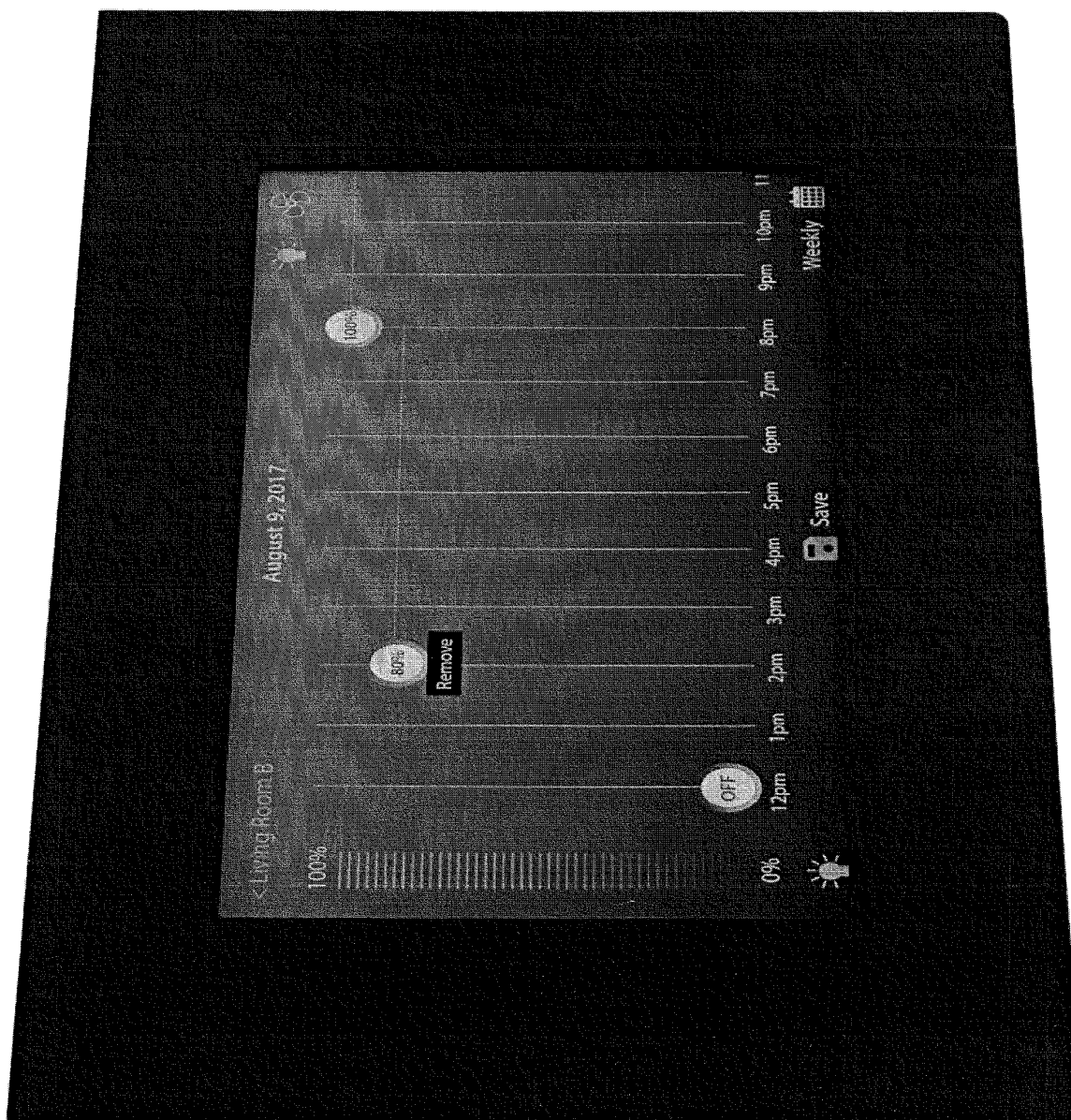
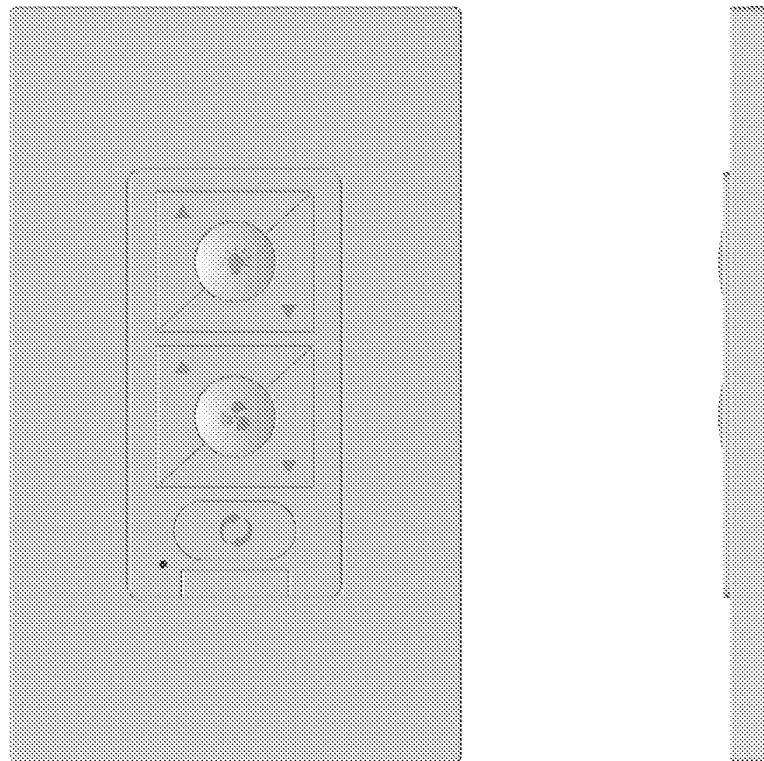


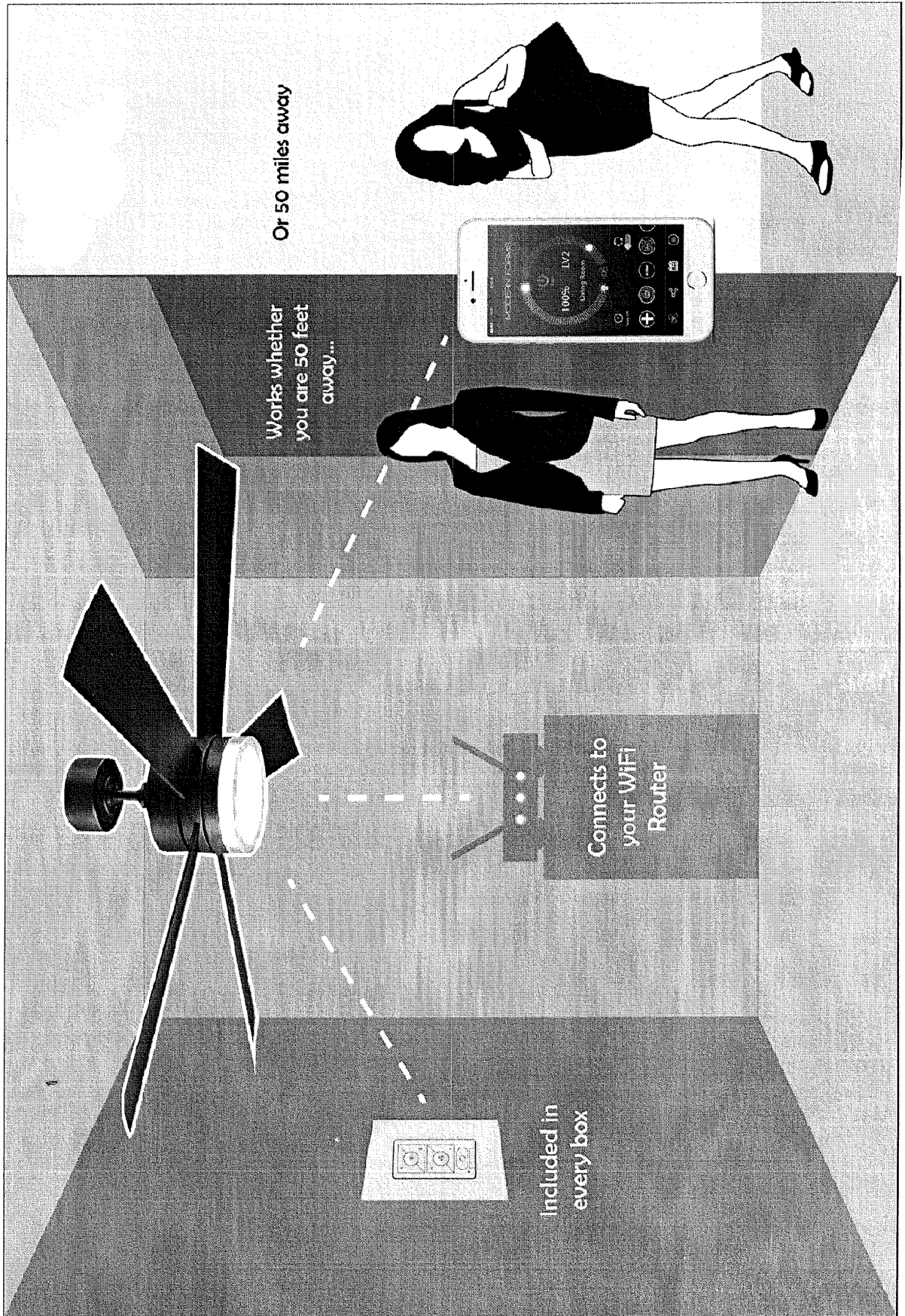
FIGURE 10



WALL CONTROL UNIT

FIGURE 11

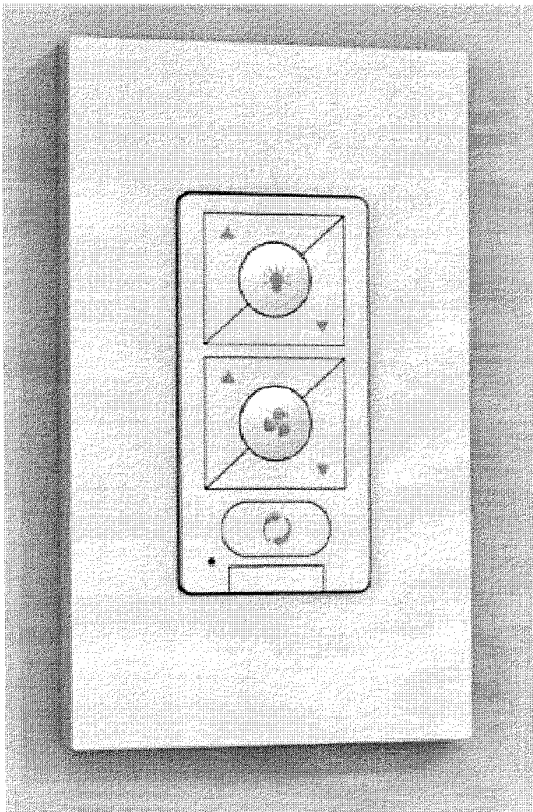




FEATURES

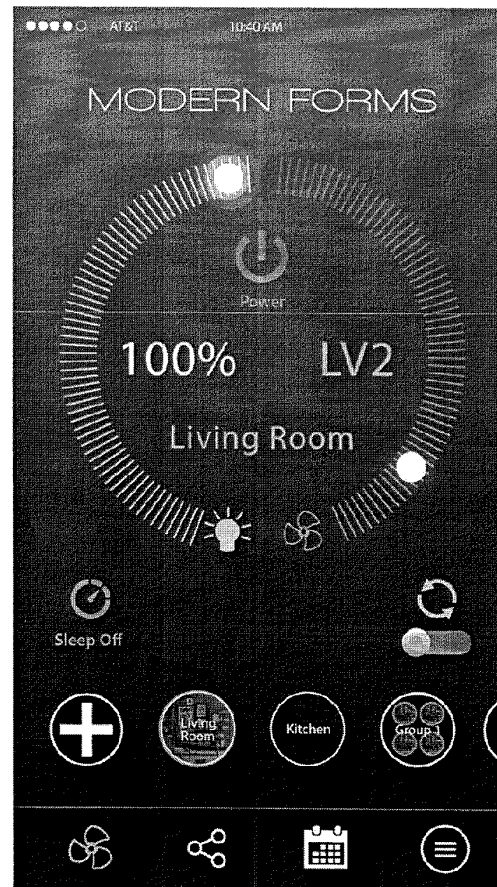
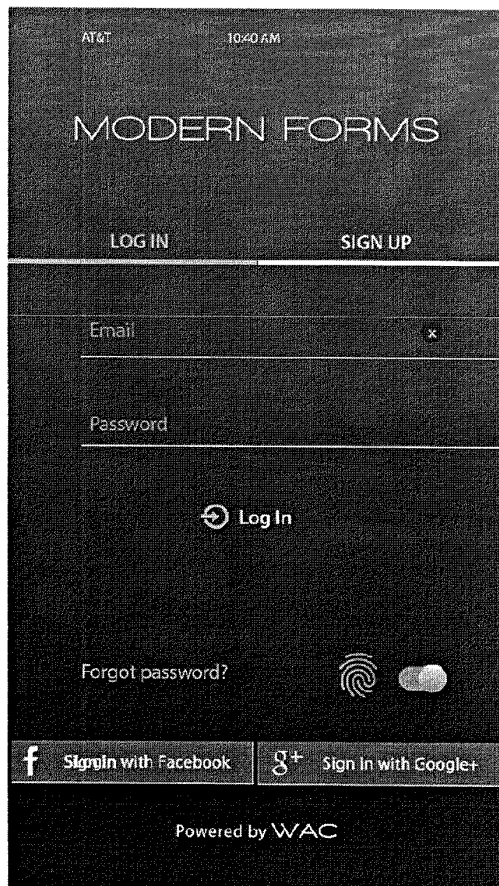
- WiFi and RF control
- 6 Speed Fan Control W/ Reverse
 - Wide Dimming Range
- Simple Local WiFi Control or Cloud Based
 - OTA updateable for future enhancements
- 7 Day Schedule
- Group Multiple Devices Together
- Away Mode

WALL SWITCH



- 2018 Design
- Included in Every Box
- Light On/Off/Dim
- Fan On/Off/6 Speeds
- Reverse
- Emergency Mechanical Cut Off

SIMPLIFIED LOCAL CONTROL



Full Dimming

Six Speeds

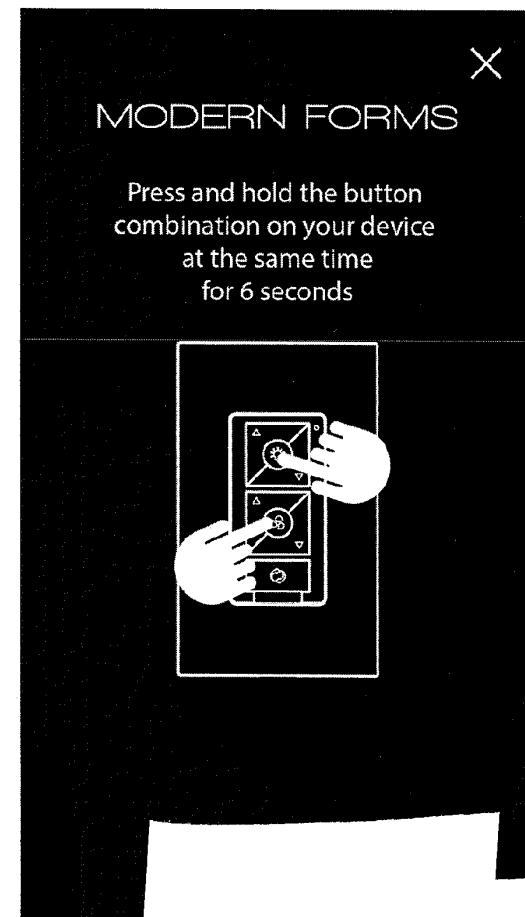
Reverse

Easy Access to
Devices

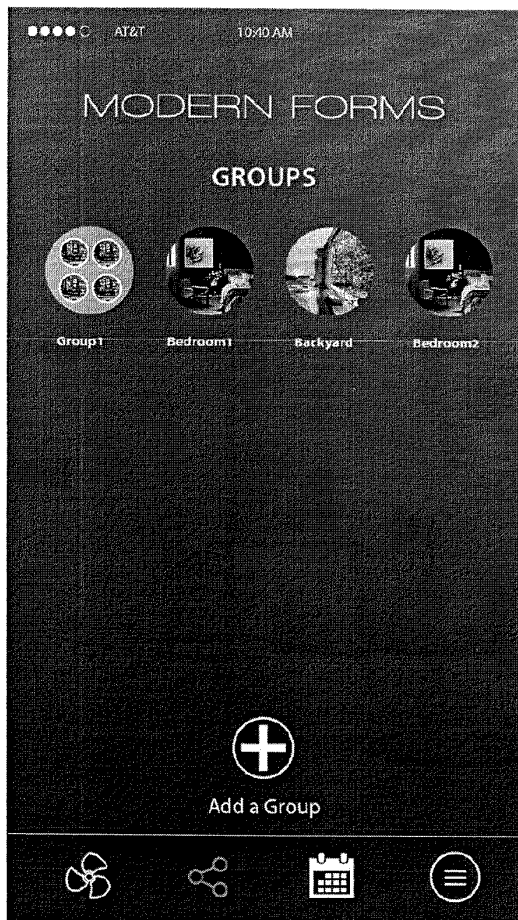
MULTIPLE SWITCH PAIRING

Enable three way switches

Application walks you through it



DEVICE GROUPING



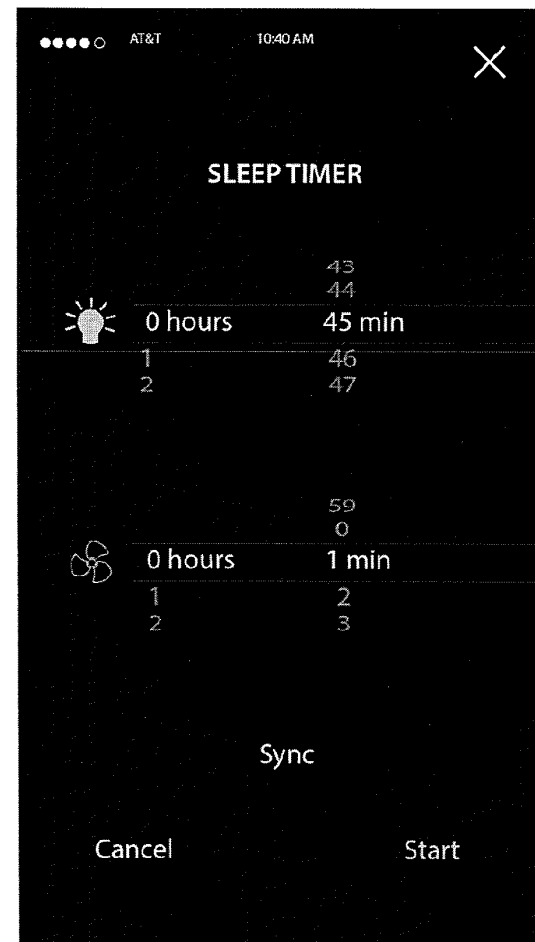
Control multiple fans at one time

Once created control from the main screen

SLEEP TIMER

Set independent timers

Make one and synchronize both



CLOUD CAPABILITIES

Opening a world of possibility

- Control Your Devices Away From Home

- Home Integration

Ask you fans to behave without opening your app

- Ability to Tie Into Other Ecosystems (Nest/Ecobee)
- Adaptive Learning Protocol

