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571-272-7822

Paper: 7
Date: August 1, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GOOGLE LLC,
Petitioner,

v.

ECOFACTOR, INC.,
Patent Owner.

IPR2022-00535
Patent 10,584,890 B2

Before SCOTT B. HOWARD, PAUL J. KORNICZKY, and BRENT M. DOUGAL, *Administrative Patent Judges.*

DOUGAL, *Administrative Patent Judge.*

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

Exhibit 1004
IPR2023-00409
Ex. 1004.0001

I. INTRODUCTION

A. Background and Summary

Petitioner, Google LLC, requests that we institute an *inter partes* review to challenge the patentability of claims 1–17 (the "challenged claims") of patent US 10,584,890 B2 (Ex. 1001, "the '890 patent"). Paper 1 ("Petition" or "Pet."). Patent Owner, EcoFactor, Inc., argues that Petitioner's request is deficient and should not be granted. Paper 6 ("Prelim. Resp.").

Applying the standard set forth in 35 U.S.C. § 325(d), we exercise our discretion to decline to institute an *inter partes* review.

B. Related Matters

The parties identify the following related district court litigation: *Google, LLC f/k/a Google Inc. v. EcoFactor, Inc.*, No. 4:21-cv-03220 (N.D. Cal.); and *EcoFactor, Inc. v. ecobee, Inc.*, No. 6:21-cv-00428 (W.D. Tex.). Pet. 6; Paper 4, 2. Petitioner also notes that it "is in the process of filing petitions for inter partes review challenging all claims of the other three patents [involved in the *Google v. EcoFactor* litigation]." Pet. 72–73.

C. The '890 Patent

The '890 patent is entitled "System and Method for Using a Mobile Electronic Device to Optimize an Energy Management System." Ex. 1001, code (54). The '890 patent relates to heating or cooling systems for buildings ("HVAC systems"). *Id.* at Abstr. Such systems can save energy by modifying the setpoint of the HVAC system when a building is unoccupied. *Id.* at 2:19–64. For example, by using a mobile device (e.g., a smartphone) to geolocate a user, the system can determine the location of the user and adjust the setpoint of the HVAC system accordingly to a home or away setting. *Id.* at 4:3–26, Fig. 8.

D. Illustrative Claim

Petitioner challenges claims 1–17 of the '890 patent. Claim 1 is the sole independent claim:

1. A thermostat system comprising:

a housing;

electrical contacts configured to connect the thermostat with wires that allow for at least two electrical connections from a building's HVAC system to the contacts;

a display configured to present information to a user;

a wireless radio compatible with a wireless radio frequency protocol and configured to communicate bi-directionally with a location-aware mobile device;

a temperature sensor;

one or more processors configured with electronic circuitry to:

receive HVAC data parameters, including a first data parameter from the temperature sensor comprising an interior temperature inside the building; and

a second data parameter from a network connected to the thermostat, wherein the second data parameter comprises an outside weather condition collected from a source external to the building;

determine a first temperature setpoint data parameter for the building, wherein the first setpoint data parameter includes a first temperature value and a first time value;

determine a second temperature setpoint data parameter for the building, wherein the second setpoint data parameter includes a second temperature value and a second time value;

receive radio frequency signals from the location-aware mobile device;

receive geo-positioning data from the location-aware mobile device and automatically adjust a temperature value based on the geo-positioning data, including initiating at least one cooling or heating cycle for the HVAC system when the geo-positioning data is determined to indicate that the building is unoccupied by the user;

electronic circuitry configured to allow the user to adjust a desired temperature for the HVAC system;

electronic circuitry configured to analyze a plurality of data parameters specific to the user, including at least one data parameter relating to usage of the HVAC system at various times; and

electronic circuitry configured to generate and communicate usage metrics pertaining to the HVAC system over time; and

a compressor delay circuit configured to delay the start or stop of a compressor for the HVAC system and protect the compressor from rapid cycling.

Ex. 1001, 33:29–34:10.

II. ANALYSIS

A. Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability (Pet. 7), supported by the declaration of Rajendra Shah (Ex. 1002):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–6, 17	103(a)[1]	Quam,[2] Drees[3]

[1] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011), revised 35 U.S.C. § 103 effective March 16, 2013. We refer to the pre-AIA version of § 103.
[2] Patent Pub. US 2015/0159901 A1, pub. June 11, 2015 (Ex. 1004, "Quam").
[3] US 5,769,314, iss. June 23, 1998 (Ex. 1010, "Drees").

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
7, 8	103(a)	Quam, Drees, Modi[4]
9–14, 16	103(a)	Quam, Drees, Barnard[5]
15	103(a)	Quam, Drees, Barnard, Van Ostrand[6]

B. Discretion Under 35 U.S.C. § 325(d)

The Director has discretion to institute an *inter partes* review, and has delegated that discretion to the Board. *See* 35 U.S.C. § 314(a); *see also* 37 C.F.R. § 42.4(a) (2021). Under 35 U.S.C. § 325(d), in determining whether to institute an *inter partes* review, we "may take into account whether, and reject the petition . . . because, the same or substantially the same . . . arguments previously were presented to the Office."

In evaluating arguments under § 325(d), we use a two-part framework,

> (1) . . . whether the same or substantially the same arguments previously were presented to the Office; and (2) if . . . satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential) ("*Advanced Bionics*").

1. Priority Date of the '890 Patent

During examination of the application that became the '890 patent, the question of priority to earlier filed applications was at issue. Ex. 1005, 99. Petitioner raises this issue in the Petition (Pet. 9–16) as the Quam and

[4] Patent Pub. US 2013/0204442 A1, pub. Aug. 8, 2013 (Ex. 1014, "Modi").
[5] US 4,660,759, iss. Apr. 28, 1987 (Ex. 1012, "Barnard").
[6] US 5,454,511, iss. Oct. 3, 1995 (Ex. 1013, "Van Ostrand").

Modi references only qualify as prior art that can be used against the '890 patent if the '890 patent is not entitled to priority. We therefore analyze Petitioner's arguments under the rubric of 35 U.S.C. § 325(d) to determine whether we should exercise our discretion to deny the Petition. For the reasons discussed below, we deny the Petition on this basis.

a) Background

Petitioner argues that the '890 patent is not entitled to priority to "its predecessor application 14/491,554 ('the '554 application'), filed on September 19, 2014"[7] and therefore has an "effective filing date of . . . no earlier than **June 7, 2017**." Pet. 9. Petitioner acknowledges that Quam and Modi both qualify as prior art[8] that can be used against the '890 patent if the '890 patent is not able to rely on its priority claim to the '554 application. *Id.*

Petitioner argues that three limitations from claim 1 of the '890 patent lack written description support in the '554 application under 35 U.S.C. § 112(a). *Id.* For this reason, Petitioner argues that the '890 patent is not entitled to an earlier priority date. *Id.*

The question of priority to the '554 application was at issue in the examination of the application that became the '890 patent. In particular, the Examiner initially determined that

> The disclosure of the prior-filed application, Application No[]. . . . 14/491,554 . . . fail[s] to provide adequate support or enablement in the manner provided by 35 U.S.C. 112(a) . . . for

[7] The '890 patent states it is a continuation of a number of sequential applications including the '554 application. Ex. 1001, code (63).
[8] The earliest possible effective filing date for the '890 patent is May 26, 2010, while the respective dates for Quam and Modi are December 11, 2013, and November 19, 2010. *See* Ex. 1001, code (63); Ex. 1004, code (60); Ex. 1014, code (60).

> one or more claims of this application. These parent applications fail to specifically disclose first, second, and third setpoints, receiving the outdoor temperature from a network, the remote interface being configured to adjust temperature setpoints for the HVAC system; sending user-specific data through the internet; "user-specific information" about the building and HVAC system; or adjusting the temperature setpoint "without user intervention."

Ex. 1005, 99.

The Applicant replied by providing argument and a chart showing support for various claim limitations in U.S. application 12/788,246, which is the earliest application in the priority chain. *Id.* at 40–73. The Applicant argued and Petitioner appears to agree that "the disclosures of every member of this patent family are identical." *Id.* at 40; *see* Pet. 13 ("The disclosures of these [predecessor] applications are identical to that of the '554 application"). As will be discussed below, included in the Applicant's argument and supporting chart are all three claim limitations challenged by Petitioner.

In response, the Examiner allowed the application, stating: "Applicant's response . . . properly established priority to 26 May 2010. Accordingly, the previously applied . . . references no longer qualify as prior art." Ex. 1005, 22.

We now address the three limitations from claim 1 challenged by Petitioner.

> *b) A Data Parameter from a Network Connected to the Thermostat Being an Outside Weather Condition Collected from a Source External to the Building*

Claim 1 recites:

> one or more processors configured . . . to: receive . . . a second data parameter from a network connected to the thermostat, wherein the second data parameter comprises an outside weather condition collected from a source external to the building.

Petitioner argues that this limitation is not disclosed in the '554 application. Pet. 12. However, Petitioner acknowledges that this limitation was at issue in the prosecution of the application that became the '890 patent. *Id.* at 14 (citing Ex. 1005, 46–49). As the same arguments were previously presented to the Office, we must now determine whether Petitioner has demonstrated that the Office made a material error in determining that the '554 application provides sufficient support. *Advanced Bionics*, 8.

Whether there is written description support requires an analysis of the "four corners of the specification from the perspective of a person of ordinary skill in the art" to see whether one skilled in the art would understand that the inventor had possession of the claimed subject matter. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). Further, written description support does not require word for word support. *Id.* at 1352.

Petitioner argues that though the '554 application references data related to outside weather conditions, it "does not disclose its source." Pet. 12–13. In particular, Petitioner argues that the '554 application "does not make clear whether the 'weather data' comes from a network" or "describe data as being 'collected from a source external to the building.'" *Id.* at 13.

Petitioner acknowledges the support cited by the Applicant during examination, but argues that:

> The passages referenced by the Applicant, however, merely provided several references to weather data, followed by a copy of Fig. 2 (presumably provided to show a network). (Ex. 1005, pp. 046-049) (Ex. 1002, ¶54). Importantly, however, the Applicant never connected the two types of disclosures, for example, by showing that the weather data (even assuming it was collected from a source outside the building) was received from a network shown in Fig. 2. (Ex. 1002, ¶54).

Id. at 14.

Petitioner's argument fails to identify any material errors by the Examiner.

First, we determine that Petitioner makes no credible argument that one of skill in the art would not understand the '554 application to teach that weather data is obtained from outside a building or that the Examiner erred in making such a determination. Petitioner acknowledges that the '554 application teaches data comprising an outside weather condition. *Id.* at 12–14. Data of an outside weather condition necessarily ultimately comes from a source outside of a building; otherwise it would not be an "outside" weather condition.

Contrary to Petitioner's argument, the claim does not require that the outside weather condition be transmitted from a source external to the building to the one or more processors through a network connected to the thermostat. *See id.* at 14. The claim states that the "outside weather condition [is] collected from a source external to the building," but then only requires that the outside weather condition be received by the one or more processors from a network connected to the thermostat. Thus, how it is collected and how it is received is not linked or required by the claim language.

Secondly, Figure 2 relied on by the Applicant shows that the entire system is set-up on a network. Thus, Figure 2 shows "a network connected to the thermostat" as required by the claim and sharing of data comes across the network, such as would occur when a server having a processor retrieves data, such as an outside weather condition, from a storage database on another server in the network. *See e.g.*, Ex. 1005, 46; Ex. 1007, 399 at ¶¶ 81, 84, 406 at ¶ 110, 440–441.

Petitioner's reasoning appears to be based on the misconception that word for word support is required, and does not appear to consider the application as a whole. For example, Petitioner fails to address what one of skill in the art would understand from the disclosure as a whole in light of the system being set-up as a network. Further, Petitioner's declarant merely parrots Petitioner's statements without any further explanation. *See* Ex. 1002 ¶¶ 51–55.

Thus, we determine that Petitioner has not demonstrated that the Office made a material error in determining that the '554 application provides sufficient support for this limitation. We further determine that the Petition fails to show by a reasonable likelihood that this limitation is not supported by the '554 application.

c) Geo-Positioning Data Indicating the Building is Unoccupied by the User

Claim 1 requires:

> one or more processors configured . . . to: . . . receive geo-positioning data from the location-aware mobile device and automatically adjust a temperature value based on the geo-positioning data, including initiating at least one cooling or heating cycle for the HVAC system when the geo-positioning

data is determined to indicate that the building is unoccupied by the user.

Petitioner argues that this limitation is not disclosed in the '554 application. Pet. 14–15. Petitioner does not acknowledge that the Applicant presented arguments concerning support for this claim limitation during examination. *Id.* at. 12 (The effective-filing-date issues considered by the Examiner overlap with only one of the three issues raised here, namely the concept of "receiving the outdoor temperature from a network."); *see also id.* at 14–15; *see also* Ex. 1005, 62–65 (Applicant's chart with citations for support addressing this limitation).

We determine that these same arguments were previously before the Office. We further determine that Petitioner makes no attempt to show that the Examiner made a material error in determining that the '554 application provides sufficient support for this limitation.

Further, Petitioner does not address all of the disclosure in the '554 application relied on by the Applicant. *Compare* Ex. 1005, 62–65 *with* Pet. 16. Petitioner argues that the '554 application does not disclose "using geo-positioning data to determine that the building is **un**occupied, and in *that* case 'initiating at least one cooling or heating cycle.'" Pet. 15. Petitioner acknowledges that the '554 application teaches using geolocation data to change HVAC settings when the user is home, but argues it does not teach the same for when the user is away. *Id.*

By not addressing all of the citations provided by the Applicant, Petitioner fails to satisfy its burden to show how the Examiner erred and how the relied upon support is insufficient. We note in particular, that at

least Figure 8 (Ex. 1007, 448), relied on by Applicant (Ex. 1005, 63), and reproduced below provides sufficient disclosure for this limitation

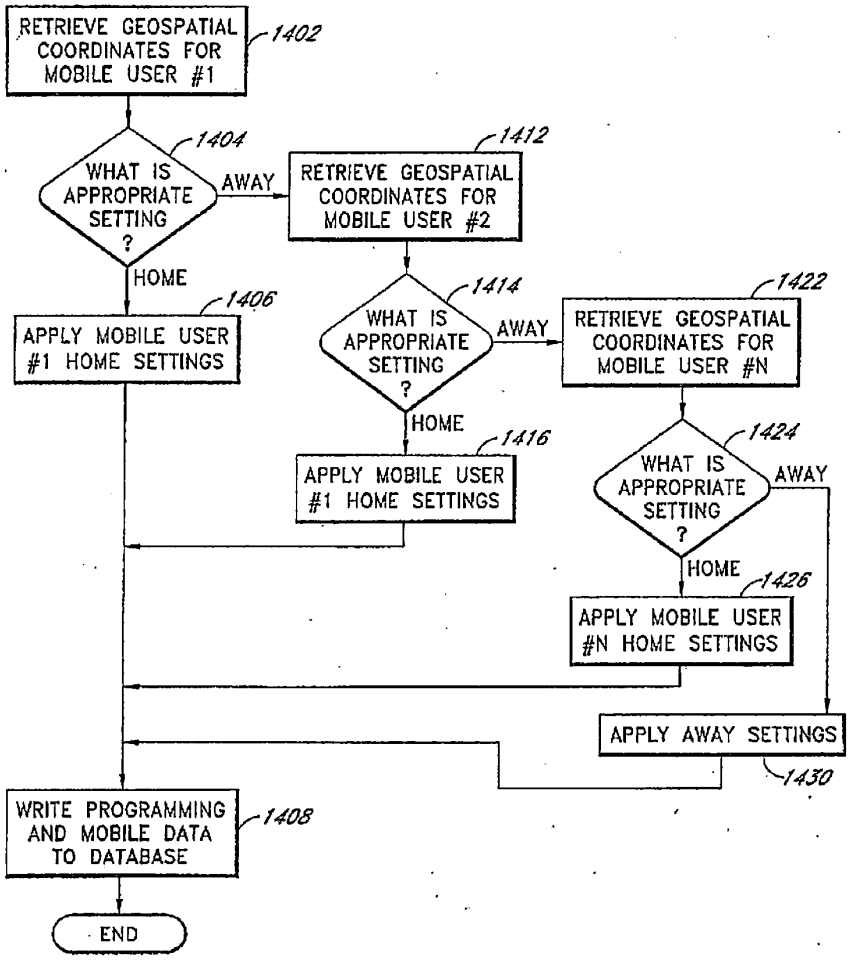


Figure 8 is a flow chart showing how HVAC settings are modified based on whether users are home or away. It can be seen that at steps 1402 and 1422 geospatial coordinates are received for users and at step 1430 away settings are applied to the HVAC system based on those geospatial coordinates.

We determine that it was reasonable for the Examiner to determine that this limitation was supported in view of Applicant's arguments and

chart with citations for support addressing this limitation (Ex. 1005, 62–65), as well as in view of the application file history and priority applications.

Thus, we determine that Petitioner has not demonstrated that the Office made a material error in determining that the '554 application provides sufficient support for this limitation. We further determine that the Petition fails to show by a reasonable likelihood that this limitation is not supported by the '554 application.

d) Analyze Data Parameters Specific to the User, Including Usage of the HVAC System

Claim 1 requires "electronic circuitry configured to analyze a plurality of data parameters specific to the user, including at least one data parameter relating to usage of the HVAC system at various times; and electronic circuitry configured to generate and communicate usage metrics pertaining to the HVAC system over time."

Petitioner argues that this limitation is not disclosed in the '554 application. Pet. 16. Petitioner does not acknowledge that the Applicant presented arguments concerning support for this claim limitation during examination. *Id.* at 12 (The effective-filing-date issues considered by the Examiner overlap with only one of the three issues raised here, namely the concept of "receiving the outdoor temperature from a network."); *see also id.* at 16; *see also* Ex. 1005, 51–59 (Applicant's chart with citations for support for this limitation).

We determine that these same arguments were previously before the Office. We further determine that Petitioner makes no attempt to show that the Examiner made a material error in determining that the '554 application provides sufficient support for this limitation.

Further, Petitioner does not address all of the disclosure in the '554 application relied on by the Applicant. Applicant's chart with citations for support for this limitation includes eight pages of citations including figures and paragraphs from the '554 application. *See* Ex. 1005, 51–59. Petitioner's analysis is less than one page, and essentially merely lists what Petitioner asserts is not disclosed. Pet. 16. Petitioner fails to satisfy its burden to show how the Examiner erred and how the relied upon support is insufficient.

We determine that it was reasonable for the Examiner to determine that this limitation was supported in view of Applicant's arguments and chart with citations for support addressing this limitation (Ex. 1005, 51–59), as well as in view of the application file history and priority applications.

Thus, we determine that Petitioner has not demonstrated that the Office made a material error in determining that the '554 application provides sufficient support for this limitation.

2. Conclusion as to 35 U.S.C. § 325(d)

As discussed in detail above, the Quam and Modi references only qualify as prior art that can be used against the '890 patent if the '890 patent is not entitled to priority. However, the Petition fails to establish that the Examiner erred in determining that the '890 patent is entitled to its priority claim. We exercise our discretion to decline to reconsider the issue of priority which has already been addressed by the Office. Thus, the Petition cannot show that Quam and Modi are prior art that can be used against the '890 patent. As Quam is essential to all grounds in the Petition, we exercise our discretion under 35 U.S.C. § 325(d) to decline to institute.

III. CONCLUSION

For the foregoing reasons, we do not institute trial.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), no *inter partes* review as to any claim of U.S. Patent 10,584,890 B2 is instituted.

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AO 120 (Rev. 08/10)

TO:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-00068	1/18/2022	Western District of Texas

PLAINTIFF	DEFENDANT
ECOFACTOR, INC.	AMAZON.COM, INC.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	10,534,382	1/14/2020	EcoFactor, Inc.
2	10,584,890	3/10/2020	EcoFactor, Inc.
3			
4			
5		Format m/d/yyyy	

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
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AO 120 (Rev. 08/10)

TO:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
6:21-cv-00428	4/28/2021	Western District of Texas

PLAINTIFF	DEFENDANT
ECOFACTOR, INC.	ECOBEE, INC.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	8,740,100	6/3/2014	EcoFactor, Inc.
2	8,751,186	6/10/2014	EcoFactor, Inc.
3	9,194,597	11/24/2015	EcoFactor, Inc.
4	10,584,890	3/10/2020	EcoFactor, Inc.
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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4		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	03/10/2020	10584890	EFACT.012C5	6388

20995 7590 02/19/2020

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ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

John Douglas Steinberg, Millbrae, CA;
EcoFactor, Inc., Redwood City, CA;

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UNITED STATES PATENT AND TRADEMARK OFFICE

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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5	6388

7590 01/31/2020

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EXAMINER	
NORMAN, MARC E	

ART UNIT	PAPER NUMBER
3763	

NOTIFICATION DATE	DELIVERY MODE
01/31/2020	ELECTRONIC

NOTICE OF NON-COMPLIANT INFORMATION DISCLOSURE STATEMENT

An Information Disclosure Statement (IDS) filed 1·28·2020 in the above-identified application fails to meet the requirements of 37 CFR 1.97(d) for the reason(s) specified below. Accordingly, the IDS will be placed in the file, but the information referred to therein has not been considered.

The IDS is not compliant with 37 CFR 1.97(d) because:

☑ The IDS lacks a statement as specified in 37 CFR 1.97(e).

☐ The IDS lacks the fee set forth in 37 CFR 1.17(p).

☐ The IDS was filed after the issue fee was paid. Applicant may wish to consider filing a petition to withdraw the application from issue under 37 CFR 1.313(c) to have the IDS considered. See MPEP 1308.

/M.L.B./
for 571-272-4200 or 1-888-786-0101
Application Assistance Unit
Office of Data Management

FORM PTOM327-B (Rev. 02/08)

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/374246
	Filing Date	April 3, 2019
	First Named Inventor	John Douglas Steinberg
	Art Unit	3763
(Multiple sheets used when necessary)	Examiner	Norman, Marc E.
SHEET 1 OF 1	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	2007/0267508	11/22/2007	Hoglund et al.	
	2	2009/0140060	06/04/2009	Stoner et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	**T[1]**

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	**T[1]**
	3	BEHROOZ, et al., Review of Control Techniques for HVAC Systems-Nonlinearity Approaches Based on Fuzzy Cognitive Maps, 41pages, 2018.	
	4	MAKELA, et al., HVAC Controls Guide for Plans Examiners and Building Inspectors, September 2011, 46 pages.	
	5	SOUTHFACE, Heating, Ventilation and Air Conditioning Controls, 3 pages, November 2019.	

32105965

Examiner Signature	Date Considered

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

Electronic Patent Application Fee Transmittal

Application Number:	16374246
Filing Date:	03-Apr-2019
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Filer:	John R. King/Amy Durrant
Attorney Docket Number:	EFACT.012C5

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt	
EFS ID:	38424499
Application Number:	16374246
International Application Number:	
Confirmation Number:	6388
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Customer Number:	20995
Filer:	John R. King/Elizabeth Rutherford
Filer Authorized By:	John R. King
Attorney Docket Number:	EFACT.012C5
Receipt Date:	28-JAN-2020
Filing Date:	03-APR-2019
Time Stamp:	18:02:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1000
RAM confirmation Number	E20201RI02407107
Deposit Account	111410
Authorized User	Elizabeth Rutherford
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)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	EFACT-012C5_issuefee.pdf	218326 88b39e34ca38abb2b52f3a1f48ba593f5745b3de	no	1
Warnings:					
Information:					
2	Miscellaneous Incoming Letter	EFACT-012C5_comments.pdf	16382 5a24cfa922a2f8e8faedad4903b925fcc1a842f8	no	2
Warnings:					
Information:					
3		EFACT-012C5_IDS.pdf	34331 3ac20aa6e4c5d41a1e9a8f02b3da6ec67c224cfe	yes	2

Multipart Description/PDF files in .zip description

Document Description	Start	End
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Form (SB08)	2	2

Warnings:					
Information:					
4	Non Patent Literature	EFACT-012C5_REF3.pdf	5296469 2fcfaf3ba040eb1ddf99939770e50451a83a0244	no	41
Warnings:					
Information:					
5	Non Patent Literature	EFACT-012C5_REF4.pdf	5098448 1d7b4d92acb13ad2361b8aa970333a9ad369c38d	no	46
Warnings:					
Information:					

6	Non Patent Literature	EFACT-012C5_REF5.pdf	592929 de06771479808952 4b86f996e6e74c042b777a97	no	3
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	30626 6fd2c6d14b17535fc40b72c91eae0ee021a601db	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	11287511	

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.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

20995 7590 11/01/2019
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5	6388

TITLE OF INVENTION: SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	02/03/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
NORMAN, MARC E	3763	236-051000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Knobbe, Martens,
2 Olson & Bear, LLP
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: EcoFactor, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Redwood City, CA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge ~~the required fee(s)~~, any deficiency, or credit any overpayment to Deposit Account No. 11-1410

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /John R. King/ Date January 28, 2020

Typed or printed name John R. King Registration No. 34,362

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Ex. 1004.0026

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor	:	John Douglas Steinberg
App. No.	:	16/374,246
Filed	:	April 3, 2019
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Examiner	:	Marc E. Norman
Art Unit	:	3763
Conf. No.	:	6388

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Statement of Reasons for Allowance in the Notice of Allowance mailed November 1, 2019, Applicant respectfully submits the following comments.

Applicant respectfully disagrees with the Examiner's statement of reasons for allowance to the extent that the limitations recited by the Examiner are not present in all of the claims. Also, to the extent that there is any implication that the patentability of the claims rests on the recitation of a single feature, Applicant respectfully disagrees with the Examiner's Statement because it is the combination of features that makes the claims patentable.

Applicant submits that the claims of the present application are allowable because each of the claims recites a combination of features that are not taught or suggested by the prior art.

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: January 28, 2020

By:/John R. King/
John R. King
Registration No. 34,362
Attorney of Record
Customer No. 20,995
(949) 760-0404

32105653

INFORMATION DISCLOSURE STATEMENT

First Inventor	:	John Douglas Steinberg
App. No.	:	16/374,246
Filed	:	April 3, 2019
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Examiner	:	Norman, Marc E.
Art Unit	:	3763
Conf. No.	:	6388

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Pursuant to 37 CFR 1.56, an Information Disclosure Statement listing references is provided herewith. Copies of any listed foreign and non-patent literature references are being submitted.

No Disclaimers

To the extent that anything in the Information Disclosure Statement or the listed references could be construed as a disclaimer of any subject matter supported by the present application, Applicant hereby rescinds and retracts such disclaimer.

Timing of Disclosure

This Information Disclosure Statement is being filed after the mailing date of a final action or after the mailing date of a Notice of Allowance. Please place these references in the file in accordance with 37 CFR 1.97(i).

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: January 28, 2020

By:/John R. King/
John R. King
Registration No. 34,362
Registered Practitioner
(949) 760-0404

32106454

Please Direct All Correspondence to Customer Number 20,995

RESCISSION OF ANY PRIOR DISCLAIMERS AND REQUEST TO REVISIT ART

Inventor	:	John Douglas Steinberg
App. No	:	16/374,246
Filed	:	April 3, 2019
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Examiner	:	Norman, Marc E.
Art Unit	:	3763
Conf #	:	6388

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The claims of the present application are different and possibly broader in scope than the claims pursued in the parent applications. To the extent any prior amendments or characterizations of the scope of any claim or referenced art could be construed as a disclaimer of any subject matter supported by the present disclosure, Applicant hereby rescinds and retracts such disclaimer. Accordingly, the references previously considered in the parent applications may need to be re-visited.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Knobbe, Martens, Olson & Bear, LLP

Respectfully submitted,

Dated: November 26, 2019

By:/John R. King/
John R. King
Registration No. 34,362
Registered Practitioner
Customer No. 20,995
(949) 760-0404

31761952

Electronic Acknowledgement Receipt

EFS ID:	37865544
Application Number:	16374246
International Application Number:	
Confirmation Number:	6388
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Customer Number:	20995
Filer:	John R. King/Jennifer Neat
Filer Authorized By:	John R. King
Attorney Docket Number:	EFACT.012C5
Receipt Date:	26-NOV-2019
Filing Date:	03-APR-2019
Time Stamp:	14:49:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	EFACT-012C5_rescission.pdf	76911 c7b9fc3b3460d1d023de128a0f54aa43b93200fb	no	1

Warnings:

Information:	
Total Files Size (in bytes):	76911

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

20995 7590 11/01/2019

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
NORMAN, MARC E	
ART UNIT	PAPER NUMBER
3763	

DATE MAILED: 11/01/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5	6388

TITLE OF INVENTION: SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	02/03/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

Ex. 1004.0033

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

20995 7590 11/01/2019
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5	6388

TITLE OF INVENTION: SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	02/03/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
NORMAN, MARC E	3763	236-051000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Ex. 1004.0034

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5	6388

20995 7590 11/01/2019

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
NORMAN, MARC E	

ART UNIT	PAPER NUMBER
3763	

DATE MAILED: 11/01/2019

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Ex. 1004.0035

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. 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 30 minutes 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, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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.

Notice of Allowability	Application No. 16/374,246	Applicant(s) Steinberg, John Douglas	
	Examiner MARC E NORMAN	Art Unit 3763	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to amendment filed 10 October 2019.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-6 and 9-19 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/MARC E NORMAN/
Primary Examiner, Art Unit 3763

REASONS FOR ALLOWANCE

Claims 1-6 and 9-19 are allowed.

The following is an examiner's statement of reasons for allowance: Applicant's response filed 10 October 2019 properly established priority to 26 May 2010. Accordingly, the previously applied Adamek and Sloo references no longer qualify as prior art. As per independent claim 1, the prior art does not teach the thermostat system combination as recited, and in particular wherein the one or more processors are configured to perform the following combined functions: determine a first temperature setpoint data parameter that includes a first temperature and a first time value; determine a second temperature setpoint data parameter that includes a second temperature and a second time value; automatically adjust a temperature value based on received geo-positioning data including initiating at least one cooling or heating cycle when the geo-positioning data is determined to indicate that the building is unoccupied by the user; analyze a plurality of data parameters specific to the user; generate and communicate usage metrics pertaining to the HVAC system over time; and a compressor delay circuit to delay the stop or start of a compressor of the HVAC system and protect the system from rapid cycling.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARC E NORMAN whose telephone number is (571)272-4812. The examiner can normally be reached on 8:30-5:00 M-F.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frantz Jules can be reached on 571-272-6681. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MARC E NORMAN/
Primary Examiner, Art Unit 3763

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	Art Unit
	MARC E NORMAN	3763

CPC - Searched*		
Symbol	**Date**	**Examiner**
F24F 11/30, 46, 52, 58, 62; 2120/10; 2130/00, 10	06/26/2019	MN
G05D 23/1905, 1951	06/26/2019	MN
H04Q 9/00	06/26/2019	MN
Y02D 70/1222, 1224, 142, 144, 164, 26	06/26/2019	MN
updated above	10/22/2019	MN

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
EAST search (see attached)	06/26/2019	MN
Inventor name search	06/26/2019	MN
Consulted parent cases	06/26/2019	MN
EAST update search	10/22/2019	MN

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	See attached EAST update search	10/22/2019	MN

/MARC E NORMAN/ Primary Examiner, Art Unit 3763	

Ex. 1004.0040

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	Art Unit
	MARC E NORMAN	3763

/MARC E NORMAN/ Primary Examiner, Art Unit 3763	

Ex. 1004.0041

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	**Art Unit**
	MARC E NORMAN	3763

CPC								
Symbol							**Type**	**Version**
F24F	/	11	/	30			F	2018-01-01
F24F	/	11	/	62			I	2018-01-01
G05D	/	23	/	1905			I	2013-01-01
G05D	/	23	/	1951			I	2013-01-01
H04Q	/	9	/	00			I	2013-01-01
Y02D	/	70	/	26			A	2018-01-01
Y02D	/	70	/	1224			A	2018-01-01
Y02D	/	70	/	1222			A	2018-01-01
Y02D	/	70	/	164			A	2018-01-01
H04Q	/	2209	/	84			A	2013-01-01
H04Q	/	2209	/	40			A	2013-01-01
F24F	/	11	/	46			A	2018-01-01
F24F	/	11	/	58			A	2018-01-01
F24F	/	2130	/	00			A	2018-01-01
F24F	/	2130	/	10			A	2018-01-01
F24F	/	11	/	52			A	2018-01-01
Y02D	/	70	/	00			A	2018-01-01
Y02D	/	70	/	142			A	2018-01-01
Y02D	/	70	/	144			A	2018-01-01
F24F	/	2120	/	10			A	2018-01-01
H04W	/	4	/	02			A	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	17	
/MARC E NORMAN/ Primary Examiner, Art Unit 3763	22 October 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20191022

Ex. 1004.0042

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	**Art Unit**
	MARC E NORMAN	3763

INTERNATIONAL CLASSIFICATION				
CLAIMED				
F24F	/	11	/	30
F24F	/	11	/	62
G05D	/	23	/	19

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	17	
/MARC E NORMAN/ Primary Examiner, Art Unit 3763	22 October 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20191022

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	**Art Unit**
	MARC E NORMAN	3763

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	4	10	17	19										
2	2	9	11		20										
5	3	10	12												
6	4	11	13												
7	5	13	14												
8	6	12	15												
	7	14	16												
	8	15	17												
3	9	16	18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	17	
/MARC E NORMAN/ Primary Examiner, Art Unit 3763	22 October 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20191022

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	**Art Unit**
	MARC E NORMAN	3763

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/01/2019	10/22/2019							
1	1	✓	=							
2	2	✓	=							
5	3	✓	=							
6	4	✓	=							
7	5	✓	=							
8	6	✓	=							
	7	✓	-							
	8	✓	-							
3	9	✓	=							
4	10	✓	=							
9	11	✓	=							
10	12	✓	=							
11	13	✓	=							
13	14	✓	=							
12	15	✓	=							
14	16	✓	=							
15	17	✓	=							
16	18	✓	=							
17	19	✓	=							
	20	✓	-							

Ex. 1004.0045

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/374,246
	Filing Date	April 3, 2019
	First Named Inventor	John Douglas Steinberg
	Art Unit	3763
(Multiple sheets used when necessary)	Examiner	Norman, Marc E.
SHEET 1 OF 1	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	10,316,581	06-11-2019	Nagel	
	2	10,339,232	07-02-2019	Hoff	
	3	10,393,398 (EFACT.013C5)	08-27-2019	Steinberg	
	4	2005/0270151	12-08-2005	Winick	
	5	2010/0070084	03-18-2010	Steinberg, et al.	
	6	2011/0282504	11-17-2011	Besore, et al.	
	7	2012/0065789	03-15-2012	Scelzi	
	8	2012/0234932	09-20-2012	Okamoto	
	9	2012/0271576	10-25-2012	Kamel	
	10	2014/0277795	09-18-2014	Matsuoka	
	11	2015/0159928	06-11-2015	Hancock	
	12	2016/0290668	10-06-2016	Taylor, et al.	
	13	2017/0329357	11-16-2017	Torres, et al.	
+	**14**	2019/0186771	06-20-2019	Steinberg et al.	
	15	2019/0187005	06-20-2019	Steinberg et al.	
	16	2019/0227582	07-25-2019	Steinberg	
	17	2019/0234810	08-01-2019	Steinberg, et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]

31479852

Examiner Signature	/MARC E NORMAN/	Date Considered	10/22/2019

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.E.N/

T[1] - Place a check mark in this area when an English language Translation is attached.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	10961	thermostat and (electrical adj connect$4)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:34
L2	5570	1 and display	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:34
L3	4084	2 and wireless$2	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:34
L4	46	3 and ((location adj aware) or (geo adj positioning) or geopositioning)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:35
L5	337	3 and ((interior or indoor or inside) adj temperature)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:36
L6	5	4 and ((interior or indoor or inside) adj temperature)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:36
L7	507	3 and (weather adj condition)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:38
L8	3	6 and (weather adj condition)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:38
L9	167	5 and (weather adj condition)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:38
L10	1730	3 and ((location adj aware) or (geo adj positioning) or geopositioning or gps)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:39
L11	210	10 and ((interior or indoor or inside) adj temperature)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:39
L12	138	11 and (weather adj condition)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:40

L13	54	12 and (setpoint or (set adj point))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:40
L15	136	steinberg-john$.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:42
L16	1	11 and 15	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:43
L17	3	11 and (compressor near2 delay)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:43
L18	3	10 and (compressor near2 delay)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:44
L19	9	3 and (compressor near2 delay)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:44
L20	17385	f24f11/30,46.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:47
L21	9111	f24f11/52,58,62.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 09:51
L26	2256	f24f2120/10.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:02
L27	853	f24f2130/00,10.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:09
L28	1639	g05d23/1905,1951.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:19
L31	13226	h04q9/00.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:31
L32	10235	y02d70/1222,1224.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:48
L33	64376	usage adj (metrics or statistics or data)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:51
L34	643	3 and 33	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2019/10/22 10:51

			DERWENT			
L35	78	5 and 33	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:51
L36	0	15 and 33	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/10/22 10:51
L37	9	(("10316581") or ("10339232") or ("10393398") or ("20050270151") or ("20100070084") or ("20110282504") or ("20120065789") or ("20120234932") or ("20120271576")).PN.	US-PGPUB; USPAT	OR	OFF	2019/10/22 11:51
L38	7	(("20140277795") or ("20150159928") or ("21060290668") or ("20170329357") or ("20190186771") or ("20190187005") or ("20190227582") or ("20190234810")).PN.	US-PGPUB; USPAT	OR	OFF	2019/10/22 11:54

10/ 22/ 2019 11:56:46 AM
C:\ Users\ mnorman1\ Documents\ EAST\ Workspaces\ 16374246a.wsp

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
16/374,246	04/03/2019	EcoFactor, Inc.	EFACT.012C5	97515

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 10/10/2019 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

X Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/John R. King/
Name:	John R. King
Registration Number:	34362

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/374,246
	Filing Date	April 3, 2019
	First Named Inventor	John Douglas Steinberg
	Art Unit	3763
(Multiple sheets used when necessary)	Examiner	Norman, Marc E.
SHEET 1 OF 1	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	10,316,581	06-11-2019	Nagel	
	2	10,339,232	07-02-2019	Hoff	
	3	10,393,398 (EFACT.013C5)	08-27-2019	Steinberg	
	4	2005/0270151	12-08-2005	Winick	
	5	2010/0070084	03-18-2010	Steinberg, et al.	
	6	2011/0282504	11-17-2011	Besore, et al.	
	7	2012/0065789	03-15-2012	Scelzi	
	8	2012/0234932	09-20-2012	Okamoto	
	9	2012/0271576	10-25-2012	Kamel	
	10	2014/0277795	09-18-2014	Matsuoka	
	11	2015/0159928	06-11-2015	Hancock	
	12	2016/0290668	10-06-2016	Taylor, et al.	
	13	2017/0329357	11-16-2017	Torres, et al.	
+	**14**	2019/0186771	06-20-2019	Steinberg et al.	
	15	2019/0187005	06-20-2019	Steinberg et al.	
	16	2019/0227582	07-25-2019	Steinberg	
	17	2019/0234810	08-01-2019	Steinberg, et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	**T[1]**

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	**T[1]**

31479852

Examiner Signature	Date Considered

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

Electronic Patent Application Fee Transmittal

Application Number:	16374246
Filing Date:	03-Apr-2019
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Filer:	John R. King/Amy Durrant
Attorney Docket Number:	EFACT.012C5

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	37422374
Application Number:	16374246
International Application Number:	
Confirmation Number:	6388
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Customer Number:	20995
Filer:	John R. King/Melissa Ramirez
Filer Authorized By:	John R. King
Attorney Docket Number:	EFACT.012C5
Receipt Date:	10-OCT-2019
Filing Date:	03-APR-2019
Time Stamp:	15:13:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$240
RAM confirmation Number	E201900F14244578
Deposit Account	111410
Authorized User	Melissa Ramirez

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)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		EFACT-012C5_response.pdf	7453117 116c446f787c08cdcf7a06261adedf482691a225	yes	52
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	6	
	Applicant Arguments/Remarks Made in an Amendment		7	52	
Warnings:					
Information:					
2		EFACT-012C5_IDS.pdf	36673 30adfe8f6da9a12d02a5e346f2cd013188108958	yes	3
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	3	
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30900 28f01c2d766dc45e92e3ab23f385b30e47346e67	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	7520690		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Inventor	:	John Douglas Steinberg
App. No.	:	16/374,246
Filed	:	April 03, 2019
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Examiner	:	Norman, Marc E
Art Unit	:	3763
Conf. No.	:	6388

RESPONSE AND AMENDMENT TO OFFICE ACTON DATED JULY 12, 2019

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Office Action dated July 12, 2019, Applicant respectfully submits the following amendments and comments.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

Please cancel Claims 7, 8, and 20, and amend Claims 1-6 and 9-19 as follows:

1. (Currently Amended) A thermostat system comprising:

a housing;

electrical contacts configured to connect the thermostat with wires that allow for at least two electrical connections from a building's HVAC system to the contacts;

a display ~~unit~~ configured to present information to a user;

~~a memory configured to store data;~~

a wireless radio compatible with a ~~the IEEE 802.11~~ wireless radio frequency protocol and configured to communicate bi-directionally with a location-aware mobile ~~remote~~ device;

a temperature sensor; ~~and~~

~~one or more processors;~~

~~the~~ one or more processors configured with electronic circuitry to:

receive HVAC data parameters, including a first data parameter from the temperature sensor comprising an interior temperature inside the building; and

~~the one or more processors further configured to receive~~ a second data parameter from a network connected to the thermostat~~connection~~, wherein the second data parameter ~~from the network connection~~ comprises an outside weather condition ~~is~~ collected from a source external to the building~~, wherein the second data comprises an outdoor temperature~~;

~~the one or more processors further configured to receive~~determine a first temperature setpoint data parameter for the building, wherein the

first setpoint data parameter includes a first temperature value and a first time value;

~~the one or more processors further configured to receive~~determine a second temperature setpoint data parameter for the building, wherein the second setpoint data parameter includes a second temperature value and a second time value;

~~the one or more processors further configured to~~ receive radio frequency signals ~~commands through the Internet by way of~~ from the location-aware mobile device~~a remote interface; wherein the interface is configured to allow the user to adjust temperature setpoints for the HVAC system~~;

receive geo-positioning data from the location-aware mobile device and automatically adjust a temperature value based on the geo-positioning data, including initiating at least one cooling or heating cycle for the HVAC system when the geo-positioning data is determined to indicate that the building is unoccupied by the user;

electronic circuity configured to allow the user to adjust a desired temperature for the HVAC system;

electronic circuitry configured to analyze a plurality of data parameters specific to the user, including at least one data parameter relating to usage of the HVAC system at various times; and

electronic circuitry configured to generate and communicate usage metrics pertaining to the HVAC system over time; and

a compressor delay circuit configured to delay the start or stop of a compressor for the HVAC system and protect the compressor from rapid cycling.