Our WAC algorithm will suggest a schedule based on your usage patterns

- Access 365 Day Schedule

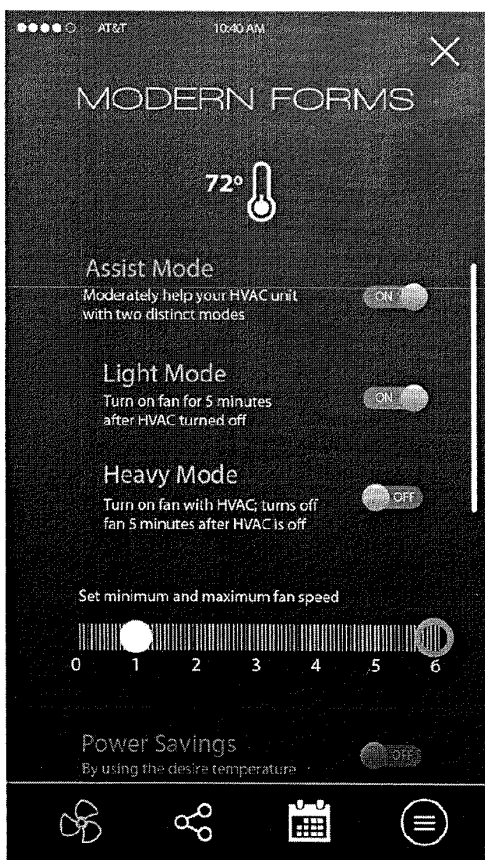
7 day schedule not enough? Get as granular as possible for each day of the year

- Invite Users to Control Devices (Hospitality?)

Allow your children or guests to gain access.

- 99.999% uptime

Custom built on Amazon AWS with high reliability

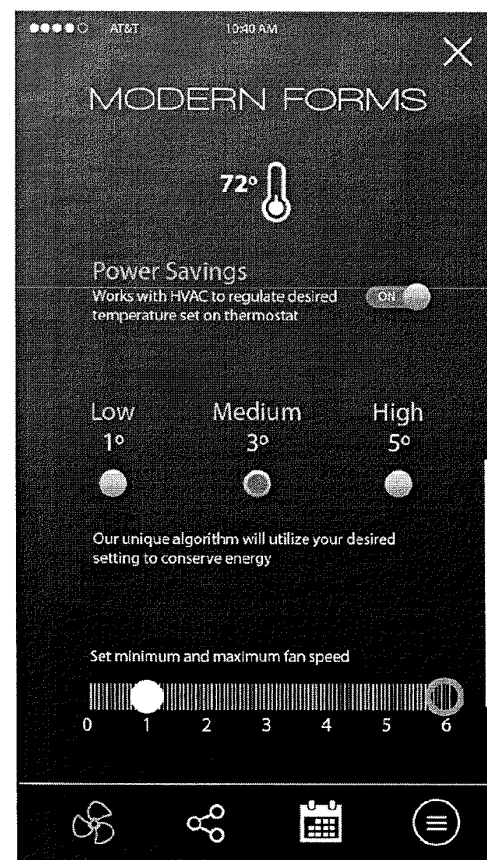


Access different options

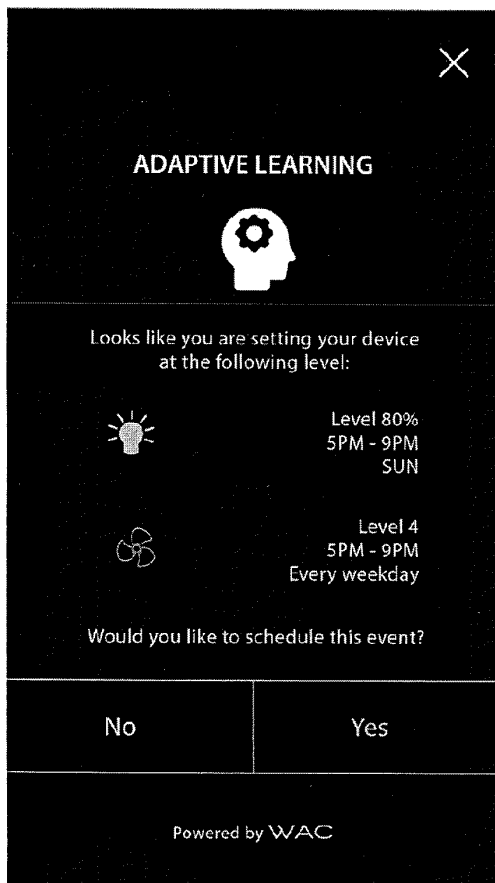
Assist Mode to help efficiency

Power Mode to ease energy costs

Set custom fan speeds



ADAPTIVE LEARNING



App Learns your usage patterns

Schedule is recommended based on this information

Opt – in and cancel at any time

INVITE USER TO CONTROL DEVICES

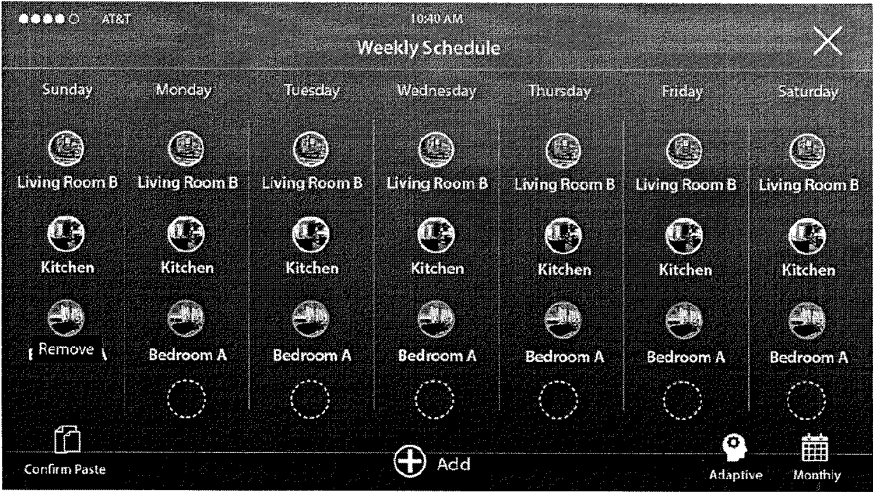
Share control with household,
employees, guests

Choose what devices they can control

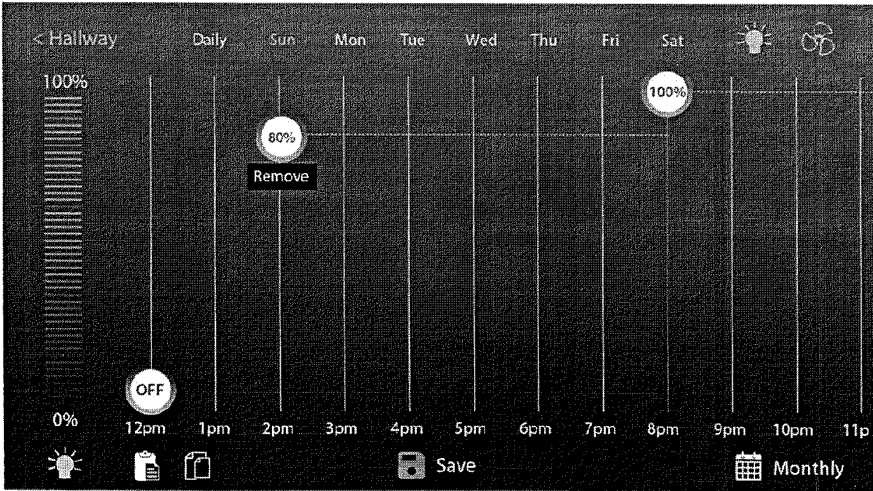
Deny access at any time



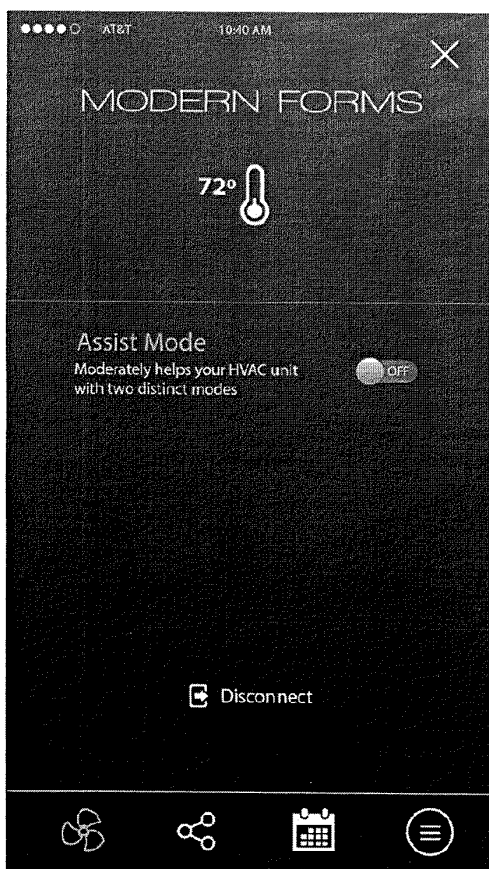
SEVEN DAY SCHEDULING



Week At a Glance

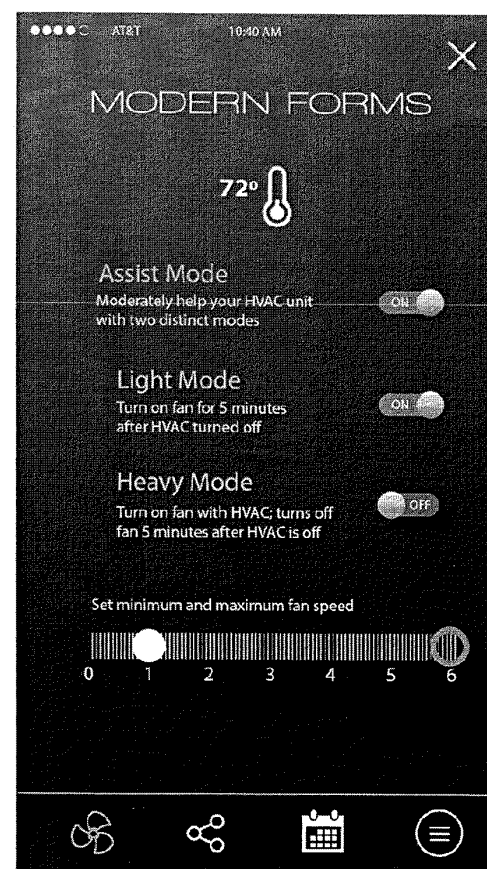


Slide to Set



Assist Mode to help efficiency

Set custom fan speeds

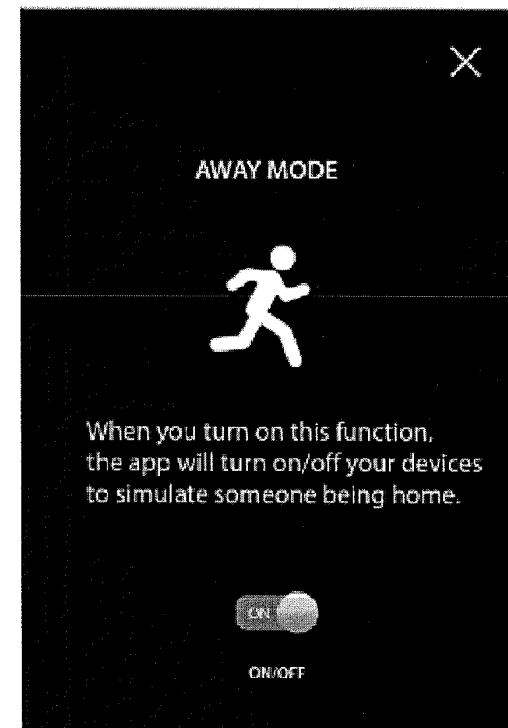


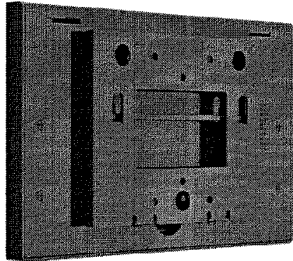
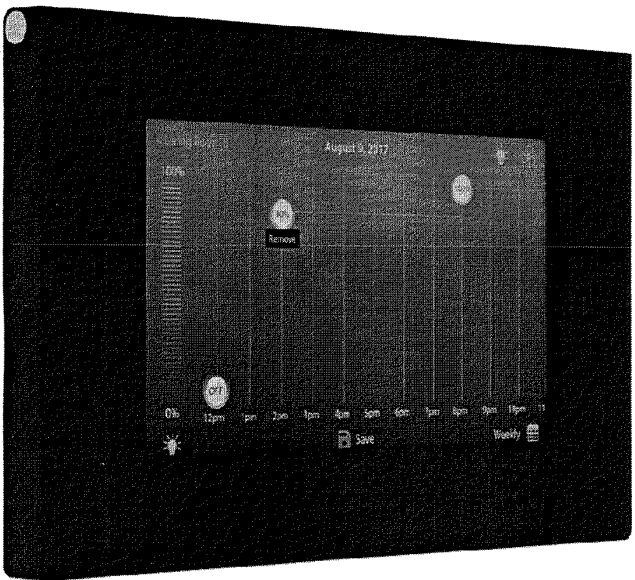
AWAY MODE

Turn it on when leaving

Mimic someone in the home while away

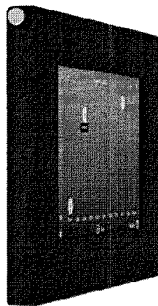
Randomly turns on/off light





Installs to single or
double gang box

Custom wall app



Connect to existing
electric

PROVISIONAL PATENT APPLICATION

METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES

FIELD

The present invention relates to fan devices, and more particularly, to methods and apparatus for controlling devices using different interfaces, e.g., an RF interface and a WiFi interface.

SUMMARY

Various embodiments are directed to use of an RF and WiFi control in the fan device to control fan status and speed and/or fan light on/off status and intensity. The fan device includes both an RF interface and a WiFi interface. The customer premises includes a WiFi router through which WiFi communications can be sent from a WiFi capable device, e.g., a cell phone, to control the fan device and its various functions. While WiFi control is via a WiFi router in the home, the control signals normally do not traverse the Internet or another external network. Accordingly, WiFi control is possible without the need for a connection to an external network or server. In addition to WiFi control, control of the fan device can be via an RF control device, e.g., a wall mounted controller. In some embodiments 120V power is supplied to the fan device via the wall mounted controller. While 120V power may be supplied via the wall controller, control signals from the wall mounted controller are transmitted using RF signals to the RF interface of the fan device. The RF interface uses a different frequency band than the frequency band used for WiFi signals sent to/from the WiFi router. In some embodiments the RF interface uses an unlicensed frequency spectrum which is different than that used for WiFi signals.

Since the RF and WiFi control signals need not pass over an external communications network as in the case of systems where commands must first be sent to a network server outside a customer premises and then sent from the network server to the device to be controlled, the fan device can be controlled either by the wall controller or a WiFi device even if a connection to the Internet or another external network is not available.

In some, but not necessarily all embodiments, the fan device reports its state and/or changes in state due to received commands to a server, e.g., located outside the

[WAC-10PROV]

customer premises. The communication with the external server may be, and sometimes is, via a WiFi router and Internet connection. The server logs the state information of one or more devices at each customer premises it is associated with. The server generates, e.g., automatically, a recommended normal schedule based on historical device state information including device on/off times, fan speed information and/or light intensity information. Machine learning and historical device state information may be, and sometimes is, used for generating the recommended schedule for a customer premises. The recommended normal control schedule is communicated to an individual, e.g., a customer at the customer premises to which the schedule relates. The communication of the proposed schedule may be, and sometimes is, from the server via the Internet and WiFi router at the customer premises to which the schedule relates. The customer can approve the recommended schedule and/or provide a revised normal schedule to be used by the server to control devices at the customer premises.

In addition to generating a normal control schedule for a customer premises, an away schedule to be used when a customer indicates that the customer premises is in an away state is generated. An away state corresponds to when the normal occupants of the customer premises are away from the customer premises. The away schedule is generated based on a random function so that devices will be turned on at somewhat randomized times making it difficult for a potential burglar to determine whether the devices are being controlled by an automated system or by a human present at the premises. In some embodiments historical device use information is taken into consideration when the server automatically generates the away schedule with the on/off times being somewhat random but remaining within a reasonable time, e.g., 30 minutes or an hour, of when the devices are turned on and off when a human is present.