~~the one or more processors further configured to send user-specific data through the Internet, wherein user-specific information about the building and HVAC system is generated based at least in part on the user-specific data,~~

~~wherein the user-specific information is presented on a website accessible through the Internet;~~

~~the one or more processors further configured to automatically adjust a temperature setpoint to a third temperature setpoint without user intervention; and~~

~~the one or more processors further configured to control the HVAC system to provide heating or cooling to the building in accordance with the third temperature setpoint.~~

2. (Currently Amended) The thermostat system of claim 1, wherein the one or more processors is further configured to determine whether the building is occupied or unoccupied.

3. (Currently Amended) The thermostat system of claim 1, wherein the one or more processors is further configured to receive a third data parameter from a first sensor, wherein the third data parameter from the first sensor includes a measurement of at least one characteristic of a building within which the thermostat is located.

4. (Currently Amended) The thermostat system of claim 3, wherein the third data parameter from the first sensor comprises a measurement of the humidity of the building.

5. (Currently Amended) The thermostat system of claim 3, wherein the third data parameter from the first sensor comprises a measurement of sunlight.

6. (Currently Amended) The thermostat system of claim 5, wherein the second data parameter from the network connected to the thermostat~~connection~~ further comprises a measurement of the outdoor humidity.

7. (Canceled)

8. (Canceled)

9. (Currently Amended) The thermostat system of claim 2, further comprising anwherein the interface is configured to allow the user to input that the building is currently unoccupied.

10. (Currently Amended) The thermostat system of claim 9, wherein the determination of whether the building is occupied or unoccupied by the one or more processors is based at least in part on a fourth data parameter received from a motion sensor.

11. (Currently Amended) The thermostat system of claim 1, further comprising awherein the memory is further configured to store historical values of the first data parameter and second data parameter.

12. (Currently Amended) The thermostat system of claim 1, wherein the one or more processors is further configured to predict, based at least on the first data parameter, the second data parameter from the network connection, and the first temperature setpoint data parameter, the time necessary for the HVAC system to operate in order for the building to reach the first temperature value by the first time value.

13. (Currently Amended) The thermostat system of claim 12, wherein the one or more processors' prediction of the time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value is further based on determiningcalculating a rate of change value necessary for the building to reach the first temperature value by the first time value.

14. (Currently Amended) The thermostat system of claim 12, wherein the automatic adjustment of the temperature setpoint is based at least in part on the prediction of time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value.

15. (Currently Amended) The thermostat system of claim 13, wherein the automatic adjustment of the temperature setpoint is based at least in part on the rate of change value.

16. (Currently Amended) The thermostat system of claim 12, further comprising awherein the memory is further configured to store historical values of the first data parameter and second data parameter; and wherein the one or more processors' prediction of the time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value is further based on historical values of the first data parameter and second data parameter.

17. (Currently Amended) The thermostat system of claim 16 wherein the one or more processors determinescalculates one or more intermediate temperature setpoints that have a temperature value between a current temperature of the building and the first temperature setpoint.

18. (Currently Amended) The thermostat system of claim 16, wherein the automatic adjustment of the temperature setpoint is based at least in part on the prediction of time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value.

19. (Currently Amended) The thermostat system of claim 1, wherein the one or more processors is further configured to receive a fifth data parameter generated based at least in part on a previous operation of the HVAC system, wherein the fifth data parameter includes at least one performance characteristic of the HVAC system.

20. (Canceled)

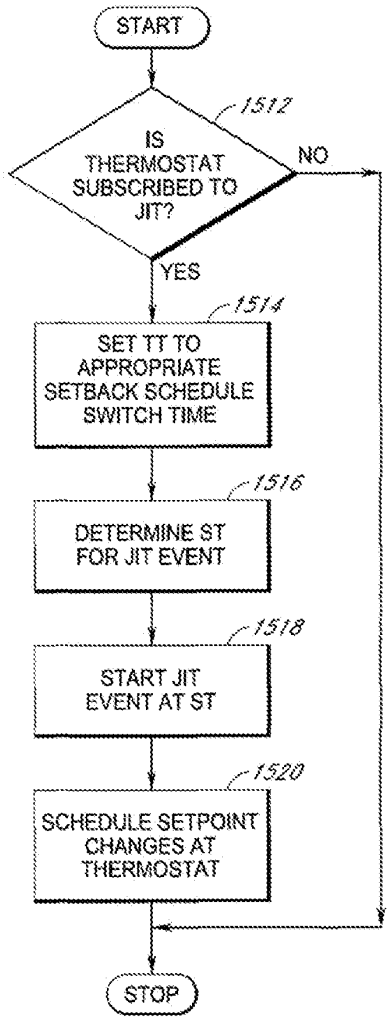
REMARKS

The July 12, 2019 Office Action was based upon pending Claims 1-20. This Amendment cancels Claims 7, 8, and 20, and amends Claims 1-6 and 9-19, which are presented for further consideration.

PRIORITY

Applicant respectfully disagrees with the Office Action's characterization that the pending claims of this application are not supported by the prior filed applications that this application claims priority to. Applicant presents the following table to show support for the limitations that were indicated in the Office Action as allegedly having insufficient support under 35 U.S.C. § 112. Although some of the claim limitations discussed in this portion of the Office Action are amended or deleted by way of this Amendment, Applicant does not admit that the amendments or deletions are due to insufficient support; rather, the amendments and deletions are made to further clarity the claimed invention. Further, Applicant provides support in the table below for limitations added or amended in this Amendment.

The disclosure support shown below is not meant to be exhaustive nor to suggest that the claim limitations are limited to the embodiments shown, but is rather provided only as representative examples of support. Although it is the Applicant's understanding that the disclosures of every member of this patent family are identical, for simplicity, Applicant will solely reference the disclosure in the first application of this patent family, 12/788,246 (U.S. Patent No. 8,556,188) in the table below.

Claim Elements	Representative Support From US 8,556,188
"first setpoint"; "second setpoint"; "third setpoint"; "a first temperature setpoint data parameter"; "a second temperature setpoint data parameter"	Fig. 10:  *FIG. 10*

	6:37-63: As shown in FIG. **6***a*, screen **351** of website **350** displays current temperature **352** as sensed by thermostat **108**. Clicking on "up" arrow **354** raises the setpoint **358**; clicking the down arrow **356** lowers setpoint **358**. Screen **351** may also convey information about the outside weather conditions, such as a graphic representation **360** of the sun, clouds, etc. In homes with multiple thermostats, screen **351** may allow users to select different devices to adjust or monitor. Users will be able to use screen **351** by selecting, for example, master bedroom thermostat **362**, living room thermostat **364**, game room thermostat **366**, or basement thermostat **368**. As shown in FIG. **6***b*, screen **370** allows users to establish programming schedules. Row **372** shows a 24-hour period. Programming row **374** displays various programming periods and when they are scheduled, such as away setting **376**, which begins at approximately 8 AM and runs until approximately 5:30 PM. When the away setting **376** is highlighted, the user can adjust the starting time and ending time for the setting by dragging the beginning time **378** to the left to choose an earlier start time, and dragging it to the right to make it later. Similarly, the user can drag ending time **380** to the left to make it earlier, and to the right to make it later. While away setting **376** is highlighted, the user can also change heating setpoint **382** by clicking on up arrow **384** or down arrow **386**, and cooling setpoint **388** by clicking on up arrow **390** or down arrow **392**. The user can save the program by clicking on save button **394**.

15:1-19:

FIG. **14** shows application of an embodiment of the subject invention in an actual house. Temperature and setpoints are plotted for the 4-hour period from 4 AM to 8 AM with temperature on the vertical axis and time on the horizontal axis. The winter nighttime setpoint **1592** is 60 degrees F.; the morning setpoint temperature **1594** is 69 degrees F. The outside temperature **1596** is approximately 45 degrees F. The target time TT **1598** for the setpoint change to morning setting is 6:45 AM. In the absence of embodiments of the subject invention, the homeowner could program the thermostat to change to the new setpoint at 6:45, but there is an inherent delay between a setpoint change and the response of the temperature inside the home. (In this home on this day, the delay is approximately fifty minutes.) Thus if the homeowner truly desired to achieve the target temperature at the target time, some anticipation would be necessary. The amount of anticipation required depends upon numerous variables, as discussed above.

Fig. 34:

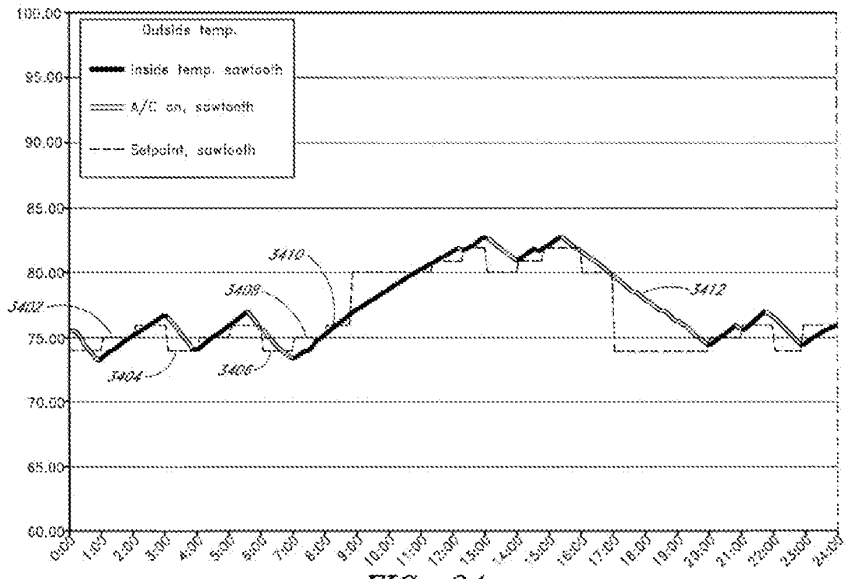


FIG. 34

Fig. 35:

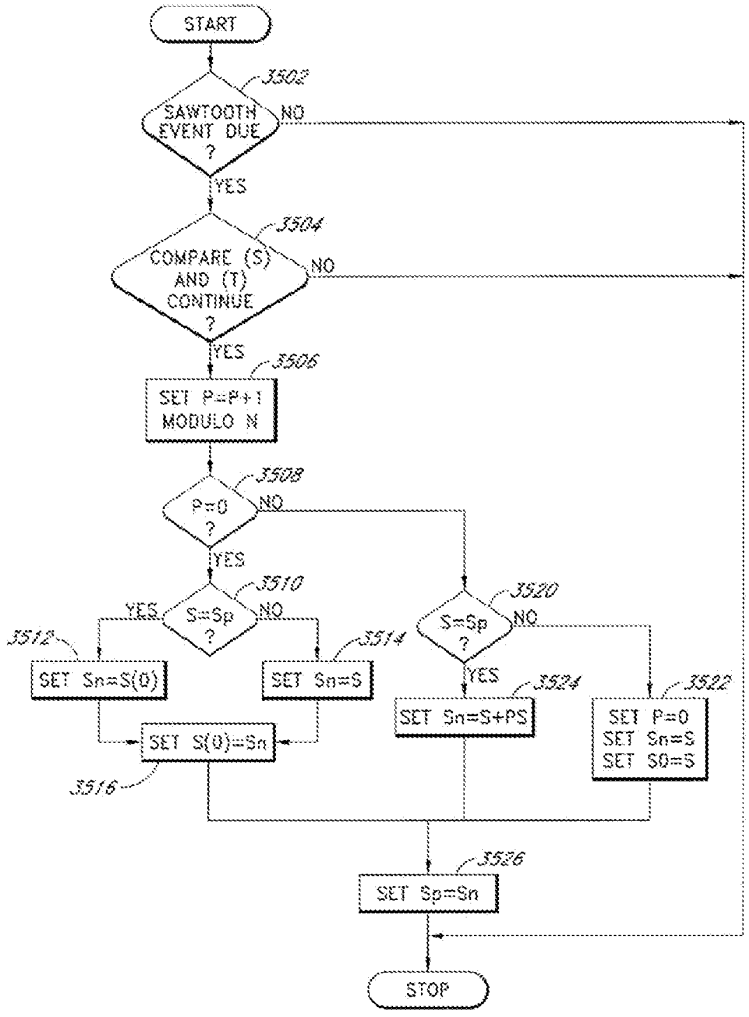

START
3502
SAWTOOTH EVENT DUE ?
NO
YES
3504
COMPARE (S) AND (T) CONTINUE ?
NO
YES
3506
SET P=P+1 MODULO N
3508
P=0 ?
NO
YES
3510
S=Sp ?
YES
NO
3512
SET Sn=S(0)
3514
SET Sn=S
3516
SET S(0)=Sn
3520
S=Sp ?
NO
YES
3524
SET Sn=S+PS
3522
SET P=0
SET Sn=S
SET S0=S
3526
SET Sp=Sn
STOP

FIG. 35

Fig. 36:

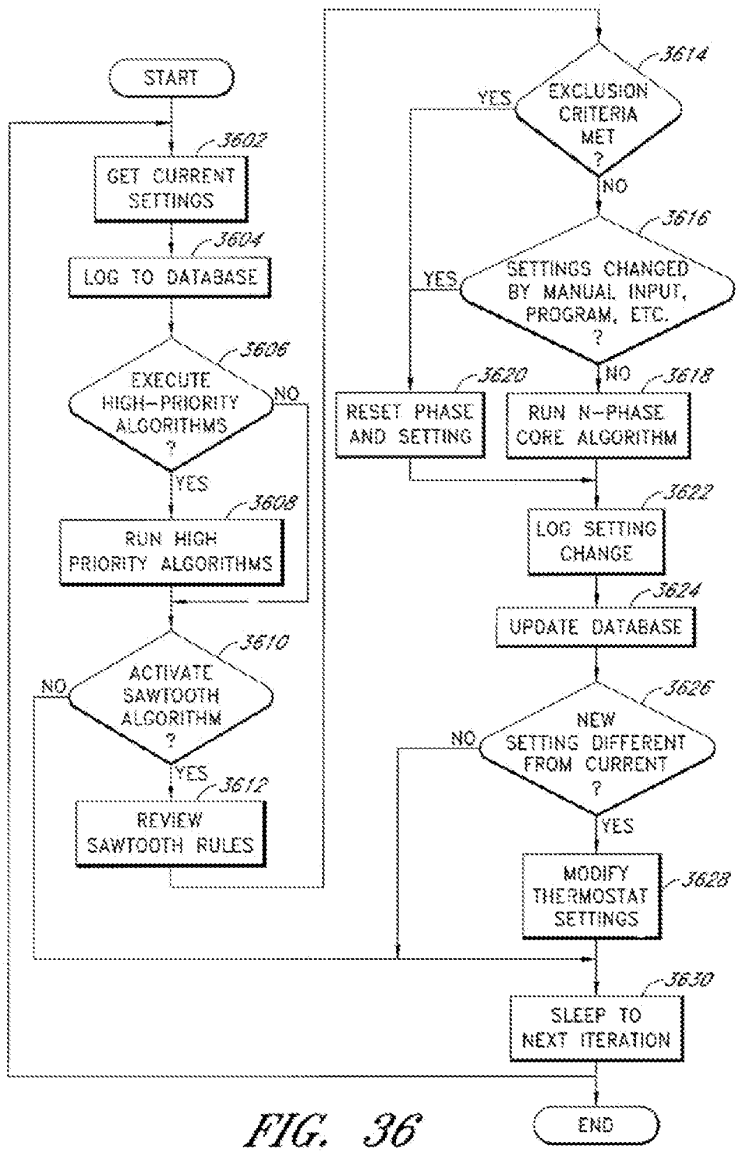


FIG. 36

Additional support:
28:3-49
29:15-41
30:24-46

"receiving the outdoor temperature from a network"; "wherein the second data parameter from the network connection comprises an outside weather condition"	13:5-20: In step **1534**, the server retrieves data used to calculate the appropriate start time with the given input parameters. This data includes a set of algorithmic learning data (ALD), composed of historic readings from the thermostat, together with associated weather data, such as outside temperature, solar radiation, humidity, wind speed and direction, etc; together with weather forecast data for the subject location for the period when the algorithm is scheduled to run (the weather forecast data, or WFD). The forecasting data can be as simple as a listing of expected temperatures for a period of hours subsequent to the time at which the calculations are performed, to more detailed tables including humidity, solar radiation, wind, etc. Alternatively, it can include additional information such as some or all of the kinds of data collected in the ALD. 20:16-31: Because server **106** logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database **300** will contain a history of the thermal performance of each house. That performance data will allow the server **106** to calculate an effective thermal mass for each such structure—that is, the speed with the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures. This will permit remote verification of load shedding by the air conditioner without directly measuring or recording the electrical load drawn by the air conditioner. 25:28-37:

FIG. **31** illustrates the steps involved in diagnosing defects in the HVAC system for specific home X. In step **3102**, the server retrieves climate data related to home X. Such data may include current outside temperature, outside temperature during the preceding hours, outside humidity, wind direction and speed, whether the sun is obscured by clouds, and other factors. In step **3104**, the server retrieves HVAC duty cycle data for home X. Such data may include target settings set by the thermostat in current and previous periods, the timing of switch-on and switch-off events and other data.