While a user can control the devices while in the home via the RF controller or a WiFi controller without having to send commands outside the home, remote control of devices is also supported. A user can login to the control server and once authenticated is allowed to send control commands to devices at the home via the control server and the WiFi router. In this way a user can control devices while away from the home. In the case of commands sent via the server, the server can, and sometimes does, update device state information based on the commands sent from the server to the device to be controlled thereby eliminating the need for the device to report a state change to the server. While in some embodiments devices do not report state changes to the server which are in response to commands communicated by the server to the device being

[WAC-10PROV]

controlled, in other embodiments the devices being controlled, e.g., fan devices, routinely report a state change to the control server regardless of whether the command was from the server, wall controller or WiFi device in the home.

The customer to which a home corresponds can enable/disable use of a control schedule by the server. For example the user can send a signal to the control server to indicate that the normal control schedule should be used or the away schedule should be used or that no control schedule should be used. The signal may indicate automated control is to be set to off for the home, automated control should be on and, when the automated control is on whether an away state is indicated indicating that the away schedule should be used or that the premises is in a normal state and thus the normal schedule should be used.

An exemplary control method, in accordance with some embodiments, comprises: receiving, at a fan device including a radio frequency signal receiver and a WiFi interface, a first radio frequency (RF) control signal from a control unit, said fan device and said control unit being located at a customer premises; implementing, at the fan device, an operation in response to a first command communicated by the first RF control signal; and operating the fan device to communicate to a server located outside the customer premises, via the WiFi interface, information indicating the operation implemented in response to the first command.

In various embodiments a controller with an RF interface is used to control a fan device which includes a fan motor and may also include a lighting device. The controller in some embodiments is in the form of a wall control module which may be, and sometimes is, mounted in a standard electrical wall box in a room in which the fan device to be controlled is located. To simplify installation and avoid the need for more than the normal 120V power line used to power an outlet, from a 120V AC prospective the controller acts as a simple pass through device through which AC power is supplied to the fan device unit. As a safety, the controller includes an AC disconnect which can be used to cut all power to the fan unit. The disconnect switch may be in the form of a push or pull switch or a pull tab which can interrupt the power to the fan device.

Control of the fan device is via an RF interface included in the wall controller. In some embodiments activation of the safety disconnect switch will cut power to the RF interface of the wall controller in addition to power to the fan device. In this way, in

[WAC-10PROV]

some but not necessarily all embodiments, the safety cut off serves as a physical kill switch integrated into the wall controller for both the wall controller and the fan device.

The controller includes inputs for controlling fan on/off operations, light on/off operation, fan speed, e.g., up/down, and/or light intensity, e.g., fan device light output up/down. In some embodiments light output and fan speed can be smoothly controlled, e.g., with light intensity being controlled in a smooth fashion over a wide range of intensity values as opposed to simply a few discrete output levels. The wall controller transmits RF control signals to implement or communicate commands that are generated based on the pressing or altering of the control inputs on the wall controller. The control signals are transmitted to the fan device using a RF frequency band which is different from that used for WiFi signals at the customer premise where the controller is located.

An exemplary fan device controller, in accordance with some embodiments, includes: an AC voltage input; an AC output for supplying power to a fan device; an RF signal interface including an RF signal transmitter for transmitting commands to a device to be controlled; an RF controller for controlling the RF signal interface to send control signals including one or more commands to said fan device; and a disconnect switch for disconnecting said AC output from said AC input when said disconnect switch is switched to a disconnect state from a connect state.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a drawing of an exemplary system including controllable fan devices, wall control units, a wireless terminal, a WiFi router and a control server in accordance with an exemplary embodiment.

Figure 2 is a drawing illustrating an exemplary wall control unit, e.g., a fan device controller, including an RF interface in accordance with an exemplary embodiment.

Figure 3 is a drawing of an exemplary controllable fan device including a controllable fan, a controllable light, an RF interface and a WiFi interface in accordance with an exemplary embodiment.

Figure 4A is a first part of a drawing illustrating an exemplary fan device system, exemplary signaling, and exemplary operations in accordance with an exemplary control method.

[WAC-10PROV]

Figure 4B is a second part of a drawing illustrating an exemplary fan device system, exemplary signaling, and exemplary operations in accordance with an exemplary control method.

Figure 4C is a third part of a drawing illustrating an exemplary fan device system, exemplary signaling, and exemplary operations in accordance with an exemplary control method.

Figure 4D is a fourth part of a drawing illustrating an exemplary fan device system, exemplary signaling, and exemplary operations in accordance with an exemplary control method.

Figure 4E is a fifth part of a drawing illustrating an exemplary fan device system, exemplary signaling, and exemplary operations in accordance with an exemplary control method.

Figure 4, comprises the combination of Figure 4A, Figure 4B, Figure 4D, and Figure 4E.

Figure 5 is a drawing of an exemplary control server in accordance with an exemplary embodiment.

Figure 6 is a drawing of an exemplary wireless terminal, e.g., a smartphone, in accordance with an exemplary embodiment.

Figure 7A is a first part of an exemplary assembly of components which may be included in an exemplary control server in accordance with an exemplary embodiment.

Figure 7B is a second part of an exemplary assembly of components, which may be included in an exemplary control server in accordance with an exemplary embodiment.

Figure 7 comprises the combination of Figure 7A and Figure 7B.

Figure 8 is a drawing of an exemplary system including controllable fan devices, wall control units, a wireless terminal, a WiFi router and a control server in accordance with another exemplary embodiment.

Figure 9 is a drawing of an exemplary AC power interface coupled to an exemplary DC power supply which may be used in the fan device of Figure 3 in accordance with an exemplary embodiment.

Figure 10 illustrates an exemplary wall mounted wireless terminal with RF and Wi-Fi interfaces in accordance with an exemplary embodiment of the present invention.

Figure 11 illustrates an exemplary wall control unit including a safety switch in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION

Figure 1 is a drawing of an exemplary fan device system 100 in accordance with an exemplary embodiment. Exemplary system 100 includes a plurality of customer premises sites (customer premises 1 (CP 1) 102, ..., customer premises M (CP M) 104), Internet 106, and a control server 108 coupled together as shown in Figure 1. CP 1 102 includes a plurality of fan devices, (fan device 1 110, ..., fan device N 112), a plurality of wall control units, e.g., fan device controllers, (wall control unit 1 114, ..., wall control unit N 116), a WiFi router 118, a wireless terminal (WT 1) 120, e.g., a cell phone, an a 120 V power source 122, e.g., a power panel. In one embodiment 120V power panel 122 includes a 20A circuit breaker. Each wall control unit (114, 116) is configured to fit in an electrical box in a wall of a customer premises.

Wall control unit 1 114 includes RF interface 1 124, light on/off switch 126, fan on/off switch 128, fan reverse switch 130, and safety switch (SS) 132. Wall control unit 1 114 is installed in electrical box 190 of wall 191. In some embodiments, fan device 1 110 and wall control unit 114 are both located in a first room in customer premises 1 102. Wall control unit N 116 includes RF interface 2 134, light on/off switch 136, fan on/off switch 138, fan reverse switch 140, and safety switch (SS) 142. Wall control unit N 116 is installed in electrical box 192 of wall 193. In some embodiments, fan device N 112 and wall control unit N 116 are both located in a second room in customer premises 1 102, the second room being a different room than the first room. Fan device state information includes fan state information for fan motors and light state information for fan lights.

Control server 108 includes customer premises information corresponding to a plurality of customer premises (CP 1 information 144, ..., CP M information 146) being controlled by the control server 108. Exemplary customer premises 1 114 information includes, e.g., historical state information corresponding to fan devices located within customer premises 1 102, an approved normal device control schedule for CP1, and a generated away device control schedule for CP1.

120 V input power is received by the power panel 122 via 120V power source input lines 148, 150. The received input power is routed through power panel 122, e.g., passes through a circuit breaker, and is output from the power panel 122, via lines 152, 154, which are input to the safety shutdown switches (132, ... 142) of the wall control units (114, ..., 116) of CP 1 102.

[WAC-10PROV]

The output of safety switch 132, when the switch is in a closed position, powers the internal circuitry on wall control unit 114 and is fed, via lines (156 and 164, 158 and 166) to the input of fan device 1 110. The output of safety switch 142, when the switch is in a closed position, powers the internal circuitry on wall control unit N 116 and is fed, via lines (160 and 168, 162 and 170) to the input of fan device N 112.

RF interface 1 124 of wall control unit 1 114 communicates with fan device 1 110 via RF signals 172. Fan device 1 110 communicates with WIFI router 118 via WiFi signals 176. RF interface N 134 of wall control unit N 116 communicates with fan device N 112 via RF signals 174. Fan device N 112 communicates with WIFI router 118 via WiFi signals 178.

WT 1 120 communicates with WiFi router 118 via WiFi signals 180. In some embodiments, e.g., embodiments supporting Wi-Fi direct, WT 1 120 may directly communicate with fan device 1 110 and fan device N 112 using WiFi signals. WT 1 120 may, and sometimes does, communicate with devices, e.g., control server 108, via the Internet and/or via another WiFi router or a base station when outside customer premises 1 102.

WiFi router 118 includes a WiFi interface, including a WiFi transmitter 196 and a WiFi receiver 195, a network interface includes a receiver 197 and a transmitter 198, a processor 199 and memory coupled together via a bus over which the various elements may interchange data and information. WiFi router 118 communicates with WiFi devices (110, 112, 120) at CP 1 102 via its WiFi interface using WiFi receiver 195 and WiFi transmitter 196. WiFi Router 118 of CP 1 102 communicates with the Internet via the network interface and link 182. A WiFi Router of CP M 104 communicates with the Internet via link 184. Internet 106 is coupled to control server 108 via communications link 186.

Figure 2 is a drawing 200 illustrating an exemplary wall control unit 202, e.g., a fan device controller, e.g., a fan/light controller, in accordance with an exemplary embodiment. Exemplary wall control unit 202 is, e.g., wall control unit 1 114 or wall control unit N 116 of CP 1 102 of system 100 of Figure 1. Wall control unit 202 includes a control panel 204, a safety switch 206, an RF interface 208, a DC power supply 210, a controller 212, an AC input 237, and an AC output 241, coupled together as shown in Figure 2. In various embodiments, the wall control unit 202 does not include a WiFi interface.

[WAC-10PROV]

Control panel 204 includes a light on/off switch 214, a fan on/off switch 216, a fan reverse switch 218, a light up switch 220, a light down switch 222, a fan speed up switch 224, and a fan speed down switch 226. Light on/off switch 214, e.g., a push button switch, is a light control input for turning a light, e.g., a light in a fan device, on or off. Light on/off switch 214 is coupled to controller 212 via line 248. Fan on/off switch 216, e.g., a push button switch, is a fan control input for turning a fan, e.g., a fan in a fan device, on or off. Fan on/off switch 216 is coupled to controller 212 via line 250. Fan reverse switch 218, e.g., a push button switch, is a fan reverse input for changing the rotation direction of a fan in a fan device. Fan reverse switch 218 is coupled to controller 212 via line 252. Fan speed up switch 224, e.g., a push button switch, is a fan speed up input for increasing the speed of a fan in a fan device. Fan speed down switch 226, e.g., a push button switch, is a fan speed down input for decreasing the speed of a fan in a fan device. Light up switch 220, e.g., a push button switch, is a light up input for increasing the light output from a light in a fan device. Light down switch 222, e.g., a push button switch, is a light down input for decreasing the output of a light in a fan device. Fan speed up switch 224, fan speed down switch 226, light up switch 220, and light down switch 222 are coupled to controller 212 via lines (258, 260, 254, 256), respectively.

RF interface 208 includes an RF transmitter 228 and, in some embodiments, an RF receiver 230, which are coupled to antenna 232, via which the wall control 202 may transmit and, in some embodiments, receive RF signals, e.g., to or from a fan device. Exemplary transmitted RF signals include, e.g., an RF control signal communicating a command. In some embodiments, the command is one of: a fan power state change command, a fan speed up command, a fan speed down command, a fan direction change command, a light power state change command, a light increase command, or a light decrease command. An exemplary received RF signal includes, e.g., an acknowledgment of a transmitted command.

In various embodiments, the RF control signals which are sent by control unit 202 to a fan device use an RF frequency which is not used for WiFi signals. In some embodiments, the RF control signals which are sent by control unit 202 to a fan device use a different frequency band and a different protocol than the WiFi signals which are received by the fan device.

120 V Input power lines 234, 236 are coupled, via AC input interface 237, to the input of safety switch 206, e.g., a disconnect switch. The outputs of safety switch 206

[WAC-10PROV]

are coupled to the input of DC power supply 210 and to lines 238, 240, which are coupled, via AC output interface 241, to a fan device via lines 242, 244. In Figure 2, safety switch 206 is shown in the ON or closed position in which input AC power is supplied to both the DC power supply 210 and to a fan device which is coupled to the wall control unit 202. When the safety switch is placed in the open or OFF position or disconnect position, AC power is cutoff, e.g., not supplied, to both the input of the DC power supply 210 of wall control unit 202 and to the fan device coupled to wall control unit 202. Safety switch 206, e.g., a disconnect switch, is for disconnecting the AC output 241 from the AC input 237 when the switch 206 is switched to a disconnect state from a connect state. In some embodiments, safety switch 206, e.g., a disconnect switch, is in the form of a push or pull switch or a pull tab which can interrupt the power to the fan device to which the wall control unit 202 is coupled.

DC power supply 210, when receiving input AC power, generates and outputs DC supply output 246, e.g., 3VDC, which is input to and used by RF interface 208 and controller 212. In some embodiments, the DC power supply 210 generates and outputs multiple DC voltages, e.g., 3VDC, 5VDC, 15VDC and -15VDC, which are used by the controller 212 and the RF interface 208. The DC power supply 210 is connected to switch 206 and to the RF controller 212. The DC power supply 206 receives AC power from the disconnect switch 206 when switch 206 is in the closed position, and the DC power supply 210 generates DC power from the received AC power and supplies the DC power to the controller 212. If an operator switches the disconnect switch 206 to a disconnect state, power is cut off to both AC output 241 and to the DC power supply 210 at the same time.

Controller 212, e.g., an RF controller, controls the RF interface 208 including RF signal transmitter 228 to generate and transmit RF control signals over line 262 in response to detected control panel input button depressions. Lines can be, for example, wires or traces over which electrical signals can be communicated. RF signal transmitter 228 transmits commands to a device, e.g., a fan device, being controlled. Controller 212, e.g., an RF controller, includes a processor 213 configured to generate a command, e.g., (a light power state change command, a fan power state change command, a fan direction change command, a light increase command, a light decrease command, a fan speed up command, a fan speed down command) in response to received input via an input (light control input 214, fan control input 216, fan reverse input 218, light up input 220, light down input 222, fan speed up input 224, or fan speed down input 226),

[WAC-10PROV]

respectively, and control the RF interface 208 to transmit said generated command in a generated RF signal to a fan device.

Figure 3 is a drawing of an exemplary fan device 300, including a fan 303 and a light 306, in accordance with an exemplary embodiment. Exemplary fan device 300 is, e.g., one of the fan devices (fan device 1 110, ..., fan device N 112) of customer premises 1 102 of system 100 of Figure 1. Fan 303 includes a fan motor 304, a fan blade unit 336 including fan blades and a hub, and fan motor shaft 338 which couples the fan motor 304 to the fan blade unit. Exemplary fan device 300 includes a fan device mounting base 302, fan motor shaft 338 and fan blade unit 336. Fan unit mounting base 302 includes a fan motor 304, a light 306, e.g., an LED light, a fan motor control circuit 308, a light control circuit 310, a WIFI interface 312, an RF interface 314, a processor 316, memory 318, an AC power interface 322 and a DC power supply 324. WIFI interface 312 includes a WIFI transmitter 354 and a WIFI receiver 356, which are coupled to antenna 313, via which the fan device 300 can send and receive WiFi signals. Exemplary received WiFi signals communicate, e.g., a fan device control command, and a proposed normal device control schedule. Exemplary fan device control commands received via WiFi receiver 356 include, e.g., a fan on command, a fan off command, a fan power state change command, a fan speed up command, a fan speed down command, a fan direction change command, a fan speed setting level command, a light on command, a light off command, a light power state change command, a light increase command, a light decrease command, and a light level setting command. In some embodiments, an exemplary received WiFi signal, e.g., conveying a control message may, and sometimes does, include multiple commands, e.g., a light on command, a fan on command, a fan direction command, a light level setting command, and a fan speed setting command. Exemplary transmitted WiFi signals communicate, e.g., fan device state information reporting messages, e.g., communicating light on/off status, light output level status, fan on/off status, fan speed, fan direction. RF interface 314 includes an RF receiver 360, and in some embodiments, and RF transmitter 358, which are coupled to antenna 315, via which the fan device 300 can send and receive RF signals. Exemplary received RF signals include, e.g., signals communicating fan device control commands, e.g., from a wall control unit 202. Exemplary control commands communicated via RF signals include, e.g., a fan power state change command, a fan speed up command, a fan speed down command, a light power state change command, a fan direction change command, a light power state change

[WAC-10PROV]

command, a light increase command, and a light decrease command. Exemplary transmitted RF signals include, e.g., fan device control acknowledgment signals. In various embodiments, the WiFi interface 312 and the RF interface 314 are configured to use different frequency bands, e.g., different non-overlapping frequency bands, and different communications protocols. In some embodiments, the same antenna is used for both the WiFi interface 312 and the RF interface 314.