Fig. 13:

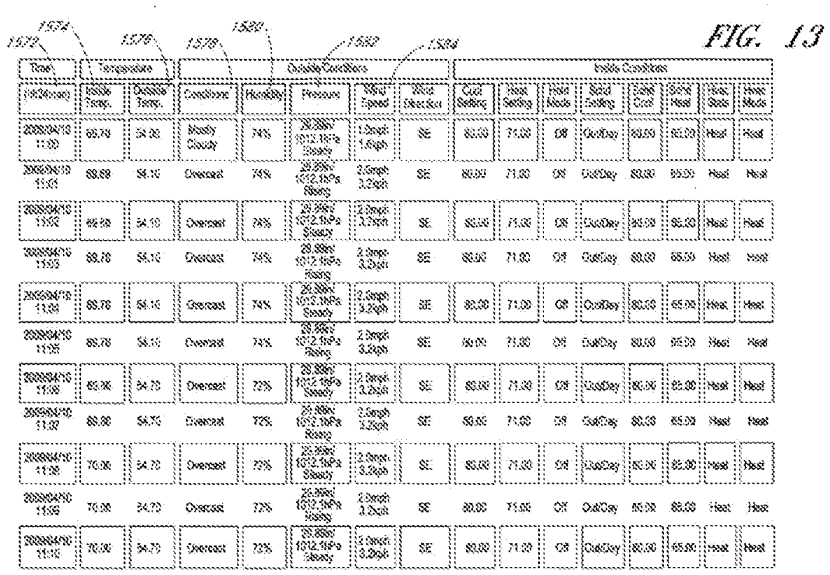


FIG. 13

Fig. 14:

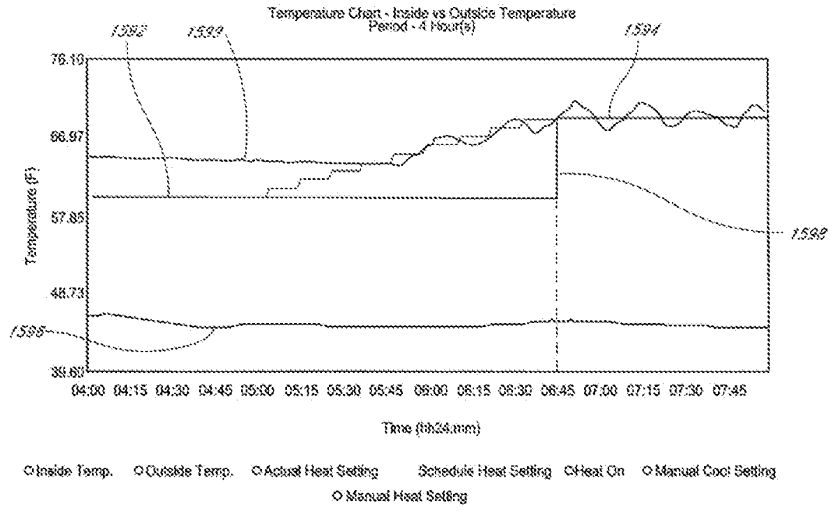
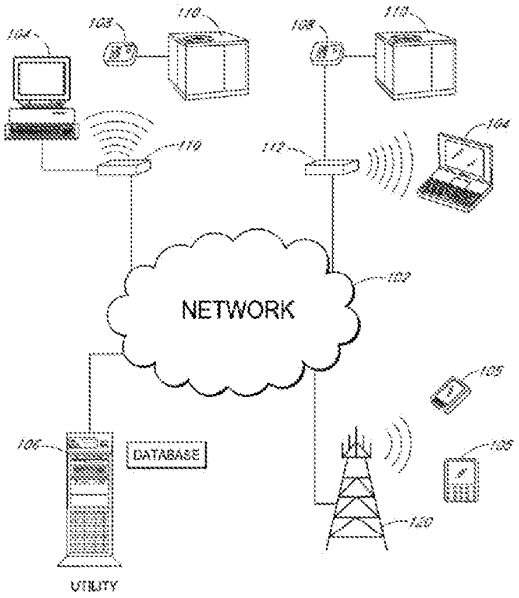
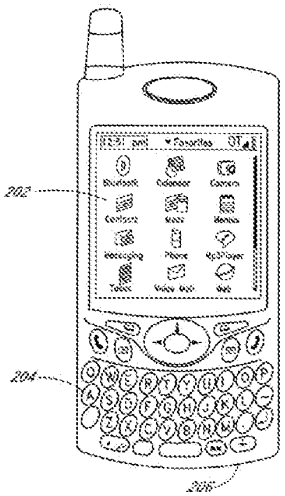

Temperature Chart - Inside vs Outside Temperature
Period - 4 Hour(s)
1592
1593
1594
1599
1595
76.10
66.97
57.85
48.73
39.60
Temperature (F)
04:00 04:15 04:30 04:45 05:00 05:15 05:30 05:45 06:00 06:15 06:30 06:45 07:00 07:15 07:30 07:45
Time (hh24:mm)
Inside Temp.
Outside Temp.
Actual Heat Setting
Schedule Heat Setting
Heat On
Manual Cool Setting
Manual Heat Setting

FIG. 14

Fig. 2:

	 *FIG. 2*
"the remote interface being configured to adjust temperature setpoints for the HVAC system"; "electronic circuity configured to allow the user to adjust a desired temperature for the HVAC system"	Fig. 3A:  *FIG. 3A* Fig. 6A:

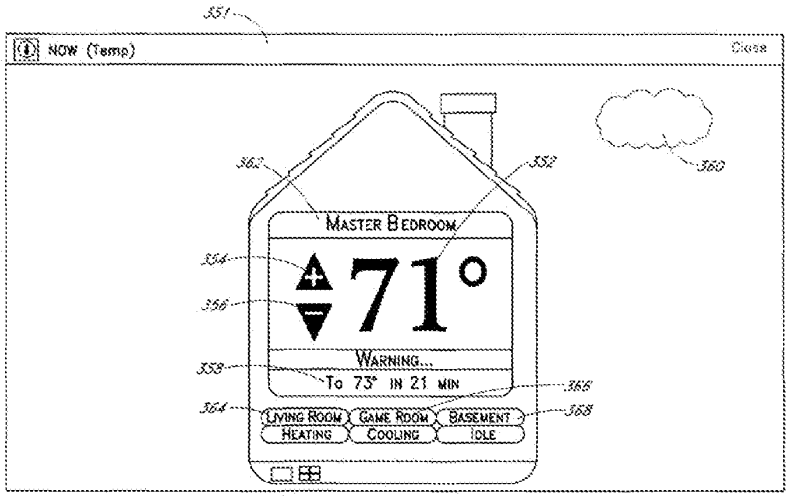


FIG. 6A

Fig. 6B:

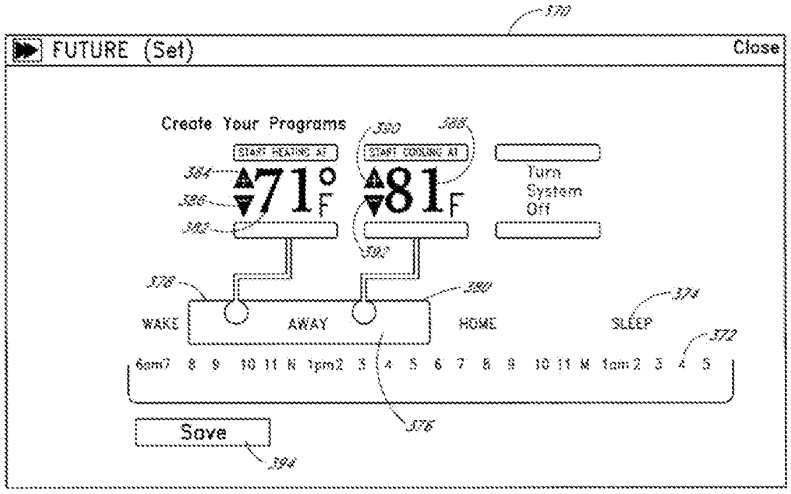
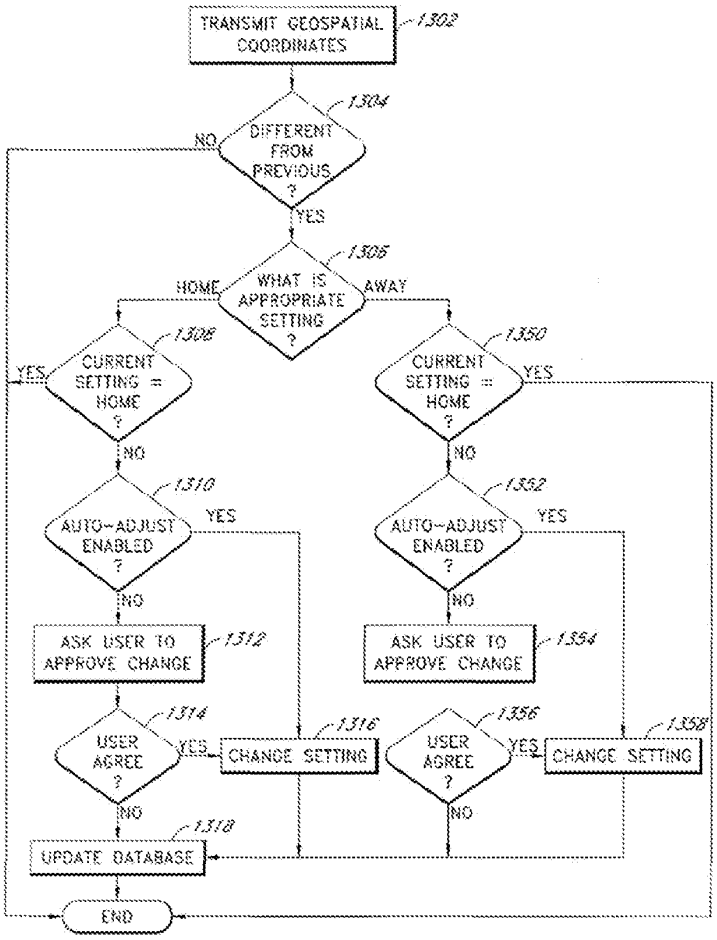


FIG. 6B

8:21-32:

	FIGS. **3***a* and **3***b* shows a representative mobile device **105** from the front and back, respectively. The front of the device includes a display **202**, and may include a physical keyboard **204**. Alternatively, a virtual keyboard may be included in a display with touchscreen functionality. For devices with voice capabilities, such as a smart phone, a microphone **206** and speaker **208** enable audio communications. An antenna **210**, which may be mounted entirely within the mobile device, aids wireless communications. Modules included within mobile device **105** but not visible from the outside may include memory cards, microprocessors, GPS receivers, battery, etc. 9:37-63: As shown in FIG. **6***a*, screen **351** of website **350** displays current temperature **352** as sensed by thermostat **108**. Clicking on "up" arrow **354** raises the setpoint **358**; clicking the down arrow **356** lowers setpoint **358**. Screen **351** may also convey information about the outside weather conditions, such as a graphic representation **360** of the sun, clouds, etc. In homes with multiple thermostats, screen **351** may allow users to select different devices to adjust or monitor. Users will be able to use screen **351** by selecting, for example, master bedroom thermostat **362**, living room thermostat **364**, game room thermostat **366**, or basement thermostat **368**. As shown in FIG. **6***b*, screen **370** allows users to establish programming schedules. Row **372** shows a 24-hour period. Programming row **374** displays various programming periods and when they are scheduled, such as away setting **376**, which begins at approximately 8 AM and runs until approximately 5:30 PM. When the away setting **376** is highlighted, the user can adjust the starting time and ending time for the setting by dragging the beginning time **378** to the left to choose an earlier start time, and dragging it to the right to make it later. Similarly, the user can drag ending time **380** to the left to make it earlier, and to the right to make it later. While away setting **376** is highlighted, the user can also change heating setpoint **382** by clicking on up arrow **384** or down arrow **386**, and cooling setpoint **388** by clicking on up arrow **390** or down arrow **392**. The user can save the program by clicking on save button **394**.
"sending user-specific data	Fig. 7:

through the internet"; "user-specific information about the building and HVAC system"; "electronic circuitry configured to analyze a plurality of data parameters specific to the user, including at least one data parameter relating to usage of the HVAC system at various times"	 *FIG. 7* Fig. 8:

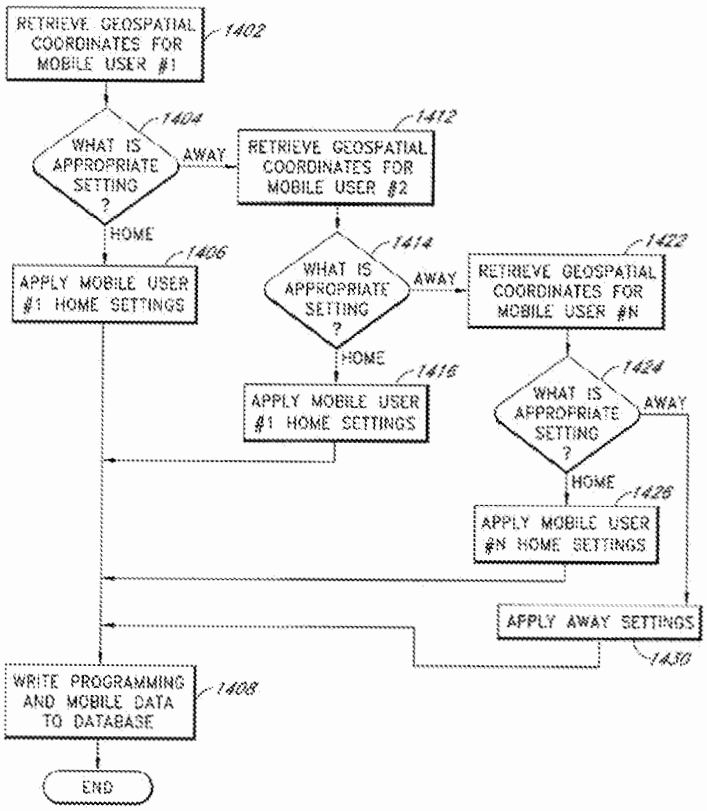

RETRIEVE GEOSPATIAL COORDINATES FOR MOBILE USER #1
1402
WHAT IS APPROPRIATE SETTING ?
1404
AWAY
HOME
RETRIEVE GEOSPATIAL COORDINATES FOR MOBILE USER #2
1412
APPLY MOBILE USER #1 HOME SETTINGS
1406
WHAT IS APPROPRIATE SETTING ?
1414
AWAY
HOME
RETRIEVE GEOSPATIAL COORDINATES FOR MOBILE USER #N
1422
APPLY MOBILE USER #1 HOME SETTINGS
1416
WHAT IS APPROPRIATE SETTING ?
1424
AWAY
HOME
APPLY MOBILE USER #N HOME SETTINGS
1426
APPLY AWAY SETTINGS
1430
WRITE PROGRAMMING AND MOBILE DATA TO DATABASE
1408
END

FIG. 8

Fig. 20:

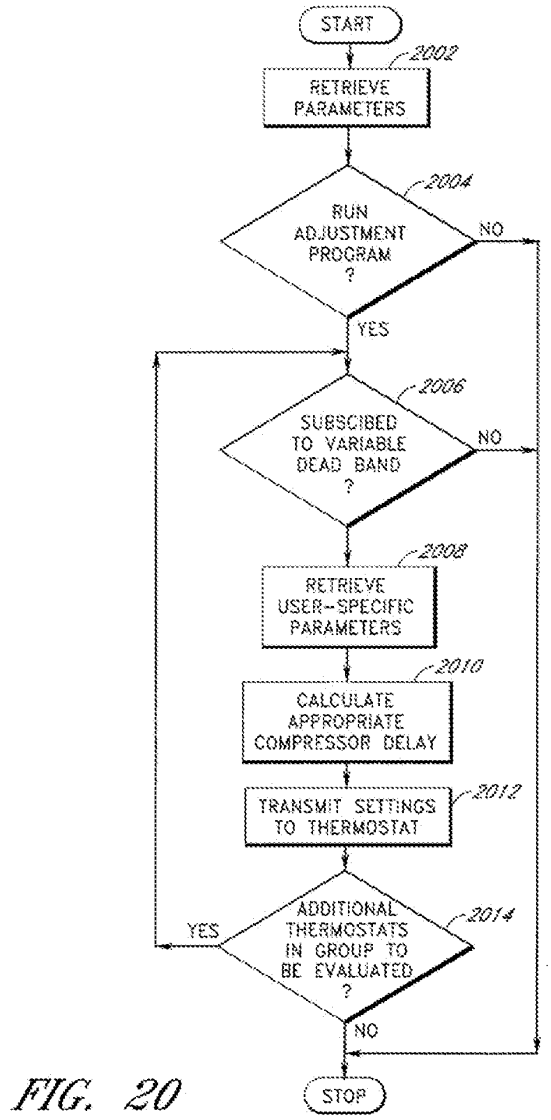


FIG. 20

9:64-66:

FIG. 7 is a high-level flowchart showing the steps involved in the operation of one embodiment of the subject invention. In step **1302**, mobile device **105** transmits geopositioning information to server **106** via the Internet. In step **1304** the

10:10-19:

If the server **106** determines that the home should be in occupied or "home" mode, then in step **1308** the server queries database **300** to determine whether thermostat **108** is already set for home or away mode. If thermostat **108** is already in home mode, then the application terminates for a specified interval. If the HVAC settings then in effect are intended to apply when the home is unoccupied, then in step **1310** the application will retrieve from database **300** the user's specific preferences for how to handle this situation.

18:50-67:

FIG. **20** shows a flowchart illustrating the steps required to initiate a compressor delay adjustment event. In step **2002**, server **106** retrieves parameters such as weather conditions, the current price per kilowatt-hour of electricity, and the state of the electric grid in terms of supply versus demand for the geographic area that includes a given home. In step **2004** server **106** determines whether to instantiate the compressor delay adjustment program for a certain group of homes in response to those conditions.

In step **2006**, server **106** determines whether a specific home is subscribed to participate in compressor delay events. If a given home is eligible, then in step **2008** the server retrieves the parameters needed to specify the compressor delay routine for that home. These may include user preferences, such as the weather, time of day and other conditions under which the homeowner has elected to permit hysteresis band changes, the maximum length of compressor delay authorized, etc.

28:31-49:

In order to implement such ramped setpoints automatically, algorithms may be created. These algorithms may be generated and/or executed as instructions on remote server **106** and the resulting setpoint changes can be transmitted to a given thermostat on a just-in-time basis or, if the thermostat **108** is capable of storing future settings, they may be transferred in batch mode to such thermostats. Basic parameters used to generate such algorithms include:

the number of discrete phases to be used;

the temperature differential associated with each phase; and

the duration of each phase

In order to increase user comfort and thus maximize consumer acceptance, additional parameters may be considered, including:

time of day

outside weather conditions

recent history of manual inputs

recent pre-programmed setpoint changes.

Fig. 30:

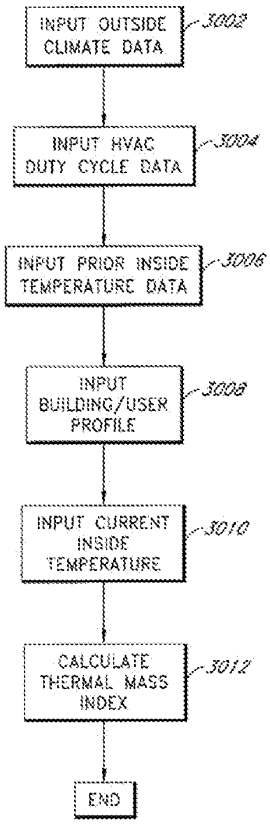

INPUT OUTSIDE CLIMATE DATA
3002
INPUT HVAC DUTY CYCLE DATA
3004
INPUT PRIOR INSIDE TEMPERATURE DATA
3006
INPUT BUILDING/USER PROFILE
3008
INPUT CURRENT INSIDE TEMPERATURE
3010
CALCULATE THERMAL MASS INDEX
3012
END

FIG. 30

9:48-63:

As shown in FIG. **66**, screen **370** allows users to establish programming schedules. Row **372** shows a 24-hour period. Programming row **374** displays various programming periods and when they are scheduled, such as away setting **376**, which begins at approximately 8 AM and runs until approximately 5:30 PM. When the away setting **376** is highlighted, the user can adjust the starting time and ending time for the setting by dragging the beginning time **378** to the left to choose an earlier start time, and dragging it to the right to make it later. Similarly, the user can drag ending time **380** to the left to make it earlier, and to the right to make it later. While away setting **376** is highlighted, the user can also change heating setpoint **382** by clicking on up arrow **384** or down arrow **386**, and cooling setpoint **388** by clicking on up arrow **390** or down arrow **392**. The user can save the program by clicking on save button **394**.

Fig. 31:

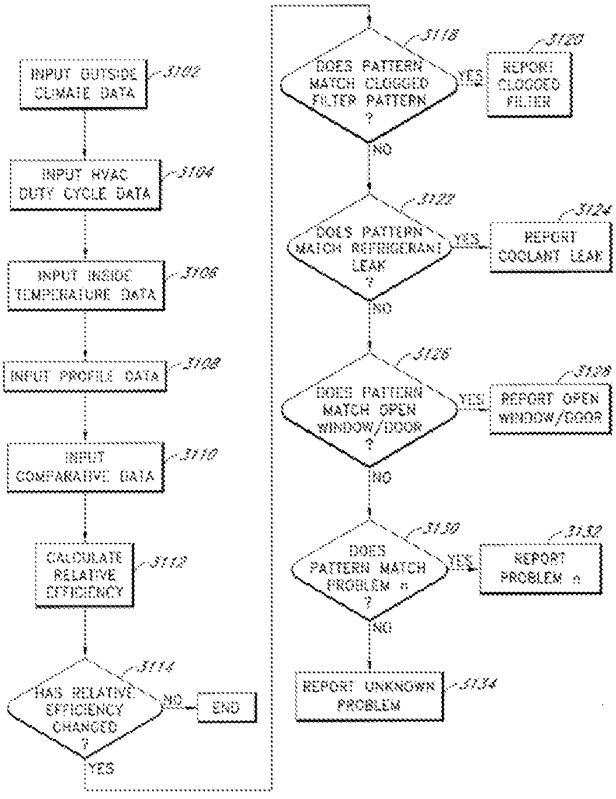


FIG. 31

25:28-65:

FIG. **31** illustrates the steps involved in diagnosing defects in the HVAC system for specific home X. In step **3102**, the server retrieves climate data related to home X. Such data may include current outside temperature, outside temperature during the preceding hours, outside humidity, wind direction and speed, whether the sun is obscured by clouds, and other factors. In step **3104**, the server retrieves HVAC duty cycle data for home X. Such data may include target settings set by the thermostat in current and previous periods, the timing of switch-on and switch-off events and other data.

In step **3106**, the server retrieves data regarding current and recent temperature readings as recorded by the thermostat in home X. In step **3108**, the server retrieves profile data for home X. Such data may include square footage and number of floors, when the house was built and/or renovated, the extent to which it is insulated, its address, make, model and age of its furnace and air conditioning hardware, and other data. In step **3110**, the server retrieves comparative data from other houses that have thermostats that also report to the server.

Such data may include interior temperature readings, outside temperature for those specific locations, duty cycle data for the HVAC systems at those locations, profile data for the structures and HVAC systems in those houses and the calculated thermal mass index for those other houses. In step **3112**, the server calculates the current relative efficiency of home X as compared to other homes. Those comparisons will take into account differences in size, location, age, etc in making those comparisons.

The server will also take into account that comparative efficiency is not absolute, but will vary depending on conditions. For example, a house that has extensive south-facing windows is likely to experience significant solar gain On sunny winter days, that home will appear more efficient than on cloudy winter days. That same house will appear more efficient at times of day and year when trees or overhangs shade those windows than it will when summer sun reaches those windows. Thus the server will calculate efficiency under varying conditions.

12:19-36:

FIG. **9***b* shows a graph of the same house on the same day, but assumes that the air conditioning is turned off from noon to 7 PM. As expected, the inside temperature **1504***a* rises with increasing outside temperatures **1502** for most of that period, reaching 88 degrees at 7 PM. Because server **106** logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database **300** will contain a history of the thermal performance of each house.

The performance data will allow the server **106** to calculate an effective thermal mass for each such structure—that is, the rate at which the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures.

Fig. 13:

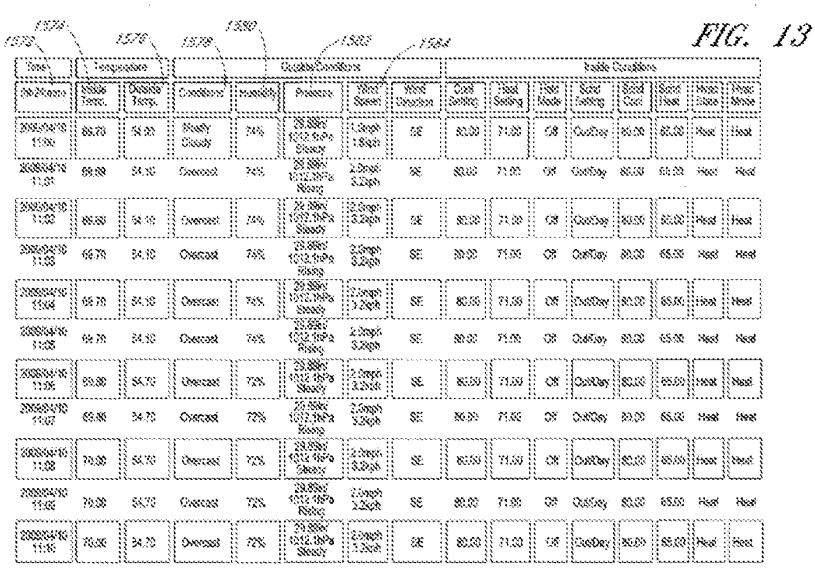
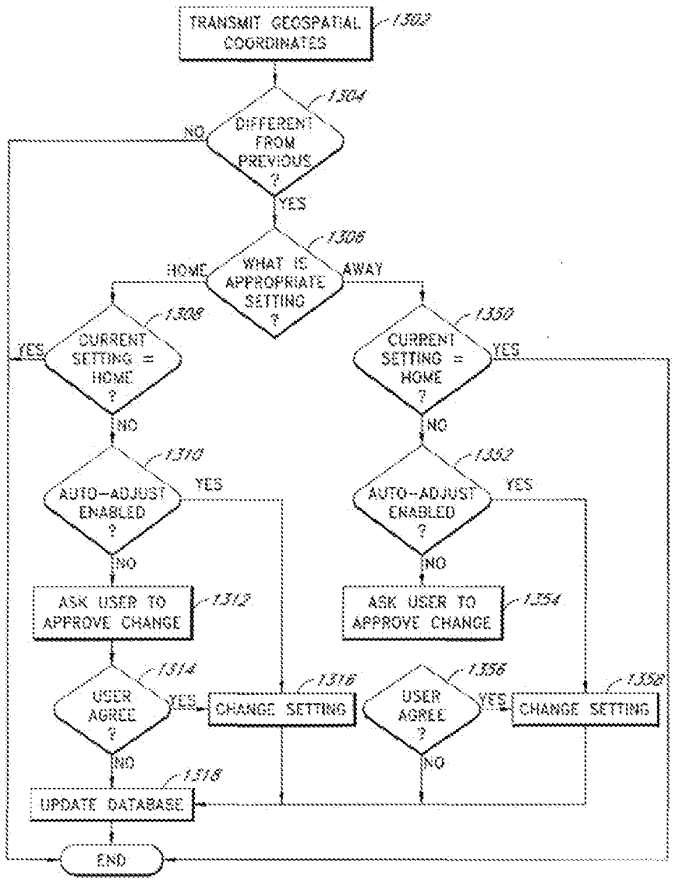


FIG. 13

"adjusting the temperature setpoint without user intervention"	Fig. 7:  *FIG. 7* 4:61-67: In a different embodiment, the variation of temperature setpoints is logged to a database. In another embodiment, the variation of temperature setpoints is initiated by a remote computer. In a further embodiment, the temperature setpoints are varied automatically. In still another embodiment, an occupant is prompted to confirm occupancy prior to adjustment of said temperature setpoint.

10:19-33:

If the user has previously specified (at the time that the program was initially set up or subsequently modified) that the user prefers that the system automatically change settings under such circumstances, the application then proceeds to step **1316**, in which it changes the programmed setpoint for the thermostat to the setting intended for the house when occupied. If the user has previously specified that the application should not make such changes without further user input, then in step **1312** the application transmits a command to the location specified by the user (generally mobile device **105**) directing the device display a message informing the user that the current setting assumes an unoccupied house and asking the user to choose whether to either keep the current settings or revert to the pre-selected setting for an occupied home.

18:16-29:

In step **1914** the server determines whether any changes to the baseline programming for the thermostat should be revised. If not, the routine terminates. If revisions are warranted, then in step **1916** the server retrieves from database **900** the permissions the server has to make autonomous changes to settings. If the server has been given permission to make the proposed changes, then in step **1918** the server revises the thermostat's programming and writes the changes to one or more databases in overall database structure **300**.

If the server has not been authorized to make such changes autonomously, then in step **1920** the server transmits the recommendation to change settings to the customer in the manner previously specified by the customer, such as email, text message, personalized website, etc.

27:48-55:

Embodiments of the invention can automatically generate optimized ramped setpoints that could save energy without compromising the comfort of the occupants. It would also be advantageous to create a temperature control system that could incorporate adaptive algorithms that could automatically determine when the ramped setpoints should not be applied due to a variety of exogenous conditions that make application of such ramped setpoints undesirable.

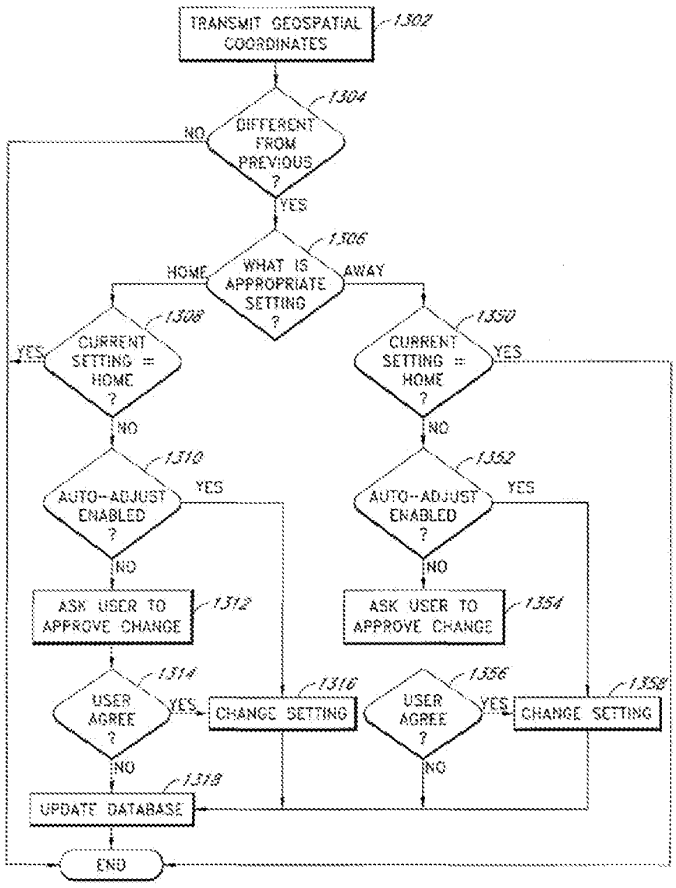
"location-aware mobile device"; "receive radio frequency signals from the location-aware mobile device"; "receive geo-positioning data from the location-aware mobile device and automatically adjust a temperature value based on the geo-positioning data, including initiating at least one cooling or heating cycle for the HVAC system when the geo-positioning data is determined to indicate that the building is unoccupied by the user"	Fig. 7:  *FIG. 7*

Fig. 8:

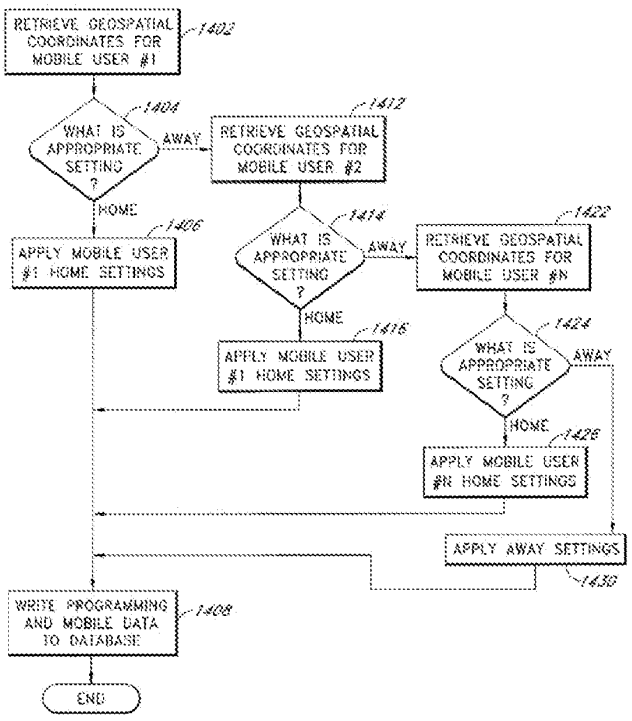


FIG. 8

3:23-43:

Many new mobile devices now incorporate another significant new technology—the ability to geolocate the device (and thus, presumably, the user of the device). One method of locating such devices uses the Global Positioning System (GPS). The GPS system uses a constellation of orbiting satellites with very precise clocks to triangulate the position of a device anywhere on earth based upon arrival times of signals received from those satellites by the device. Another approach to geolocation triangulates using signals from multiple cell phone towers. Such systems can enable a variety of so-called "location based services" to users of enabled devices. These services are generally thought of as aids to commerce like pointing users to restaurants or gas stations, etc.

It would be desirable to provide a system that could detect the location of regular occupants of a home or other structure without requiring the installation of additional hardware; that could accurately use such geospatial information in order to detect and predict occupancy, and could optimize energy consumption based upon dynamic and individually configurable heuristics.

9:4-22;

User personal accounts may also associate one or more mobile devices with such personal accounts. For mobile devices with the capability for geopositioning awareness, these personal accounts will have the ability log such positioning data over time in database **1200**.

In one embodiment, a background application installed on mobile device **105** shares geopositioning data for the mobile device with the application running on server **106** that logs such data. Based upon this data, server **106** runs software that interprets said data (as described in more detail below). Server **106** may then, depending on context, (a) transmit a signal to thermostat **108** changing setpoint because occupancy has been detected at a time when the system did not expect occupancy; or (b) transmit a message to mobile device **105** that asks the user if the server should change the current setpoint, alter the overall programming of the system based upon a new occupancy pattern, etc. Such signalling activity may be conducted via email, text message, pop-up alerts, voice messaging, or other means.

9:64-10:9:

FIG. **7** is a high-level flowchart showing the steps involved in the operation of one embodiment of the subject invention. In step **1302**, mobile device **105** transmits geopositioning information to server **106** via the Internet. In step **1304** the

	server compares the latest geopositioning data point to previous data points in order to determine whether a change in location or vector of movement has occurred. In step **1306** the server evaluates the geopositioning data in order to determine whether the temperature settings for the HVAC system for the structure associated with the mobile device **105** should be optimized for an unoccupied structure, or for an occupied structure in light of the movement (or lack thereof) in the geopositioning data. Additional support: 3:47-4:11 11:23-60 31:66-32:24
"electronic circuitry configured to generate and communicate usage metrics pertaining to the HVAC system over time"	Fig. 31:

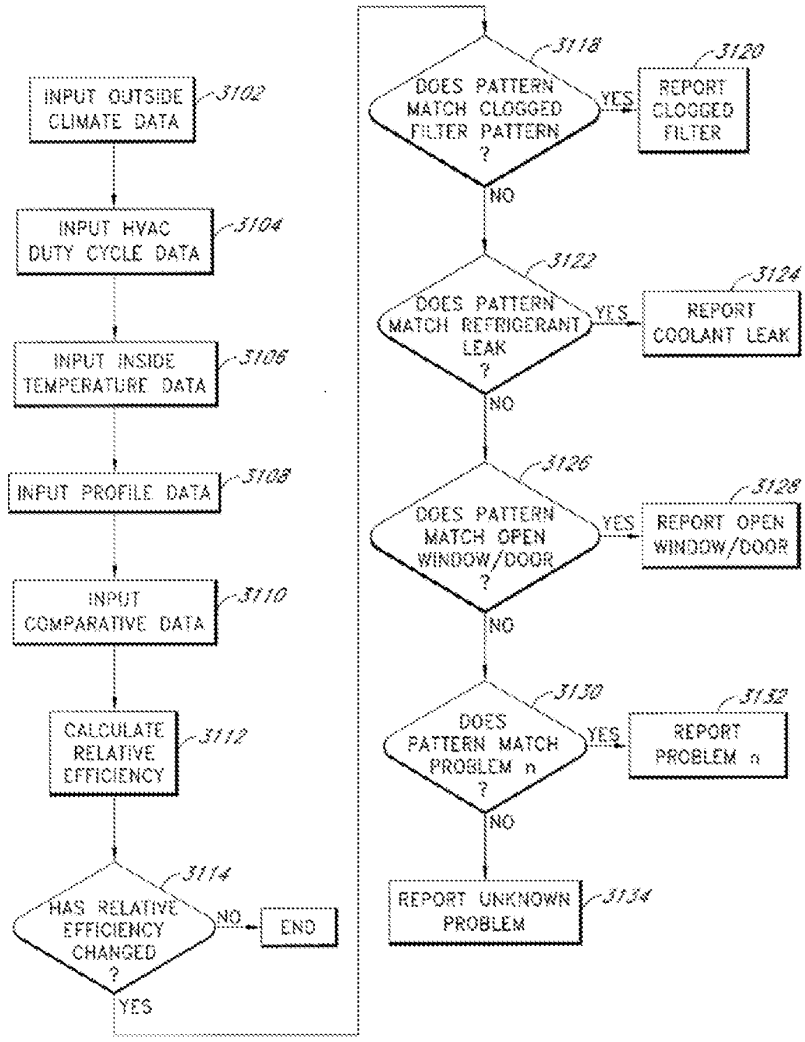

INPUT OUTSIDE CLIMATE DATA
3102
INPUT HVAC DUTY CYCLE DATA
3104
INPUT INSIDE TEMPERATURE DATA
3106
INPUT PROFILE DATA
3108
INPUT COMPARATIVE DATA
3110
CALCULATE RELATIVE EFFICIENCY
3112
HAS RELATIVE EFFICIENCY CHANGED ?
3114
NO
END
YES
DOES PATTERN MATCH CLOGGED FILTER PATTERN ?
3118
YES
REPORT CLOGGED FILTER
3120
NO
DOES PATTERN MATCH REFRIGERANT LEAK ?
3122
YES
REPORT COOLANT LEAK
3124
NO
DOES PATTERN MATCH OPEN WINDOW/DOOR ?
3126
YES
REPORT OPEN WINDOW/DOOR
3128
NO
DOES PATTERN MATCH PROBLEM n ?
3130
YES
REPORT PROBLEM n
3132
NO
REPORT UNKNOWN PROBLEM
3134

FIG. 31

Fig. 32:

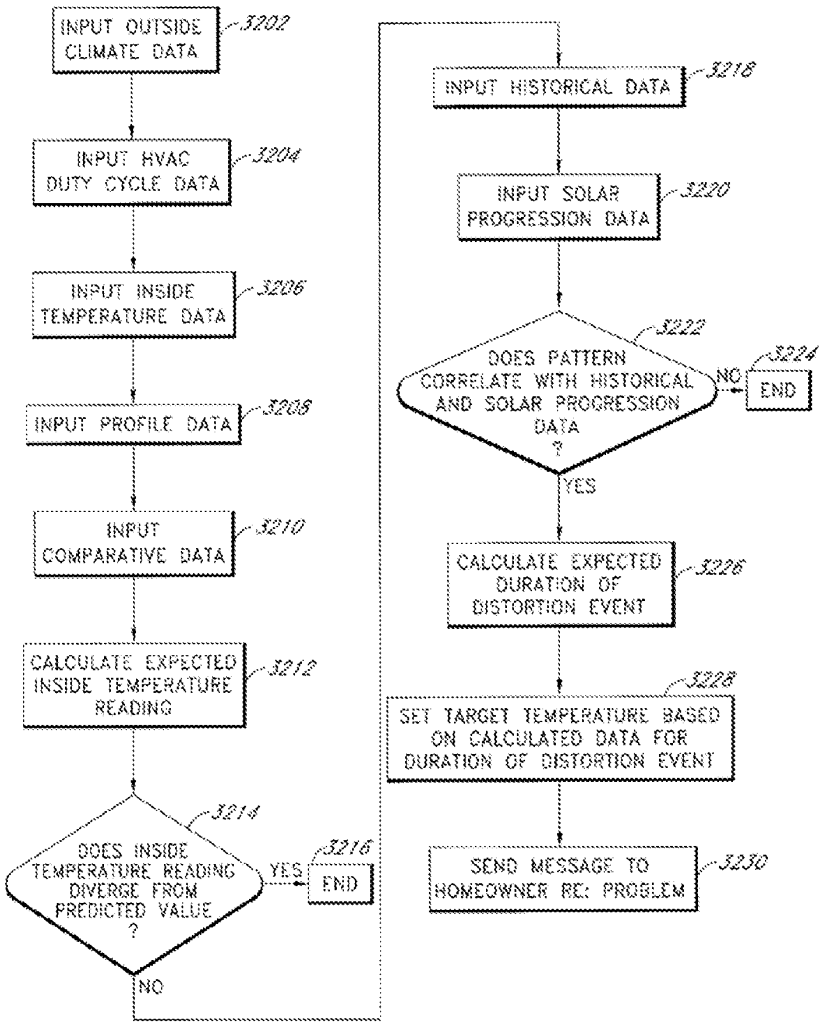


FIG. 32

25:28-26:31:

FIG. **31** illustrates the steps involved in diagnosing defects in the HVAC system for specific home X. In step **3102**, the server retrieves climate data related to home X. Such data may include current outside temperature, outside temperature during the preceding hours, outside humidity, wind direction and speed, whether the sun is obscured by clouds, and other factors. In step **3104**, the server retrieves HVAC duty cycle data for home X. Such data may include target settings set by the thermostat in current and previous periods, the timing of switch-on and switch-off events and other data.

In step **3106**, the server retrieves data regarding current and recent temperature readings as recorded by the thermostat in home X. In step **3108**, the server retrieves profile data for home X. Such data may include square footage and number of floors, when the house was built and/or renovated, the extent to which it is insulated, its address, make, model and age of its furnace and air conditioning hardware, and other data. In step **3110**, the server retrieves comparative data from other houses that have thermostats that also report to the server.

Such data may include interior temperature readings, outside temperature for those specific locations, duty cycle data for the HVAC systems at those locations, profile data for the structures and HVAC systems in those houses and the calculated thermal mass index for those other houses. In step **3112**, the server calculates the current relative efficiency of home X as compared to other homes. Those comparisons will take into account differences in size, location, age, etc in making those comparisons.

The server will also take into account that comparative efficiency is not absolute, but will vary depending on conditions. For example, a house that has extensive south-facing windows is likely to experience significant solar gain On sunny winter days, that home will appear more efficient than on cloudy winter days. That same house will appear more efficient at times of day and year when trees or overhangs shade those windows than it will when summer sun reaches those windows. Thus the server will calculate efficiency under varying conditions.