WiFi interface 312, RF interface 314, fan motor control circuit 308, light control circuit 310, processor 316 and memory 318 are coupled together via a bus 320 over which the various elements may interchange data and information. Fan motor control circuit 308 includes an On/Off control circuit 326, a fan direction control circuit 328, and a fan speed control circuit 330. The fan motor control circuit 308 is coupled to fan motor 308 via cable 350. Fan motor shaft 338 couples the fan motor to the fan blades 336. Light control circuit 310 includes an On/Off control circuit 332 and an Up/Down control circuit 334. The light control circuit 310 is coupled to light 306 via cable 352. Fan on/off control circuit 326 controls whether or not power is applied to fan motor 304, e.g., in response to received fan power state change control commands, fan power on control commands, and fan power off control commands. Fan direction control circuit 328 controls the direction fan motor 304 turns, e.g., in response to received fan direction change commands, and fan direction commands. Fan speed control circuit 330 controls the speed of fan motor 304, e.g., in response to received fan speed up commands, fan speed down commands, and fan speed setting level commands. In various embodiments, the fan motor control circuit 308 is configured to control the fan to operate at a predetermined speed and direction when initially commanded to power on from an off state, unless specified otherwise, e.g., in a schedule or by a command. Light on/off control circuit 332 controls whether or not power is applied to light 306, e.g., in response to a received light power state change control commands, light power on control commands, and light power off control commands. Light up/down control circuit 334 controls the light output level of light 306, e.g., in response to received light increase commands, light decrease commands, and light level setting commands. In some embodiments, the light level is changed by changing the voltage or current supplied to a light or a set of lights. In some embodiments, the light level is changed by changing the number of lights to which power is applied in a set of lights. In various embodiments, the light control circuit 310 is configured to control the light

[WAC-10PROV]

306 to operate at a predetermined output level when initially commanded to power on from an off state, unless specified otherwise, e.g., in a schedule or by a command.

Input AC, e.g., 120VAC, is received from a wall control unit via inputs 340, 342. AC power interface 322 conditions the received AC, e.g., performing filtering, and outputs conditioned AC power on lines 344, 346, which are used as input by other elements within fan device 300, e.g., the fan motor 304 or fan motor control circuit 308, the light 306 or the light control circuit 310, and the DC power supply 324. DC power supply 324 generates and outputs one or more DC voltages, e.g., 3VD, +5VDC, 15VDC, and/or -15VDC from the input AC power received via lines 344, 346. Output DC power is via DC power bus 448 and the DC voltages are referenced with respect to DC ground 349. In some embodiments, the DC power supply includes one of more current supplies in addition to one or more voltage supplies. DC power from DC power supply 324 is supplied to and used by processor 316, memory 318, WiFi interface 312, RF interface 314, fan motor control circuit 308, light control circuit 310, and in some embodiments, light 306 and/or fan motor 304.

Processor 316 is configured to control the RF interface 314 including RF receiver 360 to receive RF control signals, recover the control command or commands being communicated and communicate the recovered control command or commands to the fan motor control circuit 308 and/ or light control circuit 310 or send information to the fan motor control circuit 308 and/or light control circuit 310 to be used to implement the recovered control command or commands. Processor 316 is further configured to control the WiFi interface 312 including WiFi receiver 356 to receive WiFi signals including messages communicating control commands, recover the control command or commands being communicated and communicate the recovered control command or commands to the fan motor control circuit 308 and/ or light control circuit 310 or send information to the fan motor control circuit 308 and/or light control circuit to be used to implement the recovered control command or commands. Processor 316 is further configured to generate device status reporting messages and to control the WiFi interface including transmitter 354 to transmit WiF signals including the device status reporting messages communicating device state information. In various embodiments, processor 316 is configured to generate and send a device status reporting message, e.g., in response to a received and implemented RF control signal or a received and implemented WiFi control message. In some embodiments, the processor 316 is configured to limit time intervals between successive device status reporting messages,

[WAC-10PROV]

e.g., to prevent excessive status reporting messages such as where an individual is pushing an input button on a wall control unit 202 multiple times in very short time interval. In one exemplary embodiment, a device status reporting message is sent to a control server at most once per predetermined time interval, e.g., once per two second time interval or once per two minute time interval. In some embodiments, device status reporting messages to the control server communicates a change from a previously communicated device status reporting message. In various embodiments, a device status reporting message can, and sometimes does, include an aggregate of multiple received and implemented commands. In various embodiments, a generated device status reporting message includes time tag information, e.g., a transmission time tag and/or a time tag or time tags corresponding to an implemented state change or changes implemented at the fan device.

Figure 4, comprising the combination of Figure 4A, Figure 4B, Figure 4C, Figure 4D and Figure 4E, is a drawing 400, comprising Part A 401, Part B 403, Part C 405, Part D 407 and Part E 409, illustrating exemplary components of system 100 of Figure 1, exemplary signaling and exemplary operations in accordance with an exemplary embodiment. Drawing 400 includes customer premises CP 1 102, the Internet 106, and control server 108. CP 1 102 includes wall control unit 1 114, wall control unit N 116, fan device 1 110, fan device N 112, and WiFi router 118. Fan device 1 110 includes fan 1 and light 1. Fan device N 112 includes fan N and light N. Wireless terminal 120 is a mobile device, e.g., a cell phone, a laptop, a tablet, a smartphone, which is sometimes located within CP 1 102 and is sometimes located outside of CP 1 102.

In one exemplary embodiment, fan device 1 110 and wall control unit 1 114 are located in a first room, and fan device N 116 and wall control unit N 116 are located in a second room, which is a different room from the first room. In some embodiments, the fan devices 110, 112, each include a RF interface and a WiFi interface, while the wall control units 114, 116 each include a RF interface but do not include a WiFi interface. In one exemplary embodiment, wall control unit 1 114, is a wall mounted unit, which supplies power to fan device 1 110; and wall control unit N 116, is a wall mounted unit, which supplies power to fan device N 112.

In some embodiments, the RF and WiFi interfaces while both being wireless interfaces are different interfaces and use different frequency bands and different communications protocols.

[WAC-10PROV]

Drawing 400 is an exemplary signaling diagram illustrating exemplary signaling between the various devices and exemplary operations performed by the devices in accordance with an exemplary method.

In step 402 WC 1 114 generates and sends radio frequency (RF) control signal 404, e.g., a wireless RF signal, to fan unit 1 110 commanding fan unit 1 110 to change the power state of its fan. In some embodiments, the RF control signal 404 is sent using an RF signal which is not used for WiFi signals. In step 406 fan unit 1 110 receives signal 404 and recovers the communicated command. Consider that the fan in fan device 1 110 is currently off. In response to the received recovered command in RF signal 404, in step 408 fan unit 1 110 turns on its fan, which is fan 1. In step 410, fan device 1 110 generates and sends a reporting message 412 to WiFi router 1 114 reporting that fan 1 is on.

In one exemplary embodiment, the reporting message 412 includes: an identifier identifying fan device being controlled, which in this example is fan device 1 110, information indicating the time the command was implemented, information indicating the operation performed by the fan device, which in this example is turning on the fan in fan device 1 110, and information identifying the customer premises, which in this example is CP1 102. Other reporting messages described in this signaling flow diagram may also use this exemplary reporting format. The reporting allows the server 108, which is the intended end point recipient of the reporting message information, to create a log of the state of fan device 1 and create a history of the state of the device. Recorded state information corresponding to multiple fan devices at CP1 may be used to facilitate learning of use patterns and thereby allow for automated schedule generation for both normal and away schedules both of which may be, and sometimes are, machine learning based on the information reported to the control server 108 in system 100.

In step 414 WiFi router 118 receives message 412 and recovers the communicated information. In step 416 WiFi router 118 generates reporting message 418, indicating that fan 1 is on, and sends message 418, via the Internet 106, to control server 108. In step 420 control server 108 receives message 418 and recovers the communicated information, originally sourced from fan device 1, which indicates that the fan 1 in fan device 1 is on. In step 421 control server 108 updates the customer premises 1 (CP1) information to record that fan 1 is on and the time.

[WAC-10PROV]

In step 422 WC 1 114 generates and sends RF control signal 424 to fan device 1 110 commanding fan unit 1 110 to change the power state of its light, which is light 1. In step 426 fan unit 1 110 receives RF signal 424 and recovers the information communicated. Consider that light 1 is in an OFF state. In response to the recovered command of signal 424, in step 428 fan device 1 110 turns on light 1. In step 430, fan device 1 110 generates and sends a reporting message 432 to WiFi router 1 118 reporting that light 1 is on. In step 434 WiFi router 118 receives message 432 and recovers the communicated information. In step 436 WiFi router 118 generates reporting message 438, indicating that light 1 is on, and sends message 438, via the Internet 106, to control server 108. In step 440 control server 108 receives message 438 and recovers the communicated information, originally sourced from fan device 1, which indicates that light 1 is on. In step 441 control server 108 updates the customer premises 1 (CP1) information to record that light 1 is on and the time.

In step 442 WC 1 114 generates and sends RF signal 444 to fan device 1 110 commanding fan device 1 110 to perform a fan power state change. In step 446 fan device 1 110 receives signal 444 and recovers the information communicated, and in response in step 448 fan device 1 110 turns off fan 1. In step 450, fan device 1 110 generates and sends a reporting message 452 to WiFi router 1 118 reporting that fan 1 is off. In step 454 WiFi router 118 receives message 452 and recovers the communicated information. In step 456 WiFi router 118 generates reporting message 458, indicating that fan 1 is off, and sends message 458, via the Internet 106, to control server 108. In step 460 control server 108 receives message 458 and recovers the communicated information, originally sourced from fan device 1 110, which indicates that fan 1 is off. In step 462 control server 108 updates the customer premises 1 (CP1) information to record that fan 1 is off and the time.

In step 464 WC 1 114 generates and sends RF signal 466 to fan device 1 110 commanding fan device 1 110 to perform a power state change of its light, which is light 1. In step 468 fan device 1 110 receives signal 466 and recovers the information communicated, and in response in step 470 fan device 1 110 turns off light 1. In step 472, fan device 1 110 generates and sends a reporting message 474 to WiFi router 1 118 reporting that light 1 is off.

In step 476 WiFi router 118 receives message 474 and recovers the communicated information. In step 478 WiFi router 118 generates reporting message 480, indicating that light 1 is off, and sends message 480, via the Internet 106, to control

[WAC-10PROV]

server 108. In step 482 control server 108 receives message 480 and recovers the communicated information, originally sourced from fan device 1 which indicates that light 1 is off. In step 484 control server 108 updates the customer premises 1 (CP1) information to record that light 1 is off and the time.

In step 486 WT 1 120, which is a device supporting WiFi communications, generates and sends WiFi control signal 487 to WiFi router 118 commanding fan device 1 110 to turn on its light, which is light 1. In step 488 WiFi router 118 receives signal 487 and recovers the information communicated. In step 489 WiFi router 118 generates and sends WiFi signal 490 to fan device 1 110 communicating the command to turn on its light. In step 491 fan device 1 110 receives signal 490 and recovers the information communicated, and in response in step 492 fan device 1 110 turns on light 1. Thus the control command of signal 487 is communicated from WT 1 120, which is a WiFi device currently located within CP1 102, to fan device 110, located at CP1 102, via WiFi router 118, also located at CP1 102, without the command traversing a network outside the customer premises CP1 102. Thus in some embodiments, at least some times, the communication of a command, e.g., in a WiFi signal, to a fan device does not depend or involve communication over a network outside the customer premises, and the fan device can be controlled from within the CP, e.g., house, via WiFi even if an Internet or server connection to the server is not present or available.

In step 494, fan device 1 110 generates and sends a reporting message 496 to WiFi router 1 118 reporting that light 1 is on. In step 498 WiFi router 118 receives message 496 and recovers the communicated information. In step 500 WiFi router 118 generates reporting message 502, indicating that light 1 is on, and sends message 502, via the Internet 106, to control server 108. In step 504 control server 108 receives message 502 and recovers the communicated information, originally sourced from fan device 1 110, which indicates that light 1 is on. In step 506 control server 108 updates the customer premises 1 (CP1) information to record that light 1 is on and the time.

In step 508 WT 1 120 generates and sends WiFi signal 509 to WiFi router 118 commanding fan device 1 110 to turn on its fan. In step 510 WiFi router 118 receives signal 509 and recovers the communicated information. In step 511, WiFi router 118 generates and sends WiFi signal 512 to fan device 1 110 communicating the fan 1 on command. In step 513 fan unit 1 110 receives signal 512 and recovers the information communicated, and in response in step 514 fan device 1 110 turns on fan 1. In step 516, fan device 1 110 generates and sends a reporting message 518 to WiFi router 1 114

[WAC-10PROV]

reporting that fan 1 is on. In step 520 WiFi router 118 receives message 518 and recovers the communicated information. In step 522 WiFi router 118 generates reporting message 524, indicating that fan 1 is on, and sends message 524, via the Internet 106, to control server 108. In step 526 control server 108 receives message 524 and recovers the communicated information, originally sourced from fan device 1 110, which indicates that fan 1 is on. In step 528 control server 108 updates the customer premises 1 (CP1) information to record that fan 1 is on and the time. Although the control messages and reporting message, corresponding to fan device 1 110, have been shown for on/off examples, in some embodiments, the control messages which are sent may control other operations, e.g., increase light intensity of light 1, decrease light intensity of light 1, increase fan speed of fan 1, decrease fan speed of fan 1, change fan direction of fan 1, and the reporting messages may report device status or device status change in response to those commands.

Exemplary on/off device control signaling, state changes, reporting, and recording of device status in control server 108, has been shown over time, for a few examples, for fan device 1 110 including fan 1 and light 1. It should be appreciated that similar signaling and operations are performed with regard to the other fan devices, e.g., fan device N 112, located at customer premises 1 102, and control server 108 also records and builds up a historical record corresponding to status including state information of the other fan devices located at CP1 102, e.g., fan device N 112, over time.

In step 530, the control server 108 generates a proposed normal device control schedule for customer premises 1 102, e.g., based on historical recorded information. The generated proposed normal control schedule for CP1 is a fan and lighting control schedule for controlling the fan devices at CP1 including, e.g., on/off fan control schedule, on/off light control schedule, fan speed schedule, fan direction schedule, and light intensity schedule. In some embodiments, the proposed normal device control schedule is generated based on stored information including the state of one or more fan devices (fan device 1 110, ..., fan device N 112) at CP1 102 over a period of time, e.g., two or more weeks, e.g., based on collected stored reporting messages from the fan devices (110, ..., 112) over the time period. In step 532, the control server generates a message 533 communicating the generated proposed normal device control schedule and sends the generated message to WiFi router 118, via Internet 106.

[WAC-10PROV]

In step 534 the control server 108 generates an away device control schedule for CP1 102, e.g., random based or based on historical use with randomization. In various embodiments, server 108 generates the away schedule to be used to control one or more fan devices (110, ..., 112) at CP1 102 when the customer indicates that they are away from the customer premises 102. In some embodiments, operating the control server 108 to generate an away schedule includes generating said away schedule as a function of a random function used to at least partially randomize the on or off times of one or more devices. In some embodiments, operating the server 108 to generate the away schedule includes using information about past device on and off status in combination with said random function to control the on and off times as a function of at least one device, said on and off times deviating from historical on and off times by an amount of time which does not exceed a set maximum amount of time, e.g., 30 minutes, and which is determined by said random function. For example, once the historical on/off times of a light on the fan device are known the random function is used to change the on/off time in a random function but keep it within 30 minutes or so of the normal on/off time so that the on/off pattern is not identical from day to day but within an expected normal range that might occur to a human getting home or moving around the home which would not be identical each day but might not deviate greatly, e.g., by more than an hour, from day to day. In step 535 control server 108 stores the generated away device control schedule for CP1 102.

In step 536, WiFi router 118 receives message 533 and recovers the information in message 533 including the proposed normal device control schedule. In step 538, WiFi router 118, generates a message 540 including the proposed normal device control schedule and sends the message 540 to WT 1 120. Thus the generated proposed normal device control schedule has been communicated from control server 108, via the Internet 106 and WiFi router 118, located at CP1, to device WT 1 120 corresponding to the first customer premises. WT 1 120 is, e.g., the cell phone, e.g., a smartphone, of a user who is located at the first customer premises 102.

In step 542, WT 1 120 receives message 540 recovers the proposed normal control schedule and presents the proposed normal device control schedule to the user of WT 1 120. In some embodiments, the user of device 1 120 may decide to revise the proposed normal device control schedule. In step 544, WT 1 120 receives user input revisions and generates a revised normal device control schedule. In step 546, WT 1 120 generates a message 548 communicating user authorization for the proposed normal

[WAC-10PROV]

device control schedule or a revised normal device control schedule and sends message 548 to WiFi router 118. In step 550, WiFi router 118 receives message 550 and recovers the communicated information. In step 552 WiFi router 118 generates message 554 communicating the user authorization for the proposed normal device control schedule or the user revised normal device control schedule and sends message 554 via Internet 106 to control server 108.

In step 556, the control server receives message 554 and recovers the communicated user authorization for the proposed normal device control schedule or the communicated revised normal device control schedule. If user authorization is received for the suggested normal control schedule, the control server 108 designates the generated suggested control schedule as a normal approved device control schedule. If a revised normal device control schedule is received, the control server 108 designates the received revised schedule as the normal approved device control schedule. In step 557 the control server stores the approved normal control schedule.

In step 558, the control server 108 starts operating in accordance with the approved normal device control schedule, e.g., to automatically control operations at fan device 1 110 and fan device N 112 of CP1 102. In various embodiments, operating the control server 108 in accordance with the stored approved normal control schedule includes operating the server 108 to control one or more of the fan devices (110, ..., 112) at CP1 102 based on the normal approved device control schedule including transmitting a control signal from control server 108 to fan device 1 110 via the Internet 106 and WiFi router 118 to control fan device 1 to take an action at a time indicated in the normal approved device control schedule, e.g., to control the fan of fan device 1 110 to turn on at a time indicated by the normal approved device control schedule.

In some embodiments, the control server 108 will switch to automatic operations in accordance with the approved normal device control schedule based on the reception of message 554, e.g., once the proposed schedule is approved the control server starts using the approved normal device control schedule.

In some embodiments, the control server 108 will not switch to automatic operations in accordance with the approved normal device control schedule until receiving an additional message, e.g., a normal device control schedule activation message from a user, e.g., the user which approved the proposed normal schedule or sent the revised normal schedule. In some embodiments, the user may send server 108, e.g., from device WT 1 120, a message communicating one or more time intervals in

[WAC-10PROV]

which the control server 108 is to operate in accordance with the approved normal device control schedule and/or one or more time intervals in which the control server 108 is to operate in accordance with the away schedule and/or one or more time intervals in which the control server 108 is not to use either the normal schedule or the away schedule but is to allow just wall control units and user devices such as WT 1 to control the fan devices at CP1.

In step 559, the control server 108, operating in accordance with the normal approved control schedule, generates and sends control signal 560 including one or more control commands, via Internet 106, to WiFi router 118 to automatically control fan 1 and/or light 1 of fan device 1 110 based on the normal authorized device control schedule. In step 561 the control server 108 updates fan device 1 state information based on the control commands sent in message 560. In step 562, the WiFi router 118 receives control signal 560 and recovers the communicated information, e.g., control command or commands directed to fan device 1 110. In step 564, the control server generates and sends control signal 566 to automatically control fan 1 and/or light 1 of fan device 1 110. In step 568, fan device 1 110 receives control signal 566 and recovers the control information communicated. In step 569 fan device 1 110 performs an action or actions in response to one or more recovered control commands in the received WiFi signal 566, e.g., turns off fan 1, turns off light 1, reverses the direction of fan 1, increases fan 1 speed, decreases fan 1 speed, sets fan 1 speed to a particular value, increases light 1 intensity, decreases light 1 intensity, sets light 1 intensity to a particular level, etc.

In step 570, the control server 108, operating in accordance with the normal approved control schedule, generates and sends control signal 572 including one or more control commands, via Internet 106, to WiFi router 118 to automatically control fan N and/or light N of fan device N 112 based on the normal approved device control schedule. In step 571 the control server 108 updates fan device N state information based on the control commands sent in message 572. In step 574, the WiFi router 118 receives control signal 572 and recovers the communicated information. In step 576, the WiFi router 118 generates and sends control signals 578 to automatically control fan N and/or light N to fan unit N 112. In step 580, fan unit N 112 receives control signals 578, recovers the control information, e.g., control command or commands communicated in signal 578. In step 581 fan device N 112 performs an action or actions in response to the one or more received and recovered control commands in

[WAC-10PROV]

WiFi control signal 578, e.g., turns on fan N, turns off fan N, turns on light N, turns off light N, reverses the direction of fan N, increases fan N speed, decreases fan N speed, increase light N intensity, decreases light N intensity, sets the speed of fan N to a particular level, sets the light output level of light N to a particular level, etc.

Although only one arrow is shown for control signal 560, and corresponding forwarded control signal 566, to illustrate one example, it should be appreciated that many different control signals, e.g., individual control signals may be, and in some embodiments, are sent at different times to achieve different desired states of operation of fan unit 1, in accordance with the normal authorized device control schedule. Although only one arrow is shown for control signals 572, and corresponding forwarded control signals 578, it should be appreciated that many different control signals, e.g., individual control signals may be, and in some embodiments, are sent at different times to achieve different desired states of operation of fan unit N, in accordance with the normal authorized schedule.

In step 582, based on received user input, WT 1 120 generates a signal 584 indicating that the away device control schedule should be used to control the fan units at customer premises 1, and WT 1 120 sends the signal 584 to WiFi router 118. In some embodiments, signal 584 conveys an away status indicator from the user of user device WT 1 120. In step 586, WiFi router 118 receives signal 584, recovers the communicated information. In step 588 WiFi router 118 generates and sends signal 590 including information indicating that the control server should use the away schedule for customer premises 1, via Internet 106, to control server 108. In step 592 control server 108 receives signal 590 and recovers the communicated information, e.g., the away status indicator, indicating that the away schedule should now be used for CP1. In step 594, in response to received message 590, the control server 108 switches to automatic control of the fan units at customer premises 1 based on the away device control schedule. Thus the control server 108 switches from using the stored approved normal schedule to using the stored away schedule to control the one of more fan devices (110, ..., 112) at the first customer premises.

In step 596, the control server 108, operating in accordance with the away device control schedule, generates and sends control signal 598 including one or more control commands, via Internet 106, to WiFi router 118 to automatically control fan 1 and/or light 1 of fan device 1 110 based on the away device control schedule. In step 599 the control server 108 updates fan device 1 state information based on the control

[WAC-10PROV]

commands sent in message 598. In step 600, the WiFi router 118 receives control signal 598 and recovers the communicated information, e.g., control command or commands directed to fan device 1 110. In step 602, the control server 108 generates and sends control signal 604 to automatically control fan 1 and/or light 1 of fan device 1 110. In step 606, fan device 1 110 receives control signal 604, recovers the control information communicated. In step 607 fan device 1 110 performs an action or actions in response to one or more recovered control commands in the received WiFi control signal 606, e.g., turns off fan 1, turns off light 1, reverses the direction of fan 1, increases fan 1 speed, decreases fan 1 speed, sets fan 1 speed to a particular value, increases light 1 intensity, decreases light 1 intensity, sets light 1 intensity to a particular level, etc, said recovered control commands having been originally sent from control server 108.

In step 608, the control server 108, operating in accordance with the away device control schedule, generates and sends control signal 610 including one or more control commands, via Internet 106, to WiFi router 118 to automatically control fan N and/or light N of fan device N 112 based on the away device control schedule. In step 611 the control server 108 updates fan device N state information based on the control commands sent in message 610. In step 612, the WiFi router 118 receives control signal 610 and recovers the communicated information. In step 614, the control server generates and sends control signals 616 to automatically control fan N and/or light N to fan unit N 112. In step 618, fan unit N 112 receives control signals 616, recovers the control information, e.g., control command or commands communicated in signal 616. In step 619 fan device N 112 performs an action or actions in response to the one or more received and recovered control commands in WiFi control signal 578, e.g., turns on fan N, turns off fan N, turns on light N, turns off light N, reverses the direction of fan N, increases fan N speed, decreases fan N speed, increases light N intensity, decreases light N intensity, sets the speed of fan N to a particular level, sets the light output level of light N to a particular level, etc, said recovered control commands having been originally sent from control server 108.

Although only one arrow is shown for control signal 598, and corresponding forwarded control signal 604, to illustrate one example, it should be appreciated that many different control signals, e.g., individual control signals may be, and in some embodiments are, sent at different times to achieve different desired states of operation of fan unit 1, in accordance with the away device control schedule. Although only one arrow is shown for control signal 610, and corresponding forwarded control signal 616,

[WAC-10PROV]

it should be appreciated that many different control signals, e.g., individual control signals may be, and in some embodiments are, sent at different times to achieve different desired states of operation of fan unit N, in accordance with the away schedule.

In step 620, based on received user input, WT 1 120 generates a signal 622 indicating that the away device control schedule, used to control the fan units at customer premises 1, and WT 1 120, should be disabled and that the approved normal device control schedule should be used again, sends the generated signal 622 to WiFi router 114. In step 624, WiFi router 118 receives signal 622, recovers the communicated information. In step 626 WiFi router 118 generates and sends signal 628 including information indicating that the control server should disable use of the away schedule for customer premises 1 and resume using the approved normal device control schedule, via Internet 106, to control server 108. In step 630 control server 108 receives signal 628 and recovers the communicated information indicating that the away schedule should no longer be used for CP1 102 and that the normal schedule should now be used. In step 632, in response to received message 628, the control server 108 switches to automatic control of the fan devices 110, 112 at customer premises 1 102 based on the normal authorized approved device control schedule.

In step 634, the control server 108, operating in accordance with the normal approved control schedule, generates and sends control signal 635 including one or more control commands, via Internet 106, to WiFi router 118 to automatically control fan 1 and/or light 1 of fan device 1 110 based on the normal authorized device control schedule. In step 636 the control server 108 updates fan device 1 state information based on the control commands sent in message 635. In step 638, the WiFi router 118 receives control signal 635 and recovers the communicated information, e.g., control command or commands directed to fan device 1 110. In step 640, the WiFi router 118 generates and sends control signal 642 to automatically control fan 1 and/or light 1 of fan device 1 110. In step 644, fan device 1 110 receives control signal 642, recovers the control information communicated. In step 645 fan device 1 110 performs an action or actions in response to one or more recovered control commands in the received WiFi signal 642, e.g., turns off fan 1, turns off light 1, reverses the direction of fan 1, increases fan 1 speed, decreases fan 1 speed, sets fan 1 speed to a particular value, increases light 1 intensity, decreases light 1 intensity, sets light 1 intensity to a particular level, etc.

[WAC-10PROV]

In step 646, the control server 108, operating in accordance with the normal approved control schedule, generates and sends control signal 647 including one or more control commands, via Internet 106, to WiFi router 118 to automatically control fan N and/or light N of fan device N 112 based on the normal approved device control schedule. In step 648 the control server 108 updates fan device N state information based on the control commands sent in message 647. In step 650, the WiFi router 118 receives control signal 647 and recovers the communicated information. In step 652, the control server generates and sends control signals 656 to automatically control fan N and/or light N to fan unit N 112. In step 658, fan unit N 112 receives control signals 656, recovers the control information, e.g., control command or commands communicated in signal 656. In step 659 fan device N 112 performs an action or actions in response to the one or more received and recovered control commands in WiFi control signal 656, e.g., turns on fan N, turns off fan N, turns on light N, turns off light N, reverses the direction of fan N, increases fan N speed, decreases fan N speed, increases light N intensity, decreases light N intensity, sets the speed of fan N to a particular level, sets the light output level of light N to a particular level, etc.

In Figure 4E, it may be observed that mobile WT 1 120 has moved to a location outside CP1 102. In various embodiments, an authorized user can, and sometimes does, control fan devices from outside the customer premises at which the fan devices are located. Consider that the operator of WT 1 120 is authorized to control fan devices 110, 112 from locations outside customer premises 1 102. WT 1 120 may, and sometimes does, request and receive fan device status information for CP1 102, while outside CP1. In step 660 WT 1 120 generates and sends a device control signal 662 for controlling fan device 1 110 to control server 1 108, e.g., via the Internet 106. In step 664, control server 108 receives signal 662 and recovers the communicated information, e.g., a command to turn on light 1 of fan device 1 110 and/or another command or commands. In step 666, control server 108 determines, e.g., based on received authorization information, that it will serve as a relay to relay the received device control signal command to fan unit 1 110. In step 668, the control server 108 generates and sends device control signal 670, conveying the control command or commands received in signal 662, to WiFi router 118, with the destination of the information being fan device 1 110. Some embodiments include step 671, in which the control server 108 updates fan device 1 state information based on the command or commands in transmitted signal 670, in response to transmitting signal 670. Thus in this example,

[WAC-10PROV]

state information is updated without receiving a report of the command being implemented at fan device 1 110.

In step 672, WiFi router 118 receives device control signal 670. In step 674 WiFi router 118 generates and sends device control signal 676, which includes the received command or commands being relayed, to fan device 1 110, thus communicating the control command or command in signal 662, to fan device 1 110. In step 678 fan device 1 110 receives signal 676, recovers the communicated command or commands. In step 679 fan device 1 110 implements the received recovered command or commands, e.g., turns on light 1 of fan device 1 110. In some embodiments, fan device 1 110 in step 680 generates and sends acknowledgment signal 681 to server 108, which is received in step 682. Some embodiments include step 683, in which the control server 108 updates fan device 1 state information based on the commands in transmitted signal 670 and the reception of acknowledgment signal 681, in response to receiving the acknowledgment signal 681 in step 682. In step 684, server 108 generates and sends acknowledgment signal 685, which is a forwarded version of acknowledgment signal 681, to WT 1 120. In step 686 WT 1 120 receives acknowledgment signal 685 and has confirmation that the command of signal 662 has been received and/or acted upon.

Figure 4E illustrates control of fan device 1 110 via a remotely located device, WT 1 120, which may be a cellphone, e.g., a smartphone, which is currently located outside the customer premises 1 102, which sends a control signal through the control server 108 for delivery to fan device 1 110. For example, WT 1 120 is a smartphone that connects to the Internet 106 via a cellular signal and sends the command over the cellular channel to the control server 108 via the Internet 106. In the case where the control signal passes through the control server 108, the fan device 110 being controlled may not send back a message reporting implementation of the communicated command and the server 108 can update the state information based on the knowledge that the fan device 1 110 was instructed to perform the operation and/or optionally, an acknowledgment from the fan device 1 110 indicating that the control message was received and/or acted up.

Figure 5 is a drawing of an exemplary control server 700 in accordance with an exemplary embodiment. Control server 700 is, e.g., control server 108 of Figure 1 and Figure 4. Control server 700 includes an interface 702, a processor 704, e.g., a CPU, memory 706, an assembly of components 708, e.g., assembly of hardware components, e.g., assembly of circuits, coupled together via a bus 710 over which the various

[WAC-10PROV]

elements may interchange data and information. Interface 702 includes a receiver 714 and a transmitter 712. Interface 702 couples the control server to the internet and/or other networks and/or devices.

Memory 706 includes an assembly of components 716, e.g., an assembly of software components, e.g., software modules. Data/information 718 includes information corresponding to a plurality of customer premises (customer premises 1 information 720, ..., customer premises M information 722). Customer premises 1 information 720 includes received fan device 1 reporting messages 724, ..., received fan device N reporting messages 726, a generated proposed normal device control schedule for CP1 728, and a generated away device control schedule for CP1 730. In some embodiments, CP1 data/information 720 includes a revised normal device control schedule 732, e.g., based on user revisions to the proposed schedule. CP1 information 720 further includes fan device 1 state information 736, fan device N state information 738, a current control mode of operation with regard to controlling the fan devices at CP1 740, e.g., use the approved normal device control schedule, use the away device control schedule, or do not perform automatic control at the current time, a received message 742 indicating user selection of mode, or a user command to switch modes, or user communicated indicator indicating whether or not the user is away which is utilized to determine mode selection. CP 1 information further includes a received control message 744, e.g., from a WT of an authorized user, to be forwarded to a fan device indicated in the received message to control the fan device, and a generated control message 746 in accordance with (IAW) the normal or away schedule, said generated message to be sent to a fan device at an appropriate time in accordance with the normal or away schedule.

Figure 6 is a drawing of an exemplary wireless terminal (WT) 800, e.g., a smartphone, in accordance with an exemplary embodiment. Exemplary WT 800 is, e.g., WT 1 120 of Figure 1 and Figure 4.

Exemplary WT 800 includes a WiFi interface 802, a cellular wireless interface 804, a wired interface 806, a processor 808, memory 810, an I/O interface 812 coupled to display 814, e.g., a touchscreen display, keypad 816, and an assembly of components 818, e.g., an assembly of hardware components 818, e.g., an assembly of circuits. The various elements 802, 804, 806, 808, 810, 812, 818 are coupled together via a bus 820 over which the various elements may interchange data and information.

[WAC-10PROV]

WiFi interface 802 includes a WiFi transmitter 832 and a WiFi receiver 834 coupled to antennas (833, 835), respectively, via which the WT 800 may transmit and receive WiFi signals. Cellular wireless interface 804 includes a wireless transmitter 836 and a wireless receiver 838 coupled to antennas (837, 839), respectively, via which the WT 800 may transmit and receive wireless cellular signals. In some embodiments, the same antenna is used for one or more transmitters and/or receivers. Wired interface 806 includes network transmitter 840 and a network receiver 842 via which the WT 800 may transmit and receive signals, e.g., via a wired connection to the Internet and/or to other nodes.

Memory 810 includes routines 822 and data/information 824. Routines 822 includes a wireless terminal control routine 826, and a fan device control application 828. Fan device control application 828 includes an assembly of components 830, e.g., an assembly of software components, for performing different functions related to fan device control, fan device status monitoring, setup and initialization, user authorization, communications with a fan device, communications with a control server, user interfaces, etc. Fan device control application 828 controls WT 800 to present one or more custom interfaces to the user of WT 800, e.g., via smartphone display 814, which allows the user to control fan devices. In some embodiments, one exemplary control display simulates the input of control panel 204 of wall control unit 202, e.g., accepting inputs for: an on/off fan power transition command, a fan reverse command, a fan speed increase command, a fan speed decrease command, an on/off light power transition command, a light output increase command, and a light output decrease command. In some embodiments, one exemplary control display is configured to accept inputs for the following commands: a fan on command, a fan off command, a light on command, a light off command, a fan reverse command, a fan direction selection input command, a fan speed level setting command, a light intensity level setting command, a fan speed increase command, a fan speed decrease command, a light intensity increase command, a light intensity decrease command, a light intensity change rate command, e.g., allowing a smooth gradual light intensity specified change over a specified time period, and a fan speed change rate command, e.g., allowing a smooth gradual fan speed level change over a specified time period. In various embodiments, the fan device control application 828 receives user command inputs, generates control messages and sends the control messages to either the fan device, e.g., via WiFi signaling, or to a control server for forwarding to the fan device to be controlled, e.g., depending on the location

[WAC-10PROV]

of the WT 800. Fan device control app 828 is further configured to operate WT 800 to: receive a proposed normal device control schedule from a control server, present the received proposed schedule to a user, receive user approval of the schedule, receive user revisions, generate a revised schedule incorporating the revisions, and generate and send an approval message or a revised schedule to the control server. Fan device control app 828 is further configured to operate the WT 800 to: receive user input indicating that a user desires that one or more fan devices be controlled in accordance with the normal approved device control schedule, the away schedule, or manually via WT 800 input and/or a wall control panel, e.g., for a specified period of time, and communicate the user input to the control server, e.g., to control switching between normal schedule automatic device control, away schedule automatic device control, and no automatic control. In some embodiments, the application 828 generates and sends indicators, e.g., an away indicator or a home indicator, e.g., based on user input, to control switching between normal and away device control schedules. Fan device control app 828 is further configured to control WT 800 to send a request for fan device status, e.g. fan device state information such as on/off status of a fan, on/off status of a light, light intensity output level, fan direction, and fan speed, to a fan device and/or to the control server, to receive fan device status information, and to present the received fan device status information to a user of WT 800, e.g., on display 814. In some embodiments, current fan device status information is presented concurrently with an input control interface on the display, e.g., on the smartphone screen display.