In step **3114** the server compares the HVAC system's efficiency, corrected for the relevant conditions, to its efficiency

in the past. If the current efficiency is substantially the same as the historical efficiency, the server concludes **3116** that there is no defect and the diagnostic routine ends. If the efficiency has changed, the server proceeds to compare the historical and current data against patterns of changes known to indicate specific problems. For example, in step **3118**, the server compares that pattern of efficiency changes against the known pattern for a clogged air filter, which is likely to show a slow, gradual degradation over a period of weeks or even months.

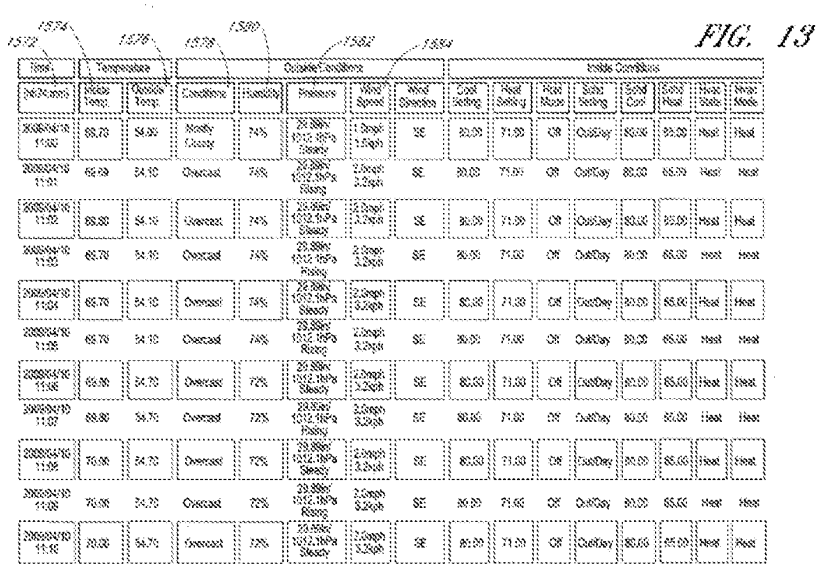
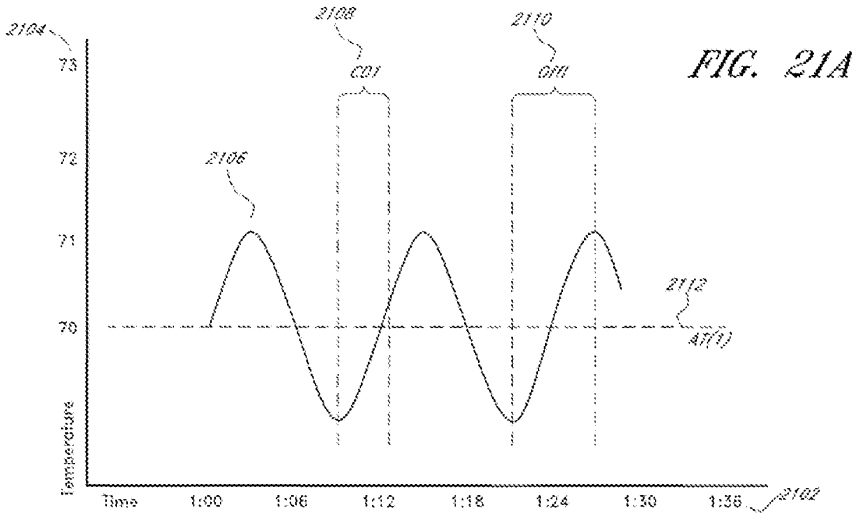
If the pattern of degradation matches the clogged filter paradigm, the server creates and transmits to the homeowner a message **3120** alerting the homeowner to the possible problem. If the problem does not match the clogged filter paradigm, the system compares **3122** the pattern to the known pattern for a refrigerant leak, which is likely to show a degradation over a period of a few hours to a few days. If the pattern of degradation matches the refrigerant leak paradigm, the server creates and transmits to the homeowner a message **3124** alerting the homeowner to the possible problem.

If the problem does not match the refrigerant leak paradigm, the system compares **3126** the pattern to the known pattern for an open window or door, which is likely to show significant changes for relatively short periods at intervals uncorrelated with climatic patterns. If the pattern of degradation matches the open door/window paradigm, the server creates and transmits to the homeowner a message **3128** alerting the homeowner to the possible problem. If the problem does not match the refrigerant leak paradigm, the system continues to step through remaining know patterns N **3130** until either a pattern is matched **3132** or the list has been exhausted without a match **3134**.

12:19-36:

FIG. **9***b* shows a graph of the same house on the same day, but assumes that the air conditioning is turned off from noon to 7 PM. As expected, the inside temperature **1504***a* rises with increasing outside temperatures **1502** for most of that period, reaching 88 degrees at 7 PM. Because server **106** logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database **300** will contain a history of the thermal performance of each house.

The performance data will allow the server **106** to calculate an effective thermal mass for each such structure—that is, the rate at which the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures.

	Fig. 13:  FIG. 13 Additional support: 14:60-67 26:32-27:47
"a compressor delay circuit configured to delay the start or stop of a compressor for the HVAC system and protect the compressor from rapid cycling"	Fig. 21a:  FIG. 21A

18:50-19:8:

An additional way in which an embodiment of the instant invention can reduce energy consumption with minimal impact on comfort is to vary the turn-on delay enforced by the thermostat after the compressor is turned off Compressor delay is usually used to protect compressors from rapid cycling, which can physically damage them.

The ability to predict the rate of change in inside temperature in a given house under varying conditions may also be applied to permit calculation of the effect of different compressor delay settings on inside temperatures, HVAC cycling and energy consumption.

FIG. **20** shows a flowchart illustrating the steps required to initiate a compressor delay adjustment event. In step **2002**, server **106** retrieves parameters such as weather conditions, the current price per kilowatt-hour of electricity, and the state of the electric grid in terms of supply versus demand for the geographic area that includes a given home. In step **2004** server **106** determines whether to instantiate the compressor delay adjustment program for a certain group of homes in response to those conditions.

In step **2006**, server **106** determines whether a specific home is subscribed to participate in compressor delay events. If a given home is eligible, then in step **2008** the server retrieves the parameters needed to specify the compressor delay routine for that home. These may include user preferences, such as the weather, time of day and other conditions under which the homeowner has elected to permit hysteresis band changes, the maximum length of compressor delay authorized, etc.

In step **2010** the appropriate compressor delay settings are determined, and in step **2012** the chosen settings are communicated to the thermostat. In step **2014** the server determines if additional thermostats in the given group must still be evaluated. If so, the server returns to step **2006** and repeats the subsequent steps with the next thermostat. If not, the routine ends.

Fig. 20:

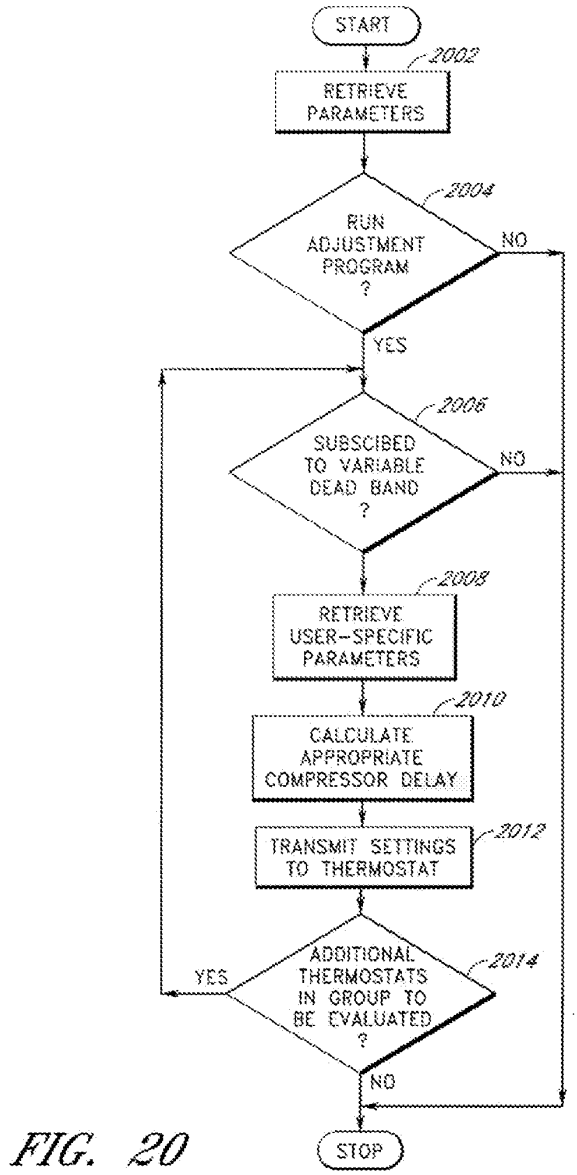


FIG. 20

Additional support:
Fig. 21b
Fig. 21c
19:8-64

Based on the support provided in the table above, Applicant respectfully submits that each claim limitation listed—and all of the claim limitations in pending Claims 1-6 and 9-19—are fully supported by 12/788,246 (U.S. Patent No. 8,556,188). Accordingly, Applicant respectfully requests Examiner to acknowledge the priority claim, as recited in the Application Data Sheet, where the earliest filing date is based on 12/788,246 (U.S. Patent No. 8.556,188), filed May 26, 2010.

DRAWINGS

For the same reasons discussed above, Applicant respectfully disagrees with the Office Action's characterization that the drawings of this application do not show every feature of the claimed invention. As shown in the table above, each of the features discussed in the Office Action is shown in at least one drawing. Applicant respectfully submits that the drawings, as presented in the table above, show every feature of the invention as claimed in pending Claims 1-6 and 9-19. Accordingly, Applicant requests Examiner to withdraw this objection.

REJECTION OF CLAIMS 1-19 UNDER 35 U.S.C. § 112

The Office Action rejected Claims 1-19 under 35 U.S.C. § 112 for use of the phrase "compatible with IEEE 802.11 wireless protocol" as being indefinite because "it is directed to an industry protocol, which is subject to change or modification, and not to an actual physical structure of the system." Applicant respectfully disagrees that this phrase renders the claims indefinite and respectfully disagrees with the rationale and characterization of this phrase in the Office Action, even under the broadest reasonable interpretation standard.

However, in the interest of advancing prosecution, Applicant has deleted this claim limitation from Claim 1 and amended Claim 1 to provide further clarity. Accordingly, Applicant respectfully requests that this rejection be withdrawn.

REJECTION OF CLAIMS 1-20 UNDER 35 U.S.C. § 103(a)

The Office Action rejected Claims 1-20 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Publication No. 2015/0053779 to Adamek in view of U.S. Publication No. 2012/0203379 to Sloo.

Applicant respectfully disagrees with the Examiner's characterization of the prior art of record and does not admit to any characterization or limitation of the claims or to any characterization of a reference by the Examiner, particularly any that are inconsistent with the language of the claims considered in their entirety and including all of their constituent limitations.

As discussed above, this application is entitled to the benefit of a priority date of at least as early as May 26, 2010. Therefore, Applicant respectfully submits that Adamek and Sloo do not qualify as prior art, rendering this rejection improper. Applicant respectfully requests Examiner to withdraw the rejection.

Even so, in the interest of advancing prosecution, Applicant has amended Claims 1-6 and 9-19 to recite additional limitations and/or to provide further clarity to the claims. Applicant respectfully submits that the prior art of record, alone or in combination, do not disclose all of the limitations of independent Claim 1. Applicant submits that the dependent claims are also allowable at least because they depend from an allowable independent claim.

Accordingly, Applicant submits that Claim 1, and its dependent claims 2-6 and 9-19, are in condition for allowance.

REQUEST FOR EVIDENTIARY SUPPORT

Should a rejection based on any of the above asserted rejections be maintained, Applicant respectfully requests appropriate evidentiary support. Additionally, if the Examiner is relying upon "common knowledge," "well known" principles, "Official Notice," or other information within the Examiner's personal knowledge to establish the rejection, Applicant requests that a reference be provided in support of this position or

that an affidavit be provided pursuant to M.P.E.P. § 2144.03 and 37 C.F.R. § 1.104(d)(2).

OTHER APPLICATIONS OF ASSIGNEE

Applicant wishes to draw the Examiner's attention to the following applications owned by the present application's assignee:

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Steinberg et al.	60/963,183 Now Expired	08/03/07	EFACT.003PR	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg et al.	60/994,011 Now Expired	09/17/07	EFACT.005PR	System And Method For Calculating The Thermal Mass Of A Building
Steinberg et al.	12/183,949 Now Pat. 7,908,116	07/31/08	EFACT.004A	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg et al.	12/183,990 Now Pat. 7,908,117	07/31/08	EFACT.003A	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg et al.	12/211,690 Now Pat. 8,019,567	09/16/08	EFACT.006A	System And Method For Evaluating Changes In The Efficiency Of An HVAC System
Steinberg et al.	12/211,733 Now Pat. 7,848,900	09/16/08	EFACT.005A	System And Method For Calculating The Thermal Mass Of A Building
Steinberg et al.	61/215,657 Now Expired	05/08/09	EFACT.009PR	System, Method And Apparatus For Just-In-Time Conditioning Using A Thermostat

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Steinberg	61/215,816 Now Expired	05/11/09	EFACT.008PR	System, Method And Apparatus For Dynamically Variable Compressor Delay In Thermostat To Reduce Energy Consumption
Steinberg et al.	61/215,999 Now Expired	05/12/09	EFACT.007PR	System, Method And Apparatus For Identifying Manual Inputs To And Adaptive Programming Of A Thermostat
Cheung et al.	12/498,142 Now Pat. 8,010,237	07/06/09	EFACT.010A	System And Method For Using Ramped Setpoint Temperature Variation With Networked Thermostats To Improve Efficiency
Steinberg	12/502,064 Now Pat. 8,180,492	07/13/09	EFACT.011A	System And Method For Using A Networked Electronic Device As An Occupancy Sensor For An Energy Management System
Steinberg et al.	12/773,690 Now Pat. 8,498,753	05/04/10	EFACT.009A	System, Method And Apparatus For Just-In-Time Conditioning Using A Thermostat
Steinberg	12/774,580 Now Pat. 8,740,100	05/05/10	EFACT.008A	System, Method And Apparatus For Dynamically Variable Compressor Delay In Thermostat To Reduce Energy Consumption
Steinberg et al.	12/778,052 Now Pat. 8,596,550	05/11/10	EFACT.007A	System, Method And Apparatus For Identifying Manual Inputs To And Adaptive Programming Of A Thermostat
Steinberg	12/788,246 Now Pat. 8,556,188	05/26/10	EFACT.012A	System And Method For Using A Mobile Electronic Device To Optimize An Energy Management System

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Steinberg	12/860,821 Now Pat. 8,090,477	08/20/10	EFACT.013A	System And Method For Optimizing Use Of Plug-In Air Conditioners And Portable Heaters
Steinberg et al.	12/959,225 Now Pat. 8,131,497	12/02/10	EFACT.005C1	System And Method For Calculating The Thermal Mass Of A Building
Steinberg et al.	13/037,162 Now Pat. 8,131,506	02/28/11	EFACT.004C1	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Cheung et al.	13/219,381 Now Pat. 9,134,710	08/26/11	EFACT.010C1	System And Method For Using Ramped Setpoint Temperature Variation With Networked Thermostats To Improve Efficiency
Steinberg et al.	13/230,610 Now Pat. 8,423,322	09/12/11	EFACT.006C1	System And Method For Evaluating Changes In The Efficiency Of An HVAC System
Steinberg	13/329,117 Now Pat. 8,340,826	12/16/11	EFACT.013C1	System And Method For Optimizing Use Of Plug-In Air Conditioners And Portable Heaters
Steinberg et al.	13/409,697 Now Pat. 8,412,488	03/01/12	EFACT.004C2	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg et al.	13/409,729 Now Pat. 8,886,488	03/01/12	EFACT.005C2	System And Method For Calculating The Thermal Mass Of A Building
Steinberg	13/470,074 Now Pat. 9,244,470	05/11/12	EFACT.011C1	System And Method For Using A Wireless Device As A Sensor For An Energy Management System

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Hublou et al.	13/523,697 Now Pat. 10,048,706	06/14/12	EFACT.014A	System And Method For Optimizing Use Of Individual HVAC Units In Multi-Unit Chiller-Based Systems
Steinberg	13/725,447 Now Pat. 8,712,590	12/21/12	EFACT.013C2	System And Method For Optimizing Use Of Plug-In Air Conditioners And Portable Heaters
Steinberg et al.	13/852,577 Now Pat. 8,738,327	03/28/13	EFACT.004C3	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg et al.	13/858,710 Now Pat. 8,751,186	04/08/13	EFACT.005C3	System And Method For Calculating The Thermal Mass Of A Building
Steinberg et al.	13/861,189 Now Pat. 9,057,649	04/11/13	EFACT.006C2	System And Method For Evaluating Changes In The Efficiency Of An HVAC System
Steinberg et al.	13/952,253 Published As 2013/0310989 Now Abandoned	07/26/13	EFACT.009C1	System, Method And Apparatus For Just-In-Time Conditioning Using A Thermostat
Steinberg	14/048,932 Now Pat. 8,840,033	10/08/13	EFACT.012C1	System And Method For Using A Mobile Electronic Device To Optimize An Energy Management System
Steinberg et al.	14/082,675 Now Pat. 9,194,597	11/18/13	EFACT.007C1	System, Method And Apparatus For Identifying Manual Inputs To And Adaptive Programming Of A Thermostat
Steinberg	14/263,762 Now Pat. 9,188,994	04/28/14	EFACT.013C3	System And Method For Optimizing Use Of Plug-In Air Conditioners And Portable Heaters

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Steinberg et al.	14/285,384 Published As 2015/0043615 Now Abandoned	05/22/14	EFACT.004C4	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg	14/292,377 Now Pat. 9,279,594	05/30/14	EFACT.008C1	System, Method And Apparatus For Dynamically Variable Compressor Delay In Thermostat To Reduce Energy Consumption
Steinberg	14/491,554 Now Pat. 9,709,292	09/19/14	EFACT.012C2	System And Method For Using A Mobile Electronic Device To Optimize An Energy Management System
Steinberg et al.	14/527,433 Published As 2015/0120235 Now Abandoned	10/29/14	EFACT.005C4	System And Method For Calculating The Thermal Mass Of A Building
Steinberg et al.	14/731,221 Now Pat. 9,939,333	06/04/15	EFACT.006C3	System And Method For Evaluating Changes In The Efficiency Of An HVAC System
Cheung et al.	14/842,134 Now Pat. 10,254,775	09/01/15	EFACT.010C2	System And Method For Using Ramped Setpoint Temperature Variation With Networked Thermostats To Improve Efficiency
Steinberg et al.	14/878,872 Now Pat. 10,018,371	10/08/15	EFACT.007C2	System, Method And Apparatus For Identifying Manual Inputs To And Adaptive Programming Of A Thermostat
Steinberg	14/920,063 Published As 2016/0097557 Now Abandoned	10/22/15	EFACT.013C4	System And Method For Optimizing Use Of Plug-In Air Conditioners And Portable Heaters

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Steinberg	15/002,791 Now Pat. 10,289,131	01/21/16	EFACT.011C2	System And Method For Using A Wireless Device As A Sensor For An Energy Management System
Steinberg	15/047,352 Now Pat. 9,982,905	02/18/16	EFACT.008C2	System, Method And Apparatus For Dynamically Variable Compressor Delay In Thermostat To Reduce Energy Consumption
Steinberg et al.	15/060,226 Published As 2016/0258822 Now Abandoned	03/03/16	EFACT.005C5	System And Method For Calculating The Thermal Mass Of A Building
Steinberg et al.	15/097,078 Published As 2016/0363337 Now Abandoned	04/12/16	EFACT.009C2	System, Method And Apparatus For Just-In-Time Conditioning Using A Thermostat
Steinberg et al.	15/426,882 Published As 2017/0241662 Now Abandoned	02/07/17	EFACT.005C6	System And Method For Calculating The Thermal Mass Of A Building
Steinberg	15/616,719 Published As 2017/0336090 Now Abandoned	06/07/17	EFACT.012C3	System And Method For Using A Mobile Electronic Device To Optimize An Energy Management System
Okita et al.	15/707,686 Published As 2019/0086882 Now Abandoned	09/18/17	EFACT.018A2	Message-Based Demand Response Systems And Methods
Okita et al.	15/707,735 Published As 2019/0089194	09/18/17	EFACT.018A1	Message-Based Demand Response Systems And Methods
Okita et al.	15/707,753 Published As 2019/0086109 Now Abandoned	09/18/17	EFACT.018A3	Occupancy Determination Using Energy Consumption Indications