Figure 7, comprising the combination of Figure 7A and Figure 7B, is a drawing of an assembly of components 900, comprising Part A 901 and Part B 903, which may be included in an exemplary control server, e.g., control server 108 of Figure 1 and Figure 4 or control server 700 of Figure 5 in accordance with an exemplary embodiment.

Assembly of components 900 may be included in an exemplary server, e.g., control server 700. The components in the assembly of components 900 can, and in some embodiments are, implemented fully in hardware within a processor, e.g., processor 704, e.g., as individual circuits. The components in the assembly of components 900 can, and in some embodiments are, implemented fully in hardware within the assembly of hardware components 708, e.g., as individual circuits corresponding to the different components. In other embodiments some of the components are implemented, e.g., as circuits, within processor 704 with other

[WAC-10PROV]

components being implemented, e.g., as circuits within assembly of components 708, external to and coupled to the processor 704. As should be appreciated the level of integration of components on the processor and/or with some components being external to the processor may be one of design choice. Alternatively, rather than being implemented as circuits, all or some of the components may be implemented in software and stored in the memory 706 of the server 700, with the components controlling operation of server 700 to implement the functions corresponding to the components when the components are executed by a processor e.g., processor 704. In some such embodiments, the assembly of components 900 is included in the memory 706 as assembly of software components 716. In still other embodiments, various components in assembly of components 900 are implemented as a combination of hardware and software, e.g., with another circuit external to the processor providing input to the processor which then under software control operates to perform a portion of a component's function.

When implemented in software the components include code, which when executed by a processor, e.g., processor 704, configure the processor to implement the function corresponding to the component. In embodiments where the assembly of components 900 is stored in the memory 706, the memory 706 is a computer program product comprising a computer readable medium comprising code, e.g., individual code for each component, for causing at least one computer, e.g., processor 704, to implement the functions to which the components correspond.

Completely hardware based or completely software based components may be used. However, it should be appreciated that any combination of software and hardware, e.g., circuit implemented components may be used to implement the functions. As should be appreciated, the components illustrated in Figure 9 control and/or configure the server 700 or elements therein such as the processor 704, to perform the functions of various steps in an exemplary method illustrated and/or described with respect to the signaling diagram 400 of Figure 4 and/or described with respect to any of the Figures or text including the lists of exemplary embodiments. Thus the assembly of components 900 includes various components that perform functions of corresponding one or more described and/or illustrated steps of an exemplary method, e.g., one or more steps of the method of Figure 4.

Assembly of components 900 includes a component 902 configured to receive reporting messages sent from fan devices, e.g., communicating fan device identification

[WAC-10PROV]

information, customer premises identification information, commands received at the fan device, operations performed at the fan device in response to received commands, fan device status information, e.g., fan device state information, e.g., fan on or fan off, fan speed, fan direction, light on or off, light intensity level, etc., and time information, e.g., time a command was received at the fan device, time an operation was performed in response to a received command, time information corresponding to state information included in the reporting message, and/or transmission time corresponding to reporting message. In some embodiments, a reporting message may, and sometimes does include aggregated information corresponding to multiple commands. Assembly of components further includes a component 904 configured to store information communicated in received reporting messages from the fan devices. In some embodiments, as part of receiving a reporting message the message reception time is also recorded and stored.

Assembly of components 900 further includes a component 906 configured to generate a proposed normal device control schedule from stored information indicating the state of one or more devices at a customer premises over a period of time, e.g., over two or more weeks, a component 908 configured to send a generated proposed normal device control schedule for a customer premises to device corresponding to the customer premises, and a component 912 configured to generate an away schedule to be used to control one or more devices at a customer premises when the customer indicates that they are away from the customer premises. In some embodiments, component 912 includes a component 914 configured to generate said away schedule as a function of a random function used to at least partially randomize the on or off times of one or more devices. In some embodiments, component 914 includes a component 916 configured to use the information about past device on and off status in combination with said random function to control the on and off times for at least one device, said on and off times deviating from historical on and off times by an amount of time which does not exceed a maximum amount of time, e.g., 30 minutes, and which is determined by the random function. Assembly of components 900 further includes a component 918 configured to store a generated away device control schedule corresponding to a customer premises, a component 920 configured to receive a message indicating approval of a proposed normal device control schedule or a revised normal device control schedule, and a component 922 configured to store an approved normal device control schedule for a customer premises, said approved schedule being either the

[WAC-10PROV]

proposed normal device control schedule or the received revised normal device control schedule.

Assembly of components 900 further includes a component 924 configured to control one or more devices at a customer premises based on the stored approved normal device control schedule corresponding to the customer premises. Component 924 includes a component 926 configured to identify and send a command to a fan device at the customer premises via the internet and a WiFi router to control the fan device based on the normal approved device control schedule. Assembly of components 900 further includes a component 928 configured to control one or more devices at a customer premises based on the stored away device control schedule corresponding to the customer premises. Component 928 includes a component 930 configured to identify and send a command to a fan device at the customer premises via the internet and a WiFi router to control the fan device based on the away device control schedule.

Assembly of components 900 further includes a component 932 configured to update information about the state of a fan device at a customer premises based on a command communicated to the fan device in accordance with an approved normal device control schedule or an away device control schedule, a component 934 configured to update information about the state of a fan device at a customer premises based on a command, e.g., a received command from a user device of an authorized user who is currently located outside the customer premises, said command being forwarded to the fan device by the control server acting as a relay device. Assembly of components 900 further includes a component 936 configured to receive a signal from a user indicating an away status corresponding to a customer premises and a component 938 configured to switch from using a stored normal device control schedule to using a stored away device control schedule based on a received away status indicator.

Figure 8 is a drawing of an exemplary system 100' including controllable fan devices (110', ..., 112'), wall control units (114', ..., 116'), a wireless terminal 120', a WiFi router 118' and a control server 108' in accordance with another exemplary embodiment. System 100' of Figure 8 is similar to system 100 of Figure 1 and similar components and similar signaling have been indicated using an apostrophe, e.g., fan device 1 110' of Figure 8 is similar to fan device 1 110 of Figure 1. There are several differences between the system 100 of Figure 1 and system 100' of system 8.

[WAC-10PROV]

Wall control unit 1 114' of system 100' of Figure 8 controls multiple fan devices (fan device 1 110' and fan device N 112'), provided power is available to those fan devices. This may be observed by RF control signaling 172' going from RF interface 1 124' to fan device 1 110' and RF control signaling 172" going from RF interface 1 124' to fan device N 112'. Wall control unit N 116' can only control fan device N 112', as shown by RF signal 174' going from RF interface N 134' to fan device N. In comparison, in system 100 of Figure 1, wall control unit 1 114 controls fan device 1 110, and wall control unit N 116 controls fan device N 112.

In system 100 of Figure 1, input power to each wall control unit (114, 116) is sourced from the same source (lines 152, 154). Safety switch 132 can be used to cut off power to fan device 1 110. Safety switch 142 can be used to cutoff power to fan device N 112.

In contrast, in system 100' of Figure 8, input AC power to wall control unit N 116' is sourced from the AC output of wall control unit 1 (lines 164', 166'). Thus in the system 100' of Figure 8, the safety switch 132' of wall control unit 1 114' can be used to cut power to fan device 1 110' and fan device N 112', and then turn input power on and reinitialize the system. This approach is useful to allow wall control unit 1 114' to reinitialize both fan devices and synchronize their operation so that control commands sent via RF signals from RF interface 124' of wall control unit 1 114' will affect both fan device 1 110' and fan device N 112' in the same manner.

In addition, in system 100' of Figure 8, safety switch (SS) 142' can be used to cut off power to just fan device N 112'.

In one exemplary embodiment N=6, and wall control unit 1 114' can, and sometimes does, control 6 fan devices (fan device 1 110', fan device 2, fan device 3, fan device 4, fan device 5, fan device 6 112') to turn on their fans, at the same time, via a command, e.g., a command communicated in an RF control signal sent from wall control unit 1 114'. In some such embodiments, all 6 fans are being powered from the same AC line, e.g., the same 20A AC input power line. In some such embodiments, the 6 fans do not include an optical encoder, magnetic encoder, e.g., resolver or synchro, or Hall effect sensor. In various embodiments, (fan device 1 110', fan device 2, fan device 3, fan device 4, fan device 5, fan device 6 112'), which can be, and sometimes are, turned on concurrently while on the same input power line, each include an exemplary AC power interface including: a varistor, a common mode choke, an X capacitor, and two Y capacitors. In some embodiments, the AC power interface of each fan device

[WAC-10PROV]

includes a multi-layer board, e.g., a 4 layer circuit board, in which one copper layer is connected to earth ground. In some embodiments, each of the 6 fan devices includes a 10 ft ceiling fan.

In another embodiment, N=10, and wall control unit 1 114' can, and sometimes does, control 10 fan devices (fan device 1 110', ..., fan device 10 112') to turn on their fans, at the same time, via a command, e.g., a command communicated in an RF control signal sent from wall control unit 1 114'. In some such embodiments, all 10 fans are being powered from the same AC line, e.g., the same 20A AC input power line. In some embodiments, each of the 10 fan devices includes a 10 ft ceiling fan.

Figure 9 is a drawing 1000 of an exemplary AC power interface 322' coupled to an exemplary DC power supply 324' which may be used in the fan device 300 of Figure 3 in accordance with an exemplary embodiment. In some embodiments, AC power interface 322' is AC power interface 322 of fan device 300 of Figure 3, and DC power supply 324' is DC power supply 324 of fan device 300 of Figure 3.

AC power, e.g., 90-264 VAC 47-63 Hz input via 16AWG wires, is input via L terminal 342, and N (Neutral) terminal 340, and G terminal 343 is connected to earth ground. The line connected to L terminal is referred to a Line IN and Line IN is fused, with fuse F1 1002, e.g., a 3.15 A fuse. After the fuse F1 1002, there are several components, varistor RV1 1004, common mode choke L1 1006, and capacitors C5 1008, C7 1010 and C11 1012, which contribute to the AC filtering, and produce a filtered AC.

Varistor RV1 1004 is, e.g., a 510V 2.5KA DISC 10MM varistor, suppresses voltage spikes. Common mode choke L1 1006, e.g., a 15MH 1A 2LN TH common mode choke, plays an important role in the system in that it actually helps with line noise entering and exiting the fan device 300, which includes receivers. Line noise is coupled within the choke 1006 to remove the noise from the AC line.

Capacitors C5 1008, C7 1010, and C11 1012 suppress high frequency noise. Capacitor C5 1008, which is a X capacitor, shunts the high frequency noise across the input AC lines (L 1007, N 1009). Capacitor C7 1010, which is a Y capacitor, shunts the high frequency noise on the AC L line 1007 to earth ground 1011. Capacitor C11 1012, which is a Y capacitor, shunts the high frequency noise on the AC N line 1009 to earth ground 1011. In one exemplary embodiment, C5 1008, C7 1010, and C11 1012 are 0.22 UF 20% 760 RAD capacitors. In another embodiment, C5 is a 220 micro

[WAC-10PROV]

Farad 275VAC capacitor; C7 is a 820 pF 1000V capacitor and C11 is a 820pF 1000V capacitor.

DC power supply 324' includes full bridge rectifier BR1 1014, capacitors C6 1016, C4 1018, and DC/DC converter circuits and filters 1020, which are coupled together as shown in Figure 9. In one embodiment, capacitor C6 1016 and capacitor C4 1018, which are across the outputs (1015, 1017) of BR1 1014, are each 82 micro Farad 400V electrolytic capacitors. BR1 1014, is a Full bridge rectifier BR1 1014, e.g., a GPP 10A 1000V GBU rectifier bridge, takes the filtered AC from lines (1007, 1009) and makes a DC BUS, V BUS 1022, with respect to DC ground 329, across its outputs 1015, 1017. In one exemplary embodiment, the DC Bus 1022 voltage is approximately 170VDC with respect to DC ground 329, in the case of a filtered 120 VAC input to BR1 1014. For example, DC Bus voltage = RMS (AC)* sqrt(2). From the DC VBUS voltage, e.g., of approximately 170VDC, other DC rail voltages are created. DC VBUS voltage 1022 is used as input to DC/DC converter circuits and filters 1022, which generates a plurality of DC output voltages (DC output voltage 1 1024, ..., DC output voltage N 1026), which are utilized by the fan device 300. In various embodiments, basic filtering is implemented, e.g., including decoupling and bypass capacitors, before and after each supply.

In some embodiments, fan device 300 including the AC power interface 322' and DC power interface 324', uses a four layer board and the AC power interface section 322' has an internal layer, e.g., a copper internal layer, referenced to earth ground. Having an adjacent copper layer like this, which is reference to earth ground, also helps to couple noise out of the system.

Various aspects and/or features of some, but not necessarily all, embodiments, are further discussed below.

Various embodiments are directed to use of an RF and WiFi control in a fan device, e.g., fan device 300, to control fan 303 status and speed and/or fan light 306 on/off status and intensity. The fan device 300 includes both an RF interface 314 and a WiFi interface 312. The customer premises, e.g., customer premises 1 102, includes a WiFi router 118 through which WiFi communications can be sent from a WiFi capable device, e.g., a cell phone 120, to control the fan device 300 and its various functions. While WiFi control is via a WiFi router 118 in the home, the control signals normally do not traverse the Internet 106 or another external network. Accordingly, WiFi control is possible without the need for a connection to an external network or server 108. In

[WAC-10PROV]

addition to WiFi control, control of the fan device 300 can be via an RF control device 200, e.g., a wall mounted controller. In some embodiments 120V power is supplied to the fan device 300 via the wall mounted controller 202. While 120V power may be supplied via the wall controller 202, control signals from the wall mounted controller 202 are transmitted using RF signals to the RF interface 314 of the fan device 300. The RF interface 314 uses a different frequency band than the frequency band used for WiFi signals sent to/from the WiFi router 118. In some embodiments the RF interface 314 uses an unlicensed frequency spectrum which is different than that used for WiFi signals.

Since the RF and WiFi control signals need not pass over an external communications network as in the case of systems where commands must first be sent to a network server outside a customer premises, e.g., CP1 102, and then sent from the network server to the device to be controlled, the fan device 300 can be controlled either by the wall controller 202 or a WiFi device even if a connection to the Internet or another external network is not available.

In some, but not necessarily all embodiments, the fan device 300 reports its state and/or changes in state due to received commands to a server, e.g., control server 108, e.g., located outside the customer premises 102. The communication with the external server 108 may be, and sometimes is, via a WiFi router 118 and Internet 106 connection. The server 108 logs the state information of one or more devices, e.g., fan device 1 110 and fan device N 112, at each customer premises it is associated with. The server 108 generates, e.g., automatically, a recommended normal schedule based on historical device state information including device on/off times, fan speed information and/or light intensity information. Machine learning and historical device state information may be, and sometimes is, used for generating the recommended schedule for a customer premises. The recommended normal control schedule is communicated to an individual, e.g., a customer at the customer premises to which the schedule relates. The communication of the proposed schedule may be, and sometimes is, from the server 108 via the Internet 106 and WiFi router 118 at the customer premises, e.g., CP 1 102, to which the schedule relates. The customer can approve the recommended schedule and/or provide a revised normal schedule to be used by the server 108 to control devices at the customer premises.

In addition to generating a normal control schedule for a customer premises, an away schedule to be used when a customer indicates that the customer premises is in an

[WAC-10PROV]

away state is generated. An away state corresponds to when the normal occupants of the customer premises are away from the customer premises. The away schedule is generated based on a random function so that devices, e.g. fan device 1 110, ..., fan device N 112, will be turned on at somewhat randomized times making it difficult for a potential burglar to determine whether the devices are being controlled by an automated system or by a human present at the premises, e.g., CP 1 102. In some embodiments historical device use information is taken into consideration when the server, e.g., control server 108, automatically generates the away schedule with the on/off times being somewhat random but remaining within a reasonable time, e.g., 30 minutes or an hour, of when the devices are turned on and off when a human is present.

While a user can control the devices, e.g., a fan device 300, while in the home via the RF controller 202 or a WiFi controller, e.g., including in WT 1 120, without having to send commands outside the home, remote control of devices, e.g., fan devices, is also supported. A user can login to the control server 108 and once authenticated is allowed to send control commands to devices, e.g., fan devices 110, 112 at the home via the control server 108 and the WiFi router 118. In this way a user can control devices, e.g., fan devices 110, 112, while away from the home. In the case of commands sent via the server 108, the server 108 can, and sometimes does, update device state information based on the commands sent from the server 108 to the device, e.g., device 110, to be controlled thereby eliminating the need for the device, e.g., device 110 to report a state change to the server 108. While in some embodiments devices, e.g., fan devices 110, 112, do not report state changes to the server 108 which are in response to commands communicated by the server 108 to the device, e.g., fan device 110, being controlled, in other embodiments the devices being controlled, e.g., fan devices 110, 112, routinely report a state change to the control server 108 regardless of whether the command was from the server 108, wall controller 202 or WiFi device, e.g., WT 120, in the home.

The customer to which a home corresponds can enable/disable use of a control schedule by the server 108. For example the user can send a signal, e.g., via WT 1 120, to the control server 108 to indicate that the normal device control schedule should be used or the away device control schedule should be used or that no control schedule should be used. The signal may indicate automated control is to be set to off for the home, automated control should be set to on for the home, and, when the automated control is on whether an away state is indicated indicating that the away schedule should

[WAC-10PROV]

be used or that the premises is in a normal state and thus the normal schedule should be used.

In various embodiments a controller, e.g., wall control unit 202, with an RF interface 208 is used to control a fan device, e.g., fan device 300, which includes a fan motor 304 and may also include a lighting device, e.g., light 306. The controller 202 in some embodiments is in the form of a wall control module which may be, and sometime is, mounted in a standard electrical wall box, e.g., box 190, in a room in which the fan device, e.g., fan device 300, to be controlled is located. To simplify installation and avoid the need for more than the normal 120v power line used to power an outlet of light, from a 120V AC prospective the controller 202 acts as a simple pass through device through which AC power is supplied to the fan device unit 300. As a safety, the controller 202 includes an AC disconnect 206 which can be used to cut all power to the fan device unit 300. The disconnect switch 206 may be in the form of a push or pull switch or a pull tab which can interrupt the power to the fan device 300.

Control of the fan device 300 is via an RF interface 208 included in the wall controller 202 . In some embodiments activation of the safety disconnect switch 206 will cut power to the RF interface 208 of the wall controller 202 in addition to power to the fan device 300. In this way, in some but not necessarily all embodiments, the safety cut off 206 serves as a physical kill switch integrated into the wall controller 202 for both the wall controller 202 and the fan device 300.

The controller 202 includes inputs (216, 214, 224, 226, 220, 222, 218) for controlling fan on/off operations, light on/off operations, fan speed, e.g., up/down, and/or light intensity, e.g., fan device light output up/down, and fan direction. In some embodiments light output and fan speed can be smoothly controlled, e.g., with light intensity being controlled in a smooth fashion over a wide range of intensity value as opposed to simply a few discrete output levels. The wall controller 202 transmits RF control signals to implement or communicate commands that are generated based on the pressing or altering of the control inputs (214, 216, 218, 220, 222, 224, 226) on the wall controller 202. The control signals are transmitted to the fan device 300 using a RF frequency band which is different from that used for WiFi signals at the customer premises where the controller 202 is located.

In some embodiments, the wireless terminal 120 is not a mobile device but is instead a wall mounted device which is mounted in the customer premises in which one or more fan devices, e.g., fan devices 1 110, . . . , fan device N 112 are located. The wall

[WAC-10PROV]

mounted wireless terminal, may, and in some embodiments does, include a touch screen display upon which menus are presented to a user through which the user can select options to control the operation of one or more functions of the fan devices located at the customer premises, such as the light intensity, fan speed, fan direction, light on/off, fan on/off for one or more of the fans located at the customer premises. Figure 10 illustrates an exemplary wall mounted wireless terminal.

Figure 11 illustrates an exemplary wall control unit with a safety switch in accordance with an exemplary embodiment of the present invention.

In some embodiments, a full calendar year (e.g., 365 day) scheduler application in the control server allows a user to store settings, instructions and commands for the operation of one or more of a set of fans devices included on a customer premises with the fan devices then being automatically controlled by the control server in accordance with the user inputted settings, e.g., timing as to when to turn on and off the fan, turn on and off the light, set direction of the rotation of the fan blades, setting of the light intensity, setting of the fan speed, etc.

List of Exemplary Numbered Method Embodiments:

Method Embodiment 1. A control method comprising: receiving, at a fan device including a radio frequency signal receiver and a WiFi interface, a first radio frequency (RF) control signal from a control unit, said fan device and said control unit being located at a customer premises; implementing, at the fan device, an operation in response to a first command communicated by the first RF control signal; and operating the fan device to communicate to a server located outside the customer premises, via the WiFi interface, information indicating the operation implemented in response to the first command (e.g., fan device sends a report identify itself, i.e., the fan device being controlled, the time the command was implemented, the operation performed and identifies the customer premises to allow the server to create a log of the state of the fan device and create a history record of the state, e.g., on/of and intensity of the various devices at the customer premises to facilitate learning of use patterns and thereby allow for automated schedule generation for both a normal and away schedule both of which maybe and sometimes are machined learned based on the information reported to the server in the network).

[WAC-10PROV]

Method Embodiment 2. The method of Method Embodiment 1, wherein said fan device and said control unit are located in the same room.

Method Embodiment 3. The method of Method Embodiment 1, wherein said control unit is a wall mounted unit through which power is supplied to the fan device, said first RF control signal being a wireless signal transmitted from an RF transmitter in the control unit to an RF receiver in the fan device.

Method Embodiment 4. The method of Method Embodiment 3, wherein the control unit does not include a WiFi interface.

Method Embodiment 5. The method of Method Embodiment 1, wherein said first command is one of: a fan on command, a fan off command, a fan power state change command, a fan speed up command, a fan speed down command, a fan direction change command, a light on command, a light off command, a light power state change command, a light increase command, a light decrease command.

Method Embodiment 6. The method of Method Embodiment 1, wherein said RF control signal is sent using an RF frequency which is not used for WiFi signals. (we need to make clear that the RF and WiFi interfaces while both being wireless interfaces are different interfaces and use different frequency bands and different communications protocols)

Method Embodiment 7. The method of Method Embodiment 6, further comprising:

- operating a WiFi router located at the customer premises to receive a first WiFi control signal from a wireless terminal (e.g., cell phone) located at the customer premises, said first WiFi control signal communicating a second command used to control the fan device;

- operating the WiFi router to communicate, via a WiFi signal, the second command to the fan device; and

- operating the fan device to implement the second command.

[WAC-10PROV]

Method Embodiment 8. The method of Method Embodiment 7, further comprising:

operating the fan to communicate to the server located outside the customer premises, via the WiFi interface, information indicating the operation implemented in response to the second command.

Method Embodiment 9. The method of Method Embodiment 8, wherein the second command is communicated from the wireless terminal to the fan device via the WiFi router located in the customer premises without said second command traversing a network outside the customer premises. (Thus, in at least some embodiments communication of the second command does not depend or involve communication over a network outside the customer premises and the fan device can be controlled from within the house via WiFi even if an Internet or server connection to the server is not present or available.)

Method Embodiment 10. The method of Method Embodiment 9, further comprising: operating the server to receive a third command directed to the first fan device; and operating the server to communicate the third command via the Internet and said WiFi router to the fan device. (Claim 10 is intended to report control of the fan device via a remotely located device, e.g., a WT such as a cell phone outside the first customer premises, which sends control signals through the server for delivery to the first fan device, in the case where the control signals pass through the server the fan device being controlled may not send back a message reporting implementation of the communicated command and the sever can update the state information based on the knowledge that the fan was instructed to perform the operation and/optionally, a acknowledgement from the device indicating that the control message was successfully received and/or acted upon.)

Method Embodiment 11. The method of Method Embodiment 10, further comprising: operating the server to update information about the state of one or more devices at the first customer premises based on the third command communicated to the fan device.

[WAC-10PROV]

Method Embodiment 12. The method of Method Embodiment 11, wherein said updating of the information about the state of one or more devices at the first customer premises is performed in response to transmitting the third command from the server (without receiving a report of the command being implemented at the fan device).

Method Embodiment 13. The method of Method Embodiment 9, further comprising: operating the server to generate a proposed normal device control schedule for the first customer premises (e.g., fan and/or lighting control schedule including speed and/or light intensity schedule) from stored information indicating the state of one or more devices at the first customer premises over a period of time (e.g., two or more weeks); communicate from the server (e.g., via the Internet and WiFi router located at the first customer premises) the proposed device control schedule to a device corresponding to the first customer premise (e.g., cell phone of a user who is located at the first customer premises) ; receive at the server a message indicating approval of the proposed normal device control schedule for the first customer premises or a revised schedule for the first customer premises; and storing as an approved normal control schedule for the first customer premises the approved proposed normal device control schedule or the revised schedule.

Method Embodiment 14. The method of Method Embodiment 13, further comprising: operating the server to control one or more devices at the first customer premises based on the stored approved normal device control schedule, said one or more devices including the first fan device.

Method Embodiment 15. The method of Method Embodiment 14, wherein operating the server to control one or more devices at the first customer premises based on the stored approved normal device control schedule includes transmitting a control signal from the server to the first fan device via the Internet and WiFi router to control the fan device to turn on at a time indicated by said approved normal control schedule.

Method Embodiment 16. The method of Method Embodiment 13, further comprising: operating the server to generate an away schedule to be used to control one or more device at the first customer premises when the customer indicates they are away from the customer premises.

[WAC-10PROV]

Method Embodiment 17. The method of Method Embodiment 16, wherein operating the server to generate an away schedule includes generating said away schedule as a function of a random function used to at least partially randomize the on or off times of one or more devices.

Method Embodiment 18. The method of Method Embodiment 17, wherein operating the server to generate the away schedule includes using information about past device on and off status in combination with said random function to control the on and off times of at least one device, said on and off times deviating from historical on and off times by an amount of time which does not exceed a set maximum amount of time (e.g., 30 minutes) and which is determined by said random function. (E.G., once the historical on/off times of a light on the fan device are known, the random function is used to change the on/off time in a random function but keep it within 30 minutes or so of the normal on/off time so that the on/off pattern is not identical from day to day but within an expected normal range that might occur to a human getting home or moving around the home which would not be identical each day but might not deviate greatly, e.g., by more than an hour, from day to day.)

Method Embodiment 19. The method of Method Embodiment 16, further comprising; receiving, at the server, a signal from a user indicating an away status; and switching, at the server, from using the stored approved normal schedule to using the stored away schedule to control the one or more devices at the first customer premises.

List of Exemplary Numbered System Embodiments:

System Embodiment 1. A system (100) comprising: a fan device (110) comprising: a fan motor (304); a radio frequency (RF) signal receiver (360) configured to receive radio frequency (RF) control signals from a control unit (114), said fan device (110) and said control unit (114) being located at a customer premises (102); a WiFi interface (312); a fan motor control circuit (308) configured to control the fan motor (304) in response to a received first radio frequency control signal, said first radio frequency control signal communicating a first command; and a first processor (316) configured to communicate to a server (108), located outside the customer premises

[WAC-10PROV]

(102), via the WiFi interface (312), information indicating an operation implemented in response to the first command.

System Embodiment 1a. The system of System Embodiment 1, wherein said fan device further comprises:

a light (306); and

a light control circuit (310) configured to control the light (306) in response to a received second radio frequency control signal, said second radio frequency control signal communicating a second command; and

wherein said first processor (316) is further configured to communicate to said server (108), via the WiFi interface (312), information indicating an operation implemented in response to said second command.

System Embodiment 1A. The system (100) of System Embodiment 1a, wherein said fan device (110) and said control unit (114) are located in the same room.

System Embodiment 1B. The system (100) of System Embodiment 1a, further comprising said control unit (114); wherein said control unit (114) includes an RF transmitter (228); and wherein said control unit (114) is a wall mounted unit through which power is supplied to the fan device (110), said first RF control signal and said second RF control signal being wireless signals transmitted from said RF transmitter (228) in the control unit (114) to said RF signal receiver (360) in the fan device (110).

System Embodiment 1C. The system (110) of System Embodiment 1B, wherein the control unit (114) does not include a WiFi interface.

System Embodiment 2. The system (100) of System Embodiment 1a, wherein said first RF control signal communicates one of: a fan on command, a fan off command, a fan power state change command, a fan speed up command, a fan speed down command, a fan direction change command; and wherein said second RF control signal communicates one of: a light on command, a light off command, a light power state change command, a light increase command, a light decrease command.

[WAC-10PROV]

System Embodiment 3. The system (100) of System Embodiment 1a, wherein said first RF control signal and said second RF control signal are sent using RF frequencies which are not used for WiFi signals.

System Embodiment 4. The system (100) of System Embodiment 3, further comprising: a WiFi router (118) located at the customer premises, said WiFi router (118) comprising: a receiver (195) configured to receive a first WiFi control signal from a wireless terminal (120) located at the customer premises (102), said first WiFi control signal communicating a third command used to control the fan device (110); a transmitter (196) configured to communicate, via a WiFi signal, the third command to the fan device (110); and wherein said first processor (316) is configured to control at least one of the fan motor control circuit (308) or the light control circuit (310) to implement the third command.

System Embodiment 5. The system (100) of System Embodiment 4, further comprising: wherein said first processor (316) is configured to control the WiFi interface (312) in said fan device (110) to send information indicating the operation implemented in response to the third command.

System Embodiment 6. The system (100) of System Embodiment 5, further comprising: said wireless terminal (120), wherein said wireless terminal (120) includes: a WiFi interface (802); and a fan device control application (828) configured to generate said third command in response to user input; and wherein the third command is communicated from the wireless terminal (120) to the fan device (110) via the WiFi router (108) located in the customer premises (102) without said third command traversing a network outside the customer premises (102).

System Embodiment 7. The system (100) of System Embodiment 6, further comprising: said server (108), wherein said server (108) includes a second processor (704) configured to: operating the server (108) to receive a fourth command directed to the first fan device (110); and operating the server (108) to communicate the fourth command via the Internet (106) and said WiFi router (118) to the fan device (110).

[WAC-10PROV]

System Embodiment 8. The system (100) of System Embodiment 7, wherein said second processor (704) is further configured to: operating the server (108) to update information about the state of one or more devices at the first customer premises (102) based on the fourth command communicated to the fan device (110).

System Embodiment 9. The system (100) of System Embodiment 8, wherein said updating of the information about the state of one or more devices at the first customer premises is performed in response to transmitting the fourth command from the server (108).

System Embodiment 10. The system (100) of System Embodiment 6, wherein said second processor (704) is further configured to: operating the server (108) to generate a proposed normal device control schedule for the first customer premises (102) from stored information indicating the state of one or more devices (110, 112) at the first customer premises over a period of time; operate the server (108) to send (e.g., via the Internet (106) and WiFi router (118) located at the first customer premises (102)) the proposed device control schedule to a device (120) corresponding to the first customer premise (102) (e.g., cell phone of a user who is located at the first customer premises); operate the server (108) to receive a message indicating approval of the proposed normal device control schedule for the first customer premises (102) or a revised schedule for the first customer premises (102); and operate the server (108) to store as an approved normal control schedule for the first customer premises the approved proposed normal device control schedule or the revised schedule.

System Embodiment 11. The system (100) of System Embodiment 10, wherein said second processor (704) is further configured to: operating the server (108) to control one or more devices (110, 112) at the first customer premises (102) based on the stored approved normal device control schedule, said one or more devices (110, 112) including the first fan device (110).

System Embodiment 12. The system (100) of System Embodiment 11, wherein said second processor (704) is configured to: operate the server (108) to send a control signal from the server (108) to the first fan device (110) via the Internet (106) and WiFi router (110) to control the fan device (110) to turn on at a time indicated by

[WAC-10PROV]

said approved normal control schedule, as part of being configured to operate the server (108) to control one or more devices (110, 112) at the first customer premises (102) based on the stored approved normal device control schedule.

System Embodiment 13. The system (100) of System Embodiment 10, wherein said second processor (704) is further configured to: operate the server (108) to generate an away schedule to be used to control one or more device (110, 112) at the first customer premises (102) when the customer indicates they are away from the customer premises (102).

System Embodiment 14. The system (100) of System Embodiment 13, wherein said second processor (704) is configured to: generate said away schedule as a function of a random function used to at least partially randomize the on or off times of one or more devices, as part of being configured to operate the server to generate an away schedule.

System Embodiment 15. The system (100) of System Embodiment 14, wherein said second processor (704) is configured to use information about past device on and off status in combination with said random function to control the on and off times of at least one device, said on and off times deviating from historical on and off times by an amount of time which does not exceed a set maximum amount of time (e.g., 30 minutes) and which is determined by said random function, as part of being configured to operate the server to generate the away schedule. (E.g., once the historical on/off times of a light on the fan device are known the random function is used to change the on/off time in a random function but keep it within 30 minutes or so of the normal on/off time so that the on/off pattern is not identical from day to day but within an expected normal range that might occur to a human getting home or moving around the home which would not be identical each day but might not deviate greatly, e.g., by more than an hour, from day to day.)

System Embodiment 16. The system (100) of System Embodiment 13, wherein said server (108) further comprises: a receiver (714) configured to receive a signal from a user indicating an away status; and wherein said second processor (704) is further configured to control the server (108) to switch from using the stored approved

[WAC-10PROV]

normal schedule to using the stored away schedule to control the one or more devices (110, 112) at the first customer premises (102).

List of Exemplary Numbered Apparatus Embodiments:

Apparatus Embodiment 1. A fan device controller (202) including: an AC voltage input (237); an AC output (241) for supplying power to a fan device (300); an RF signal interface (208) including an RF signal transmitter (228) for transmitting commands to a device (300) to be controlled; an RF controller (212) for controlling the RF signal interface (212) to send control signals including one or more commands to said fan device (300); and a disconnect switch (206) for disconnecting said AC output (241) from said AC input (237) when said disconnect switch (206) is switched to a disconnect state from a connect state.

Apparatus Embodiment 2. The fan device controller (200) of Apparatus Embodiment 1, further comprising: a fan control input (216) for turning a fan (304) on or off; and a light control input (214) for turning a light (306) on or off.

Apparatus Embodiment 3. The fan device controller (202) of Apparatus Embodiment 2, further comprising: a light up input (220) coupled to said RF controller (212); and a light down input (222) coupled to said RF controller (212).

Apparatus Embodiment 4. The fan device controller (202) of Apparatus Embodiment 3, further comprising: a fan speed up input (224) coupled to said RF controller (212); and a fan speed down input (226) coupled to said RF controller (212).

Apparatus Embodiment 5. The fan device controller (202) of Apparatus Embodiment 4, further comprising: a fan reverse input (218) coupled to said RF controller (212).

Apparatus Embodiment 6. The fan device controller (202) of Apparatus Embodiment 5, further comprising: a DC power supply (210) connected to said disconnect switch (206) and to said RF controller (212), said DC power supply (206) receiving AC power from said disconnect switch (206) and supplying DC power generated from said AC power to the RF controller (212).

[WAC-10PROV]

Apparatus Embodiment 7. The fan device controller (202) of Apparatus Embodiment 6, wherein switching the disconnect switch to a disconnect state cuts power to both the AC output (243) and to said DC power supply (210) thereby cutting power to a fan device (300) coupled to said fan device controller (202) and to the RF controller (212) at the same time.

Apparatus Embodiment 8. The fan device controller (202) of Apparatus Embodiment 7, wherein said RF controller (212) includes a processor (213); and wherein said processor (213) is configured to: generate commands in response to input received via one of the inputs (214, 216, 218, 220, 222, 224 or 226) included in said fan device controller (202); and control said RF interface (208) to transmit said commands in RF signals to the fan device (300).