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Okita et al.	15/707,769 Published As 2019/0086110 Now Abandoned	09/18/17	EFACT.019A2	Systems And Methods For Acclimatization-Based Variable Thermostat Settings
Okita et al.	15/707,829 Published As 2019/0086108 Now Abandoned	09/18/17	EFACT.019A1	Systems And Methods For Humidity-Based Variable Thermostat Settings
Okita et al.	15/707,873 Published As 2019/0086106 Now Abandoned	09/18/17	EFACT.019A3	Systems And Methods For Fan Delay-Based Variable Thermostat Settings
Okita et al.	15/713,318 Published As 2018/0087795	09/22/17	EFACT.017A2	Multi-Function Thermostat
Okita et al.	15/713,358 Published As 2018/0087793	09/22/17	EFACT.017A1	Multi-Function Thermostat
Steinberg et al.	15/836,688 Published As 2018/0259400 Now Abandoned	12/08/17	EFACT.004C5	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg	15/841,039 Published As 2018/0216841	12/13/17	EFACT.013C5	System And Method For Optimizing Use Of Plug-In Air Conditioners And Portable Heaters
Steinberg et al.	15/905,251 Published As 2018/0321093	02/26/18	EFACT.006D1	System And Method For Evaluating Changes In The Efficiency Of An HVAC System
Steinberg	15/965,339 Published As 2018/0313567	04/27/18	EFACT.008C3	System, Method And Apparatus For Dynamically Variable Compressor Delay In Thermostat To Reduce Energy Consumption

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Steinberg et al.	15/994,532 Now Abandoned	05/31/18	EFACT.004C6	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg et al.	16/028,230 Published As 2019/0137133	07/05/18	EFACT.007C3	System, Method And Apparatus For Identifying Manual Inputs To And Adaptive Programming Of A Thermostat
Hublou et al.	16/033,565 Now Abandoned	07/12/18	EFACT.014C1	System And Method For Optimizing Use Of Individual HVAC Units In Multi-Unit Chiller-Based Systems
Steinberg et al.	16/193,478 Published As 2019/0186771	11/16/18	EFACT.007C4	System, Method And Apparatus For Identifying Manual Inputs To And Adaptive Programming Of A Thermostat
Steinberg et al.	16/193,530 Published As 2019/0187005	11/16/18	EFACT.004C7	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Steinberg	16/264,050	01/31/19	EFACT.012C4	System And Method For Using A Mobile Electronic Device To Optimize An Energy Management System
Steinberg et al.	16/277,682	02/15/19	EFACT.005C7	System And Method For Calculating The Thermal Mass Of A Building
Hublou et al.	16/287,366	02/27/19	EFACT.014C2	System And Method For Optimizing Use Of Individual HVAC Units In Multi-Unit Chiller-Based Systems
Okita et al.	16/290,111	03/01/19	EFACT.019A1C1	Systems And Methods For Humidity-Based Variable Thermostat Settings

Inventors	Appl. No.	Filing Date	Attorney Docket No.	Title
Steinberg et al.	16/290,226	03/01/19	EFACT.009C3	System, Method And Apparatus For Just-In-Time Conditioning Using A Thermostat
Steinberg et al.	16/295,272	03/07/19	EFACT.004C8	System And Method For Using A Network Of Thermostats As Tool To Verify Peak Demand Reduction
Cheung et al.	16/295,402	03/07/19	EFACT.010C3	System And Method For Using Ramped Setpoint Temperature Variation With Networked Thermostats To Improve Efficiency
Steinberg et al.	16/295,436	03/07/19	EFACT.007C5	System, Method And Apparatus For Identifying Manual Inputs To And Adaptive Programming Of A Thermostat
Steinberg et al.	16/374,083 Published As 2019/0234810	04/03/19	EFACT.006C4	System And Method For Evaluating Changes In The Efficiency Of An HVAC System
Steinberg	16/374,085 Published As 2019/0227582	04/03/19	EFACT.011C3	System And Method For Using A Wireless Device As A Sensor For An Energy Management System
Steinberg	16/374,246 Published As 2019/0285299	04/03/19	EFACT.012C5	System And Method For Using A Mobile Electronic Device To Optimize An Energy Management System
Steinberg	16/523,806	07/26/19	EFACT.013C6	System And Method For Optimizing Use Of Plug-In Air Conditioners And Portable Heaters

Applicant notes that cited references, office actions, responses and notices of allowance currently exist or will exist for the above-referenced matters. Applicant also understands that the Examiner has access to sophisticated online Patent Office

computing systems that provide ready access to the full file histories of these matters including, for example, specifications, drawings, pending claims, cited art, office actions, responses, declarations, and notices of allowance.

Rather than submit copies these file histories, Applicant respectfully requests that the Examiner continue to review these file histories online for past, current, and future information about these matters. Also, if the Examiner cannot readily access these file histories, the Applicant would be pleased to provide any portion of any of the file histories at any time upon specific Examiner request.

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Submitted concurrently herewith is a Supplemental Information Disclosure Statement citing references for consideration. Applicant respectfully requests the Examiner to consider the pending claims in connection with these references in order to make the references of record.

NO DISCLAIMERS OR DISAVOWALS

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application.

Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution.

Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

CONCLUSION

Applicants have endeavored to address all of the Examiner's concerns as expressed in the outstanding Office Action. In light of the above remarks, reconsideration and withdrawal of the outstanding rejections is specifically requested.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 10/10/2019

By: /John R. King/
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31479094

INFORMATION DISCLOSURE STATEMENT

First Inventor	:	John Douglas Steinberg
App. No.	:	16/374,246
Filed	:	April 3, 2019
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Examiner	:	Norman, Marc E.
Art Unit	:	3763
Conf. No.	:	6388

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Pursuant to 37 CFR 1.56, an Information Disclosure Statement listing references is provided herewith.

No Disclaimers

To the extent that anything in the Information Disclosure Statement or the listed references could be construed as a disclaimer of any subject matter supported by the present application, Applicant hereby rescinds and retracts such disclaimer.

Timing of Disclosure

This Information Disclosure Statement is being filed after receipt of a First Office Action, but before the mailing date of a Final Action and before the mailing date of a Notice of Allowance.

This Statement is accompanied by the fees set forth in 37 CFR 1.17(p). The Commissioner is hereby authorized to charge any additional fees which may be required or to credit any overpayment to Account No. 11-1410.

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: October 10, 2019

By:/John R. King/
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PTO/SB/06 (09-11)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/374,246	Filing Date 04/03/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	10/10/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 2	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/CHERYL A CLARK/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. 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 12 minutes 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. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5

CONFIRMATION NO. 6388

20995
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PUBLICATION NOTICE



Title:SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

Publication No.US-2019-0285299-A1
Publication Date:09/19/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5	6388

20995 7590 07/12/2019

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EXAMINER	
NORMAN, MARC E	

ART UNIT	PAPER NUMBER
3763	

NOTIFICATION DATE	DELIVERY MODE
07/12/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

efiling@knobbe.com
jayna.cartee@knobbe.com

Office Action Summary	**Application No.** 16/374,246	**Applicant(s)** Steinberg, John Douglas	
	Examiner MARC E NORMAN	**Art Unit** 3763	**AIA (FITF) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 03 April 2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-20 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

Due to the issues related to priority set forth below, the effective filing date of the application is being treated as 3 April 2019. Accordingly, the present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Priority

Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, 365(c), or 386(c) is acknowledged. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120, 121, 365(c), or 386(c) as follows:

The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of 35 U.S.C. 112(a) or the first paragraph of pre-AIA 35 U.S.C. 112, except for the best mode requirement. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994)

The disclosure of the prior-filed application, Application Nos. 12/788,246, 14/048,932, 14/491,554, 15/616,719, and 16,264,050 fail to provide adequate support or enablement in the manner provided by 35 U.S.C. 112(a) or pre-AIA 35 U.S.C. 112, first paragraph for one or more claims of this application. These parent applications fail to specifically disclose first, second, and third setpoints, receiving the outdoor temperature from a network, the remote interface being configured to adjust temperature setpoints for the HVAC system; sending user-specific data through the internet; "user-specific information" about the building and HVAC system; or adjusting the temperature setpoint "without user intervention."

Since the parent applications do not provide support for these various features of the claims, the present case has not been accorded priority to those applications, and the effective filing date is the date the present action was filed, 3 April 2019. If Applicant disagrees with these findings, Applicant is requested to clearly point out where support for the claimed limitations is provided in the parent applications.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the limitations: first, second, and third setpoints, receiving the outdoor temperature from a network, the remote interface being configured to adjust temperature setpoints for the HVAC system; sending user-specific data through the internet; "user-specific information" about the building and HVAC system; and adjusting the temperature setpoint "without user intervention" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant

will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

> The following is a quotation of 35 U.S.C. 112(b):
> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.
>
> The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-19 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 1 recites the limitation "compatible with IEEE 802.11 wireless protocol" in line 7 of the claim. This limitation renders the claim indefinite since it is directed to an industry protocol, which is subject to change or modification, and not to an actual physical structure of the system.

Claims 2-19 are rejected since they depend from rejected claim 1.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under pre-AIA 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

Claims 1-4, 7-11, 19, and 20 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Adamek et al. (US 2015/0053779 A1) in view of Sloo et al. (2012/0203379 A1).

As per claims 1 and 20, Adamek et al. disclose a thermostat comprising: a housing (Fig. 23, etc.); a display unit configured to present information to a user (Fig. 19, etc.); a memory 44 configured to store data; a wireless radio 20 configured to communicate bi-directionally with a

remote device (Fig. 3, etc.); a temperature sensor 60; and one or more processors 40; the one or more processors 40 configured to receive a first data from the temperature sensor (Fig. 2, etc.); the one or more processors 40 further configured to receive a second data from a network connection, wherein the second data from the network connection is collected from a source external to the building, wherein the second data comprises an outdoor temperature (para. 0049, lines 6-10); the one or more processors 40 further configured to receive a first temperature setpoint (para. 0051, line 2) for the building, wherein the first setpoint may include a temperature value and a time value (para. 0050, lines 3-7; para. 0055, lines 2-4; para. 0065, lines 1-6; etc.); the one or more processors 40 further configured to receive a second temperature setpoint (para. 0051, lines 3-4) for the building, wherein the second setpoint may include a temperature value and a time value (para. 0050, lines 3-7; para. 0055, lines 2-4; para. 0065, lines 1-6; etc.); the one or more processors 40 further configured to receive commands through the Internet by way of a remote interface 25; wherein the interface is configured to allow the user to adjust temperature setpoints for the HVAC system (para. 0052); the one or more processors 40 further configured to send user-specific data through the Internet, wherein user-specific information about the building and HVAC system is generated based at least in part on the user-specific data (paras. 0122 and 0123 regarding thermostat interacting with user via cloud to transfer back and forth user information), wherein the user-specific information is presented on a website accessible through the Internet (para. 00121, lines 14-19 regarding referring user to a website based on user-specific interaction or need); the one or more processors further configured to automatically adjust a temperature setpoint to a third temperature setpoint without user intervention (para. 0051, lines 9-15 wherein the third setpoint may be an automatically operated away or sleep); and the one or more processors further configured to control the HVAC system to provide heating or cooling to the building in accordance with the third temperature setpoint (para. 0053, lines 9-16).

Adamek et al. do not explicitly teach the thermostat comprising contacts configured to connect the thermostat with wires that allow for at least two electrical connections from a building's HVAC system to the contacts. However, providing multiple wiring contacts for connection with HVAC devices is generally old in the thermostat arts, as taught by Sloo et al. (Fig. 5E, etc.). It would have been obvious to one of ordinary skill in the art at the effective filing date of the invention to provide similar contacts on the thermostat of Adamek et al. for the purpose of allowing the thermostat communicate with and control the HVAC system. Also, while Adamek et al. do not explicit teach the wireless communication being compatible with the IEEE 802.11 wireless protocol, such language is indefinite as being directed to an industry protocol rather than actual structure as discussed above under 35 U.S.C. 112b, and is thus not accorded patentable weight.

As per claim 2, Adamek et al. teach wherein the one or more processors 40 is further configured to determine whether the building is occupied or unoccupied (para. 0051, lines 6-9).

As per claim 3, Adamek et al. teach wherein the one or more processors 40 is further configured to receive a third data from a first sensor, wherein the third data from the first sensor includes a measurement of at least one characteristic of a building within which the thermostat is located (para. 0049, lines 2-6).

As per claim 4, Adamek et al. teach wherein the third data from the first sensor comprises a measurement of the humidity of the building (para. 0049, line 4).

As per claim 7, Adamek et al. teach wherein the third temperature setpoint is the first temperature setpoint for the building corresponding to a desired temperature setting when the building is occupied, in the event the one or more processors determines that the building is occupied (para. 0051, lines 9-15 – sleep mode when building is occupied).

As per claim 8, Adamek et al. teach wherein the third temperature setpoint is the second temperature setpoint for the building corresponding to a desired temperature setting when the building is unoccupied, in the event the one or more

As per claim 9, Adamek et al. do not teach wherein the interface is configured to allow the user to input that the building is currently unoccupied. Sloo et al. teach a thermostat interface wherein a user may input that the building is currently unoccupied (para. 0075, lines 13-27). As per claim 10, Sloo et al. further wherein the determination of whether the building is occupied or unoccupied by the one or more processors is based at least in part on a fourth data received from a motion sensor (para. 0057, lines 13-27; para. 0041, lines 1-2). It would have been obvious to one of ordinary skill in the art at the effective filing date of the invention to apply such manual or sensor based determination of occupancy to the system of Adamek et al. for the purpose of controlling HVAC operation in order to save energy when the building is unoccupied. processors determines that the building is unoccupied para. 0051, lines 8-9).

As per claim 11, the memory 44 of Adamek et al. is generally configured to store data. Since no particular or special modification would need to be made to the memory for it to historical values of the first data and second data, it is considered inherently capable of such storage.

As per claim 19, Adamek et al. teach wherein the one or more processors 40 is further configured to receive a fifth data generated based at least in part on a previous operation of the HVAC system, wherein the fifth data includes at least one performance characteristic of the HVAC system (para. 0064, line 10).

Claim 5 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Adamek et al. (US 2015/0053779 A1) in view of Sloo et al. (2012/0203379 A1), and further in view of Altonen et al. (2012/0091804 A1).

As per claim 5, Adamek et al. do not teach wherein the third data from the first sensor comprises a measurement of sunlight. Altonen et al. teach an HVAC system wherein

the temperature setpoint is adjusted according to an amount of sunlight (para. 0117, lines 1-8; etc.). It would have been obvious to one of ordinary skill in the art at the effective filing date of the invention to similarly control the HVAC setpoint of Adamek et al. according to a sunlight amount for the same purpose of taking into account the effect solar radiation has on the heat load of the building.

Claim 6 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Adamek et al. (US 2015/0053779 A1) in view of Sloo et al. (2012/0203379 A1) and Altonen et al. (US 2012/0091804 A1), and further in view of Cheung et al. (US 2010/0262299 A1).

As per claim 6, Adamek et al. do not teach wherein the second data from the network connection further comprises a measurement of the outdoor humidity. Cheung et al. teach an HVAC system wherein the temperature setpoint is adjusted according to outdoor humidity (para. 0014, lines 8-17). It would have been obvious to one of ordinary skill in the art at the effective filing date of the invention to similarly control the HVAC setpoint of Adamek et al. according to an outdoor humidity for the same purpose of taking into account the effect outdoor humidity has on the heat load of the building.

Claims 12, 13, and 16 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Adamek et al. (US 2015/0053779 A1) in view of Sloo et al. (2012/0203379 A1), and further in view of Shiel et al. (US 2016/0195865 A1).

As per claim 12, Adamek et al. do not teach wherein the one or more processors is further configured to predict, based at least on the first data, the second data from the network connection, and the first temperature setpoint, the time necessary for the HVAC system to operate in order for the building to reach the first temperature value by the first time value. Shiel teaches using indoor temperature, outdoor temperature, and set point data to determine the time necessary to reach a desired temperature value (paras. 0141-0144). It would have been obvious to one of ordinary skill in the art at the effective filing date of the

invention to provide this control feature to the system of Adamek et al. for the purpose of reducing and optimizing energy consumption (Shiel, background section, paras. 0005-0007).

As per claim 13, Shiel et al. further teach the prediction being based on a rate of chance value to reach the set point (MSCR; equations 1-4; paras. 0141-0144; etc.).

As per claim 16, Shiel et al. further teach storing historical values of indoor and outdoor temperatures in a memory (para. 0141, lines 1-3 regarding recording the internal space and external temperatures from cooling off time to approximately midnight) , and predicting the time to the setpoint based on those values (paras. 0141-0144).

Allowable Subject Matter

Claims 14, 15, 17, and 18 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARC E NORMAN whose telephone number is (571)272-4812. The examiner can normally be reached on 8:30-5:00 M-F.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frantz Jules can be reached on 571-272-6681. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MARC E NORMAN/
Primary Examiner, Art Unit 3763

Notice of References Cited	Application/Control No. 16/374,246	Applicant(s)/Patent Under Reexamination Steinberg, John Douglas	
	Examiner MARC E NORMAN	Art Unit 3763	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20160195865-A1	07-2016	Shiel; Patrick Andrew	G05B19/042	700/276
*	B	US-20150053779-A1	02-2015	Adamek; Martin	F24F11/30	236/1C
*	C	US-20120091804-A1	04-2012	Altonen; Gregory	E06B9/68	307/31
*	D	US-20120203379-A1	08-2012	SLOO; David	G05D23/1902	700/276
*	E	US-20100262299-A1	10-2010	Cheung; Leo	G05B13/0245	700/278
	F					
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	**Art Unit**
	MARC E NORMAN	3763

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/01/2019								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
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	17	✓								
	18	✓								
	19	✓								
	20	✓								

Ex. 1004.0126

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/374,246	Steinberg, John Douglas
	Examiner	Art Unit
	MARC E NORMAN	3763

CPC - Searched*		
Symbol	**Date**	**Examiner**
F24F 11/30, 46, 52, 58, 62; 2120/10; 2130/00, 10	06/26/2019	MN
G05D 23/1905, 1951	06/26/2019	MN
H04Q 9/00	06/26/2019	MN
Y02D 70/1222, 1224, 142, 144, 164, 26	06/26/2019	MN

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
EAST search (see attached)	06/26/2019	MN
Inventor name search	06/26/2019	MN
Consulted parent cases	06/26/2019	MN

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

/MARC E NORMAN/ Primary Examiner, Art Unit 3763	

Ex. 1004.0127

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/374,246
	Filing Date	April 3, 2019
	First Named Inventor	John Douglas Steinberg
	Art Unit	3763
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 2	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS						
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	07/01/2
	1	5,261,481	11/16/1993	Baldwin, et al.		
	2	5,761,083	06/02/1998	Brown, Jr., et al.		
	3	7,055,759	06/06/2006	Wacker, et al.		
	4	7,354,005	04/08/2008	Carey, et al.		
	5	7,565,225	07/21/2009	Dushane, et al.		
	6	7,802,618	09/28/2010	Simon, et al.		
	7	8,386,082	02/26/2013	Oswald		
	8	8,583,288	11/12/2013	Rossi, et al.		
	9	8,880,231	11/04/2014	Boucher, et al.		
	10	9,188,994 (EFACT.013C3)	11/17/2015	Steinberg		
	11	10,254,775 (EFACT.010C2)	04/09/2019	Cheung et al.		
	12	10,289,131 (EFACT.011C2)	05/14/2019	Steinberg		
	13	2003/0131623	07/17/2003	Suppes		
	14	2007/0044501	03/01/2007	Schnell, et al.		
	15	2008/0283621	11/20/2008	Quirino, et al.		
	16	2009/0013703	01/15/2009	Werner		
	17	2009/0216382	08/27/2009	Ng		
	18	2010/0019051	01/28/2010	Rosen		
	19	2011/0202181	08/18/2011	Lee, et al.		
	20	2012/0125592	05/24/2012	Fadell, et al.		
	21	2014/0352340	12/04/2014	Berg, et al.		
	22	2016/0258822 (EFACT.005C5)	09/08/2016	Steinberg, et al.		
	23	2019/0086106	03/21/2019	Okita et al.		
	24	2019/0086108	03/21/2019	Okita et al.		
	25	2019/0086109	03/21/2019	Okita et al.		
	26	2019/0086110	03/21/2019	Okita et al.		
	27	2019/0086882	03/21/2019	Okita et al.		
	28	2019/0089194	03/21/2019	Okita et al.		

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.E.N/

T[1] - Place a check mark in this area when an English language Translation is attached.

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/374,246
	Filing Date	April 3, 2019
	First Named Inventor	John Douglas Steinberg
	Art Unit	3763
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 2 OF 2	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	29	2019/0137133 (EFACT.007C3)	05/09/2019	Steinberg, et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]

NON PATENT LITERATURE DOCUMENTS		
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
	30	Examination Report No. 2 in Australian Application No. 2013274827, dated May 22, 2017 (EFACT.014AU).