Apparatus Embodiment 9. The fan device controller (202) of Apparatus Embodiment 8, wherein said fan device controller (202) is configured to fit in an electrical box (190) in a wall (191) of a customer premises (102).

WHAT IS CLAIMED IS:

The above described apparatus, systems and methods to the extent they are new and novel are to be considered the invention and are claimed. Individual components and/or combinations of components to the extent they are new, novel and useful are also to be considered the invention and are claimed alone or in combination with other elements shown in the present application. Among what is claimed is:

Method Claims

1. A control method comprising:
 - receiving, at a fan device including a radio frequency signal receiver and a WiFi interface, a first radio frequency (RF) control signal from a control unit, said fan device and said control unit being located at a customer premises;
 - implementing, at the fan device, an operation in response to a first command communicated by the first RF control signal; and
 - operating the fan device to communicate to a server located outside the customer premises, via the WiFi interface, information indicating the operation implemented in response to the first command (e.g., fan device sends a report identify itself, i.e., the fan device being controlled, the time the command was implemented, the operation performed and identifies the customer premises to allow the server to create a log of the state of the fan device and create a history record of the state, e.g., on/of and intensity of the various devices at the customer premises to facilitate learning of use patterns and thereby allow for automated schedule generation for both a normal and away schedule both of which maybe and sometimes are machined learned based on the information reported to the server in the network).
- 1A. The method of claim 1, wherein said fan device and said control unit are located in the same room.
- 1B. The method of claim 1, wherein said control unit is a wall mounted unit through which power is supplied to the fan device, said first RF control signal being a wireless signal transmitted from an RF transmitter in the control unit to an RF receiver in the fan device.

[WAC-10PROV]

1C. The method of claim 1B, wherein the control unit does not include a WiFi interface.

2. The method of claim 1, wherein said first command is one of: a fan on command, a fan off command, a fan power state change command, a fan speed up command, a fan speed down command, a fan direction change command, a light on command, a light off command, a light power state change command, a light increase command, a light decrease command.

3. The method of claim 1, wherein said RF control signal is sent using an RF frequency which is not used for WiFi signals. (we need to make clear that the RF and WiFi interfaces while both being wireless interfaces are different interfaces and use different frequency bands and different communications protocols)

4. The method of claim 3, further comprising:
operating a WiFi router located at the customer premises to receive a first WiFi control signal from a wireless terminal (e.g., cell phone) located at the customer premises, said first WiFi control signal communicating a second command used to control the fan device;
operating the WiFi router to communicate, via a WiFi signal, the second command to the fan device; and
operating the fan device to implement the second command.

5. The method of claim 4, further comprising:
operating the fan device to communicate to the server located outside the customer premises, via the WiFi interface, information indicating the operation implemented in response to the second command.

6. The method of claim 5 wherein the second command is communicated from the wireless terminal to the fan device via the WiFi router located in the customer premises without said second command traversing a network outside the customer premises.
(thus, in at least some embodiments communication of the second command does not depend or involve communication over a network outside the customer premises and the

[WAC-10PROV]

fan device can be controlled from within the house via WiFi even if an Internet or server connection to the server is not present or available)

Claim 7 is intended to report control of the fan device via a remotely located device, e.g., a WT such as a cell phone outside the first customer premises, which sends control signals through the server for delivery to the first fan device, in the case where the control signals pass through the server the fan device being controlled may not send back a message reporting implementation of the communicated command and the sever can update the state information based on the knowledge that the fan was instructed to perform the operation and/or optionally, a acknowledgement from the device indicating that the control message was successfully received and/or acted upon.

7. The method of claim 6, further comprising:
operating the server to receive a third command directed to the first fan device;
and
operating the server to communicate the third command via the Internet and said WiFi router to the fan device.

8. The method of claim 7, further comprising:
operating the server to update information about the state of one or more devices at the first customer premises based on the third command communicated to the fan device.

9. The method of claim 8, wherein said updating of the information about the state of one or more devices at the first customer premises is performed in response to transmitting the third command from the server (without receiving a report of the command being implemented at the fan device).

10. The method of claim 6, further comprising:
operating the server to generate a proposed normal device control schedule for the first customer premises (e.g., fan and/or lighting control schedule including speed and/or light intensity schedule) from stored information indicating the state of one or more devices at the first customer premises over a period of time (e.g., a two or more weeks);

[WAC-10PROV]

communicate from the server (e.g., via the Internet and WiFi router located at the first customer premises) the proposed device control schedule to a device corresponding to the first customer premise (e.g., cell phone of a user who is located at the first customer premises) ;

receive at the server a message indicating approval of the proposed normal device control schedule for the first customer premises or a revised schedule for the first customer premises; and

storing as an approved normal control schedule for the first customer premises the approved proposed normal device control schedule or the revised schedule.

11. The method of claim 10, further comprising:

operating the server to control one or more devices at the first customer premises based on the stored approved normal device control schedule, said one or more devices including the first fan device.

12. The method of claim 11, wherein operating the server to control one or more devices at the first customer premises based on the stored approved normal device control schedule includes transmitting a control signal from the server to the first fan device via the Internet and WiFi router to control the fan device to turn on at a time indicated by said approved normal control schedule.

13. The method of claim 10, further comprising:

operating the server to generate an away schedule to be used to control one or more device at the first customer premises when the customer indicates they are away from the customer premises.

14. The method of claim 13, wherein operating the server to generate an away schedule includes generating said away schedule as a function of a random function used to at least partially randomize the on or off times of one or more devices.

15. The method of claim 14, wherein operating the server to generate the away schedule includes using information about past device on and off status in combination with said random function to control the on and off times for at least one device, said on and off times deviating from historical on and off times by an amount of time which

[WAC-10PROV]

does not exceed a set maximum amount of time (e.g., 30 minutes) and which is determined by said random function. (e.g., once the historical on/off times of a light on the fan are known the random function is used to change the on/of time in a random function but keep it within 30 minutes or so of the normal on/of time so that the on/off pattern is not identical from day to day but within an expected normal range that might occur to a human getting home or moving around the home which would not be identical each day but might not deviate greatly, e.g., by more than an hour, from day to day)

16. The method of claim 13, further comprising:
receiving, at the server, a signal from a user indicating an away status; and
switching, at the server, from using the stored approved normal schedule to using the stored away schedule to control the one or more devices at the first customer premises.

System Claims

1. A system (100) comprising:
a fan device (110) comprising:
a fan motor (304);
a radio frequency (RF) signal receiver (360) configured to receive radio frequency (RF) control signals from a control unit (114), said fan device (110) and said control unit (114) being located at a customer premises (102);
a WiFi interface (312);
a fan motor control circuit (308) configured to control the fan motor (304) in response to a received first radio frequency control signal, said first radio frequency control signal communicating a first command; and
a first processor (316) configured to communicate to a server (108), located outside the customer premises (102), via the WiFi interface (312), information indicating an operation implemented in response to the first command.
- 1a. The system of claim 1, wherein said fan device further comprises:
a light (306); and

[WAC-10PROV]

a light control circuit (310) configured to control the light (306) in response to a received second radio frequency control signal, said second radio frequency control signal communicating a second command; and

wherein said first processor (316) is further configured to communicate to said server (108), via the WiFi interface (312), information indicating an operation implemented in response to said first command.

1A. The system (100) of claim 1a, wherein said fan device (110) and said control unit (114) are located in the same room.

1B. The system (100) of claim 1a, further comprising said control unit (114);

wherein said control unit (114) includes an RF transmitter (228); and

wherein said control unit (114) is a wall mounted unit through which power is supplied to the fan device (110), said first RF control signal and said second RF control signal being wireless signals transmitted from said RF transmitter (228) in the control unit (114) to said RF signal receiver (360) in the fan device (110).

1C. The system (110) of claim 1B, wherein the control unit (114) does not include a WiFi interface.

2. The system (100) of claim 1a,

wherein said first RF control signal communicates one of: a fan on command, a fan off command, a fan power state change command, a fan speed up command, a fan speed down command, a fan direction change command; and

wherein said second RF control signal communicates one of: a light on command, a light off command, a light power state change command, a light increase command, a light decrease command.

3. The system (100) of claim 1a, wherein said first RF control signal and said second RF control signal are sent using RF frequencies which are not used for WiFi signals.

4. The system (100) of claim 3, further comprising:

a WiFi router (118) located at the customer premises, said WiFi router (118) comprising:

[WAC-10PROV]

a receiver (195) configured to receive a first WiFi control signal from a wireless terminal (120) located at the customer premises (102), said first WiFi control signal communicating a third command used to control the fan device (110);

a transmitter (196) configured to communicate, via a WiFi signal, the third command to the fan device (110); and

wherein said first processor (316) is configured to control at least one of the fan motor control circuit (308) or the light control circuit (310) to implement the third command.

5. The system (100) of claim 4, further comprising:

wherein said first processor (316) is configured to control the WiFi interface (312) in said fan device (110) to send information indicating the operation implemented in response to the third command.

6. The system (100) of claim 5, further comprising:

said wireless terminal (120), wherein said wireless terminal (120) includes:

a WiFi interface (802); and

a fan device control application (828) configured to generate said third command in response to user input; and

wherein the third command is communicated from the wireless terminal (120) to the fan device (110) via the WiFi router (108) located in the customer premises (102) without said third command traversing a network outside the customer premises (102).

7. The system (100) of claim 6, further comprising:

said server (108), wherein said server (108) includes a second processor (704) configured to:

operating the server (108) to receive a fourth command directed to the first fan device (110); and

operating the server (108) to communicate the fourth command via the Internet (106) and said WiFi router (118) to the fan device (110).

8. The system (100) of claim 7, wherein said second processor (704) is further configured to:

[WAC-10PROV]

operating the server (108) to update information about the state of one or more devices at the first customer premises (102) based on the fourth command communicated to the fan device (110).

9. The system (100) of claim 8, wherein said updating of the information about the state of one or more devices at the first customer premises is performed in response to transmitting the fourth command from the server (108).

10. The system (100) of claim 6, wherein said second processor (704) is further configured to:

operating the server (108) to generate a proposed normal device control schedule for the first customer premises (102) from stored information indicating the state of one or more devices (110, 112) at the first customer premises over a period of time;

operate the server (108) to send (e.g., via the Internet (106) and WiFi router (118) located at the first customer premises (102)) the proposed device control schedule to a device (120) corresponding to the first customer premise (102) (e.g., cell phone of a user who is located at the first customer premises) ;

operate the server (108) to receive a message indicating approval of the proposed normal device control schedule for the first customer premises (102) or a revised schedule for the first customer premises (102); and

operate the server (108) to store as an approved normal control schedule for the first customer premises the approved proposed normal device control schedule or the revised schedule.

11. The system (100) of claim 10, wherein said second processor (704) is further configured to:

operating the server (108) to control one or more devices (110, 112) at the first customer premises (102) based on the stored approved normal device control schedule, said one or more devices (110, 112) including the first fan device (110).

12. The system (100) of claim 11, wherein said second processor (704) is configured to:

operate the server (108) to send a control signal from the server (108) to the first fan device (110) via the Internet (106) and WiFi router (110) to control the fan device

[WAC-10PROV]

(110) to turn on at a time indicated by said approved normal control schedule, as part of being configured to operate the server (108) to control one or more devices (110, 112) at the first customer premises (102) based on the stored approved normal device control schedule.

13. The system (100) of claim 10, wherein said second processor (704) is further configured to:

operate the server (108) to generate an away schedule to be used to control one or more device (110, 112) at the first customer premises (102) when the customer indicates they are away from the customer premises (102).

14. The system (100) of claim 13, wherein said second processor (704) is configured to: generate said away schedule as a function of a random function used to at least partially randomize the on or off times of one or more devices, as part of being configured to operate the server to generate an away schedule.

15. The system (100) of claim 14, wherein said second processor (704) is configured to use information about past device on and off status in combination with said random function to control the on and off times for at least one device, said on and off times deviating from historical on and off times by an amount of time which does not exceed a set maximum amount of time (e.g., 30 minutes) and which is determined by said random function, as part of being configured to operate the server to generate the away schedule. (e.g., once the historical on/off times of a light on the fan are known the random function is used to change the on/of time in a random function but keep it within 30 minutes or so of the normal on/of time so that the on/off pattern is not identical from day to day but within an expected normal range that might occur to a human getting home or moving around the home which would not be identical each day but might not deviate greatly, e.g., by more than an hour, from day to day)

16. The system (100) of claim 13, wherein said server (108) further comprises:
a receiver (714) configured to receive a signal from a user indicating an away status; and

wherein said second processor (704) is further configured to control the server (108) to switch from using the stored approved normal schedule to using the stored

[WAC-10PROV]

away schedule to control the one or more devices (110, 112) at the first customer premises (102).

Apparatus Claims

1. A fan device controller (202) including:
 - an AC voltage input (237);
 - an AC output (241) for supplying power to a fan device (300);
 - an RF signal interface (208) including an RF signal transmitter (228) for transmitting commands to a device (300) to be controlled;
 - an RF controller (212) for controlling the RF signal interface (212) to send control signals including one or more commands to said fan device (300); and
 - a disconnect switch (206) for disconnecting said AC output (241) from said AC input (237) when said disconnect switch (206) is switched to a disconnect state from a connect state.
2. The fan device controller (200) of claim 1, further comprising:
 - a fan control input (216) for turning a fan (304) on or off; and
 - a light control input (214) for turning a light (306) on or off.
3. The fan device controller (202) of claim 2, further comprising:
 - a light up input (220) coupled to said RF controller (212); and
 - a light down input (222) coupled to said RF controller (212).
4. The fan device controller (202) of claim 3, further comprising:
 - a fan speed up input (224) coupled to said RF controller (212); and
 - a fan speed down input (226) coupled to said RF controller (212).
5. The fan device controller (202) of claim 4, further comprising:
 - a fan reverse input (218) coupled to said RF controller (212).
6. The fan device controller (202) of claim 5, further comprising:
 - a DC power supply (210) connected to said disconnect switch (206) and to said RF controller (212), said DC power supply (206) receiving AC power from said

[WAC-10PROV]

disconnect switch (206) and supplying DC power generated from said AC power to the RF controller (212).

7. The fan device controller (202) of claim 6, wherein switching the disconnect switch to a disconnect state cuts power to both the AC output (243) and to said DC power supply (210) thereby cutting power to a fan device (300) coupled to said fan device controller (202) and to the RF controller (212) at the same time.

8. The fan device controller (202) of claim 7,
wherein said RF controller (212) includes a processor (213); and
wherein said processor (213) is configured to:
generate commands in response to input received via one of the inputs
(214, 216, 218, 220, 222, 224 or 226) included in said fan device controller (202); and
control said RF interface (208) to transmit said commands in RF signals
to the fan device (300).

9. The fan device controller (202) of claim 8, wherein said fan device controller (202) is configured to fit in an electrical box (190) in a wall (191) of a customer premises (102).

[WAC-10PROV]

ABSTRACT

Various embodiments are directed to use of RF and WiFi control in a fan device to control fan status and speed and/or fan light on/off status and intensity. A customer premises includes a WiFi router through which WiFi communications can be sent from a WiFi capable device, e.g., a cell phone, to control the fan device and its various functions. While WiFi control is via a WiFi router in the home, the control signals normally do not traverse the Internet or another external network. In addition to WiFi control, control of the fan device can be via an RF control device, e.g., a wall mounted controller. In some embodiments, the fan device reports its state and/or changes in state due to received commands to a server, and the server generates a recommended normal control schedule and an away control schedule and then uses the schedules to control fan device.

A controller with an RF interface is used to control a fan device which includes a fan motor and may also include a lighting device. The controller in some embodiments is in the form of a wall control module which may be mounted in a standard electrical wall box in a room in which the fan device to be controlled is located. To simplify installation and avoid the need for more than the normal 120v power line used to power an outlet of light, from a 120V AC prospective the controller acts as a simple pass through device through which AC power is supplied to the fan device unit. As a safety, the controller includes an AC disconnect which can be used to cut all power to the fan unit.

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES		
First Named Inventor/Applicant Name:		Eric Stefankiewicz		
Filer:		Michael P. Straub/Stephen Straub		
Attorney Docket Number:		WAC-10PROV		
Filed as Small Entity				
Filing Fees for Provisional				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
PROVISIONAL APPLICATION FILING FEE	2005	1	130	130
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				130

Electronic Acknowledgement Receipt	
EFS ID:	31496297
Application Number:	62617152
International Application Number:	
Confirmation Number:	7220
Title of Invention:	METHODS AND APPARATUS FOR CONTROLLING FAN DEVICES
First Named Inventor/Applicant Name:	Eric Stefankiewicz
Customer Number:	149297
Filer:	Michael P. Straub/Stephen Straub
Filer Authorized By:	Michael P. Straub
Attorney Docket Number:	WAC-10PROV
Receipt Date:	12-JAN-2018
Filing Date:	
Time Stamp:	21:42:25
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 130
RAM confirmation Number	011618INTEFSW00008049601862
Deposit Account	601862
Authorized User	Stephen Straub
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)					
37 CFR 1.20 (Post Issuance fees)					
37 CFR 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	WAC10PROV_ADS.pdf	1822873	no	8
			9f430569436b737c31079405691b87706b c05fa		
Warnings:					
Information:					
2	Provisional Cover Sheet (SB16)	WAC-10PROV_ProvisionalSB. pdf	1477226	no	3
			7578e58b300b39450e4c708c2a81f283051 82168		
Warnings:					
Information:					
3	Drawings-only black and white line drawings	WAC-10_PROV_FIGS.pdf	4248734	no	31
			5c2a722f261498c377cec54953af10a369eb 7f6b		
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
4	Specification	WAC-10PROV.pdf	297074	no	60
			1e6e6c63a6b22f84df28a8c3386a2da8df72 c178		
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	29904	no	2
			e95ad2a95f07f887a1cd7242fc1d01be4e93 ae72		
Warnings:					
Information:					
Total Files Size (in bytes):			7875811		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.