30694052

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.E.N/

T[1] - Place a check mark in this area when an English language Translation is attached.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	11349	thermostat and (wireless or radio) and (temperature adj sensor) and (internet or network)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 08:37
S2	2994	S1 and ((external or outside or outdoor) adj2 temperature)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 08:38
S3	189	S2 and (first adj2 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 08:39
S4	157	S3 and (second adj2 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 08:39
S5	73	S4 and (third adj2 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 08:40
S6	65	S5 and (occupancy or occupied)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:05
S7	59	S6 and (remote adj device)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:05
S8	14	S5 not S7	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:23
S9	360	S1 and (((external or outside or outdoor) adj2 temperature) with (network or internet))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:35
S10	157	S4 and (second adj2 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:35
S11	40	S4 and S9	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:35
S12	1	("9709292").PN.	US-PGPUB; USPAT	OR	OFF	2019/06/26 09:38
S13	0	("012and1").PN.	US-PGPUB; USPAT	OR	OFF	2019/06/26 09:38

S14	1	S12 and S1	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:38
S15	1	S12 and S2	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:38
S16	1	S12 and S4	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:38
S17	0	S12 and S5	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:38
S18	1	S12 and (first adj2 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:41
S19	1	S18 and (second adj2 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:41
S20	1	S12 and ieee	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:43
S21	0	S12 and (((external or outside or outdoor) adj2 temperature) with (network or internet))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:43
S22	1	S12 and ((external or outside or outdoor) adj2 temperature)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:44
S23	0	S12 and (((external or outside or outdoor) adj2 temperature) same (network or internet))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:45
S24	841	S2 and ((setpoint or (set adj point)) with temperature with time)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:46
S25	1	S12 and ((setpoint or (set adj point)) with temperature with time)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:46
S26	6	(remote adj interface) with adjust$3 with (setpoint or (set adj point))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:49
S27	0	S12 and S26	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:49
S28	141963	(remote adj2 interface) sane (adjust$3 or control$4) with (setpoint or (set adj point))	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2019/06/26 09:50

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S29	0	S12 and ((remote adj2 interface) same (adjust$3 or control$4) with (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:50
S30	1	S12 and ((interface) same (adjust$3 or control$4) with (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 09:50
S31	0	S12 and (user adj specific adj data)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:13
S32	0	S12 and (without adj user adj intervention)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:24
S33	1	S12 and (website)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:24
S34	1	S12 and (automatically with adjust$3 with setpoint)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:25
S35	0	S12 and humnidity and sunlight	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:28
S36	1	S12 and humidity and sunlight	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:28
S37	1	S12 and sunlight	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:29
S38	0	S12 and (outdoor adj humidity)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:31
S39	1	S12 and ((outdoor or outside or external) near4 humidity)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:31
S40	1	S12 and (setpoint with unoccupied)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:35
S41	0	S12 and (intermediate with temperature with setpoint)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:37
S42	1	S12 and (predict$3 with time)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:50
S43	1	S12 and (setpoint with (predict$3 with	US-PGPUB;	OR	ON	2019/06/26

		time))	USPAT; EPO; JPO; DERWENT			10:51
S44	0	S12 and (user adj specific adj information)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:54
S45	0	S12 and (user adj specific with building)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:54
S46	16301	f24f11/30,46,52,58,62.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 10:55
S47	2636	(f24f2120/10 or f24f2130/00,10).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:03
S48	1604	(g05d23/1905,1951).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:13
S49	12287	h04q9/00.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:18
S50	32507	y02d70/1222,1224,142,144,164,26.cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:19
S51	61667	S46 or S47 or S48 or S49 or S50	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:20
S52	2424	S1 and S51	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:21
S53	80	S52 and (automatically with adjust$3 with setpoint)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:21
S54	166	S52 and (automatically with (adjust$3 or control$4) with setpoint)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:46
S55	114	S54 and ((external or outside or outdoor) adj2 temperature)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 11:46
S56	15	S7 and (automatically with (adjust$3 or control$4) with (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/26 12:45
S57	1	("8010237").PN.	US-PGPUB; USPAT	OR	OFF	2019/06/27 09:28
S58	1	S57 and (contact or wire)	US-PGPUB;	OR	ON	2019/06/27

			USPAT; EPO; JPO; DERWENT			09:29
S59	1	("20150053779").PN.	US-PGPUB; USPAT	OR	OFF	2019/06/27 09:30
S60	1	S59 and (contact or wire)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 09:30
S61	1	S59 and (wiring with connect$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 09:31
S62	1	S59 and memory	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 09:40
S63	1	S59 and (wireless or radio)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 09:41
S64	1	S59 and ((outdoor or outside or external or exterior) near3 temperature)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 09:46
S65	1	S59 and (first adj3 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 09:49
S66	1	S59 and ((setpoint or (set adj point)) with time)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 09:50
S67	1	S59 and (user near5 (data or information))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 10:24
S68	1	S59 and (website or (web adj site))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 10:31
S69	1	S59 and (third adj3 (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 11:28
S70	1	S59 and (connect$4)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 11:36
S71	0	S59 and (connect$4 with (HVAC or equipment))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 11:37
S72	597	thermostat.ti,ab. and ((connect$4 or contact) with wire with (HVAC or equipment))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 11:38
S73	1	S59 and occupied	US-PGPUB;	OR	ON	2019/06/27

			USPAT; EPO; JPO; DERWENT			12:25
S74	1	S59 and (humidity or solar)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 12:28
S75	0	S59 and (sunlight or sun or solar)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 12:28
S76	0	S59 and (input$4 with (occupied or unoccupied or occupancy))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:05
S77	0	S59 and (input$4 with away)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:06
S78	0	S59 and historical	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:28
S79	0	S59 and past	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:28
S80	1	S59 and previous	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:28
S81	0	S59 and earlier	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:29
S82	1	S59 and (stor$3 with (setpoint or (set adj point)))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:30
S83	0	S59 and (user with (occupied or unoccupied or occupancy))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:33
S84	0	S59 and (set$4 with (occupied or unoccupied or occupancy))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 13:33
S85	1	("20150053779").PN.	US-PGPUB; USPAT	OR	OFF	2019/06/27 14:42
S86	1	S85 and (performance near3 (data or characteristic))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 14:42
S87	41	thermostat.ti,ab. and ((sunlight or solar) adj2 sensor)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/06/27 16:05
S88	7	(US-20120091804-$ or US-	US-PGPUB;	OR	ON	2019/07/01

		20100262299-$ or US-20090171512-$ or US-20150053779-$ or US-20120203379-$).did. or (US-8010237-$ or US-5544036-$).did.	USPAT			09:28
S89	3	S88 and (sunlight or sun or solar)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/07/01 09:28
S90	3	S88 and (setpoint or (set adj point)) and (sunlight or sun or solar)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/07/01 09:30
S91	1	S88 and (setpoint or (set adj point)) same (sunlight or sun or solar)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/07/01 09:31
S92	2	S88 and ((outdoor or outside or external) near3 humidity)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/07/01 09:45
S93	7	(US-20120091804-$ or US-20100262299-$ or US-20090171512-$ or US-20150053779-$ or US-20120203379-$).did. or (US-8010237-$ or US-5544036-$).did.	US-PGPUB; USPAT	OR	ON	2019/07/01 11:05
S94	2	S93 and (user with (set$4 or input$4) with occup$5)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/07/01 11:05
S95	1	S94 and motion	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/07/01 11:36
S96	4	predict$3 with time with (difference near5 ((outdoor ot outside or external) adj3 temperature) near5 ((indoot or inside or internal) adj3 temperature))	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2019/07/01 11:46

7/ 1/ 2019 2:24:57 PM
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	Unknown
	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	H2176	12/05/2006	Meyer et al.	
	2	12/805705	06/10/2010	Crabtree	
	3	13/470074	08/30/2012	Steinberg	
	4	13/523697	06/14/2012	Hublou et al.	
	5	13/725447	06/06/2013	Steinberg	
	6	13/729401	12/28/2012	Sloop	
	7	13/852577	03/28/2013	Steinberg et al.	
	8	13/858710	09/05/2013	Steinberg et al.	
	9	13/861189	04/11/2013	Steinberg et al.	
	10	14/082,675 (EFACT.007C1)	11/18/2003	Steinberg et al.	
	11	14/263,762	04/28/2014	Steinberg	
	12	14/285,384	05/22/2014	Steinberg et al.	
	13	14/292,377	05/30/2014	Steinberg	
	14	14/491,554	09/19/2014	Steinberg	
	15	14/527,433	10/29/2014	Steinberg et al.	
	16	14/731,221	06/04/2015	Steinberg et al.	
	17	15/616,719	06/07/2017	Steinberg et al.	
	18	D 646,990	10/18/2011	Rhodes	
	19	D 659,560	05/15/2012	Rhodes	
	20	D 673,467	01/01/2013	Lee et al.	
	21	D 705,095 (EFACT.015DA)	05/20/2014	Steinberg et al.	
	22	4,136,732	01/30/1979	Demaray et al.	
	23	4,270,693	06/02/1981	Hayes	
	24	4,341,345	07/27/1982	Hammer et al.	
	25	4,403,644	09/13/1983	Hebert	
	26	4,451,879	05/29/1984	Welch et al.	
	27	4,475,685	10/09/1984	Grimado et al.	
	28	4,655,279	04/07/1987	Harmon	

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	Unknown
	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 2 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	29	4,674,027	06/16/1987	Beckey	
	30	4,675,828	06/23/1987	Winston	
	31	4,702,305	10/27/1987	Beckey et al.	
	32	4,702,413	10/27/1987	Beckey et al.	
	33	4,897,798	01/30/1990	Cler	
	34	5,124,502	06/23/1992	Nelson et al.	
	35	5,244,146	09/14/1993	Jefferson et al.	
	36	5,270,952	12/14/1993	Adams et al.	
	37	5,279,458	01/18/1994	Dewolf et al.	
	38	5,297,838	03/15/1994	Juravich	
	39	5,314,004	05/24/1994	Strand et al.	
	40	5,348,078	09/20/1994	Dushane et al.	
	41	5,454,511	10/03/1995	Van Ostrand et al.	
	42	5,462,225	10/31/1995	Massara et al.	
	43	5,544,036	08/06/1996	Brown et al.	
	44	5,555,927	09/17/1996	Shah	
	45	5,572,438	11/05/1996	Ehlers et al.	
	46	5,682,949	11/04/1997	Ratcliffe et al.	
	47	5,706,190	01/06/1998	Russ et al.	
	48	5,717,609	02/10/1998	Packa et al.	
	49	5,725,148	03/10/1998	Hartman	
	50	5,729,474	03/17/1998	Hildebrand et al.	
	51	5,818,347	10/06/1998	Dolan et al.	
	52	5,839,654	11/24/1998	Weber	
	53	5,924,486	07/20/1999	Ehlers et al.	
	54	5,977,964	11/02/1999	Williams et al.	
	55	6,079,626	06/27/2000	Hartman	
	56	6,115,713	09/05/2000	Pascucci et al.	
	57	6,145,751	11/14/2000	Ahmed	

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

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	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 3 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	58	6,178,362	01/23/2001	Woolard et al.	
	59	6,216,956	04/17/2001	Ehlers et al.	
	60	6,223,544	05/01/2001	Seem	
	61	6,260,765	07/17/2001	Natale et al.	
	62	6,241,156	06/05/2001	Kline et al.	
	63	6,351,693	02/26/2002	Monie	
	64	6,400,956	06/02/2002	Richton	
	65	6,400,996	06/04/2002	Hoffberg et al.	
	66	6,437,692	08/20/2002	Petite et al.	
	67	6,449,534	09/10/2002	Stewart	
	68	6,454,177	09/24/2002	Sasao et al.	
	69	6,478,233	11/12/2002	Shah	
	70	6,480,803	11/12/2002	Pierret et al.	
	71	6,483,906	11/19/2002	Lggulden et al.	
	72	6,536,675	03/25/2003	Pesko et al.	
	73	6,542,076	04/01/2003	Joao	
	74	6,549,130	04/15/2003	Joao	
	75	6,574,537	06/02/2003	Kipersztok et al.	
	76	6,580,950	06/17/2003	Johnson	
	77	6,594,825	07/15/2003	Goldschmidtlki et al.	
	78	6,595,430	07/22/2003	Shah	
	79	6,598,056	07/22/2003	Hull et al.	
	80	6,619,555	09/16/2003	Rosen	
	81	6,622,097	09/16/2003	Hunter	
	82	6,622,115	09/16/2003	Brown et al.	
	83	6,622,925	09/23/2003	Carner et al.	
	84	6,622,926	09/23/2003	Sartain et al.	
	85	6,628,997	09/30/2003	Fox et al.	
	86	6,633,823	10/14/2003	Bartone et al.	

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	Unknown
	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 4 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	87	6,643,567	11/04/2003	Kolk et al.	
	88	6,644,098	11/11/2003	Cardinale et al.	
	89	6,671,586	12/30/2003	Davis et al.	
	90	6,695,218	02/24/2004	Fleckenstein	
	91	6,700,224	03/02/2004	Biskup, Sr.,	
	92	6,726,113	04/27/2004	Guo	
	93	6,731,992	05/04/2004	Ziegler	
	94	6,734,806	05/11/2004	Cratsley	
	95	6,772,052	08/03/2004	Amundsen	
	96	6,785,592	08/31/2004	Smith	
	97	6,785,630	08/31/2004	Kolk	
	98	6,786,421	09/07/2004	Rosen	
	99	6,789,739	09/14/2004	Rosen	
	100	6,845,918	01/25/2005	Rotondo	
	101	6,853,959	02/08/2005	Ikeda et al.	
	102	6,868,293	03/15/2005	Schurr	
	103	6,868,319	03/15/2005	Kipersztok et al.	
	104	6,882,712	04/19/2005	Iggulden et al.	
	105	6,889,908	05/10/2005	Crippen et al.	
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	107	6,912,429	06/28/2005	Bilger	
	108	6,981,383	01/03/2006	Shah et al.	
	109	6,991,029	01/31/2006	Orfield et al.	
	110	7,009,493	03/07/2006	Howard	
	111	7,031,880	04/18/2006	Seem et al.	
	112	7,039,532	05/02/2006	Hunter	
	113	7,061,393	06/13/2006	Buckingham et al.	
	114	7,089,088	08/08/2006	Terry et al.	
	115	7,130,719	10/31/2006	Ehlers et al.	

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

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PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	Unknown
	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 5 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	116	7,130,832	10/31/2006	Bannai et al.	
	117	7,167,079	01/23/2007	Smyth et al.	
	118	7,187,986	03/06/2007	Johnson et al.	
	119	7,205,892	04/17/2007	Luebke et al.	
	120	7,206,670	04/17/2007	Pimputkar et al.	
	121	7,215,746	05/08/2007	Iggulden et al.	
	122	7,216,015	05/08/2007	Poth Robert J.	
	123	7,231,424	06/11/2007	Bodin et al.	
	124	7,232,075	06/19/2007	Rosen	
	125	7,242,988	07/10/2007	Hoffberg et al.	
	126	7,260,823	08/21/2007	Schlack et al.	
	127	7,356,384	04/08/2008	Gull et al.	
	128	7,476,020	01/13/2009	Zufferey et al.	
	129	7,483,964	01/27/2009	Jackson et al.	
	130	7,590,469	09/15/2009	Grohman	
	131	7,644,869	01/12/2010	Hoglund et al.	
	132	7,702,424	04/20/2010	Cannon et al.	
	133	7,758,729	07/20/2010	DeWhitt	
	134	7,784,704	08/31/2010	Harter	
	135	7,848,900 (EFACT.005A)	12/07/2010	Steinberg et al.	
	136	7,869,904	01/11/2011	Cannon et al.	
	137	7,894,943	02/22/2011	Sloup et al.	
	138	7,908,116 (EFACT.004A)	03/15/2011	Steinberg et al.	
	139	7,908,117 (EFACT.003A)	03/15/2011	Steinberg et al.	
	140	7,983,795	07/19/2011	Josephson et al.	
	141	8,010,237 (EFACT.010A)	08/30/2011	Cheung Leo et al.	
	142	8,019,567 (EFACT.006A)	09/13/2011	Steinberg et al.	
	143	8,090,477 (EFACT.013A)	01/03/2012	Steinberg	

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

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PTO/SB/08 Equivalent

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	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 6 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	144	8,131,497 (EFACT.005C1)	03/06/2012	Steinberg et al.	
	145	8,131,506 (EFACT.004C1)	03/06/2012	Steinberg et al.	
	146	8,180,492 (EFACT.011A)	05/15/2012	Steinberg	
	147	8,340,826 (EFACT.013C1)	12/25/2012	Steinberg et al.	
	148	8,412,488 (EFACT.004C2)	04/02/2013	Steinberg et al.	
	149	8,423,322 (EFACT.006C1)	04/16/2013	Steinberg et al.	
	150	8,428,782	04/23/2013	Imes	
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	154	8,556,188 (EFACT.012A)	10/15/2013	Steinberg	
	155	8,596,550 (EFACT.007A)	12/03/2013	Steinberg et al.	
	156	8,712,590 (EFACT.013C2)	04/29/2014	Steinberg	
	157	8,738,327 (EFACT.004C3)	05/27/2014	Steinberg et al.	
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	166	9,244,470 (EFACT.011C1)	01/26/2016	Steinberg	
	167	9,279,594 (EFACT.008C1)	03/08/2016	Steinberg	

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	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 7 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	168	9,353,965	05/31/2016	Goyal et al.	
	169	9,534,805	01/03/2017	Matsuoka et al.	
	170	9,709,292 (EFACT.012C2)	07/18/2017	Steinberg	
	171	9,791,839	10/17/2017	Matsuoka et al.	
	172	9,939,333 (EFACT.006C3)	04/10/2018	Steinberg et al.	
	173	9,982,905 (EFACT.008C2)	05/29/2018	Steinberg	
	174	10,018,371 (EFACT.007C2)	07/10/2018	Steinberg et al.	
	175	10,048,706 (EFACT.014A)	08/14/2018	Hublou et al.	
	176	2001/0025349	09/27/2001	Sharood et al.	
	177	2003/0040934	02/27/2003	Skidmore et al.	
	178	2004/0065095	04/08/2004	Osborne et al.	
	179	2004/0117330	06/17/2004	Ehlers et al.	
	180	2004/0133314	07/08/2004	Ehlers et al.	
	181	2004/0176880	09/09/2004	Obradovich et al.	
	182	2005/0222889	10/06/2005	Lai et al.	
	183	2005/0288822	12/29/2005	Rayburn	
	184	2006/0045105	03/02/2006	Dobosz et al.	
	185	2006/0214014	09/28/2006	Bash et al.	
	186	2006/0283965	12/21/2006	Mueller et al.	
	187	2007/0043477	02/22/2007	Elhers et al.	
	188	2007/0045431	03/03/2007	Chapman et al.	
	189	2007/0146126	06/28/2007	Wang	
	190	2007/0107450	05/17/2007	Sasao et al.	
	191	2008/0083234	04/10/2008	Krebs et al.	
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	193	2008/0198549	08/21/2008	Rasmussen et al.	
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Examiner Signature /MARC E NORMAN/	Date Considered 07/01/2019

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	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 8 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	196	2009/0018673	01/15/2009	Dushane et al.	
	197	2009/0052859	02/26/2009	Greenberger et al.	
	198	2009/0057426	03/05/2009	Sullivan et al.	
	199	2009/0062970	03/05/2009	Forbes et al.	
	200	2009/0065596	03/12/2009	Seem et al.	
	201	2009/0099699	04/16/2009	Steinberg et al.	
	202	2009/0125151	05/14/2009	Steinberg et al.	
	203	2009/0188985	07/30/2009	Scharing et al.	
	204	2009/0240381	09/24/2009	Lane	
	205	2009/0271013	10/29/2009	Chen	
	206	2009/0281667	11/12/2009	Masui et al.	
	207	2010/0019052	01/28/2010	Yip	
	208	2010/0070086	03/18/2010	Harrod et al.	
	209	2010/0070089	03/18/2010	Harrod et al.	
	210	2010/0070093	03/18/2010	Harrod et al.	
	211	2010/0070234	03/18/2010	Steinberg et al.	
	212	2010/0156608	06/24/2010	BAE et al.	
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	214	2010/0211224	08/19/2010	Keeling et al.	
	215	2010/0235004	09/16/2010	Thind	
	216	2010/0289643	11/18/2010	Trundle et al.	
	217	2010/0318227	12/16/2010	Steinberg et al.	
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	219	2011/0046792	02/24/2011	Imes et al.	
	220	2011/0046798	02/24/2011	Imes et al.	
	221	2011/0046799	02/24/2011	Imes et al.	
	222	2011/0046800	02/24/2011	Imes et al.	
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Examiner Signature /MARC E NORMAN/	Date Considered 07/01/2019

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	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 9 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	225	2011/0054699	03/03/2011	Imes et al.	
	226	2011/0054710	03/03/2011	Imes et al.	
	227	2011/0118857	05/19/2011	Bodnar	
	228	2011/0173542	07/14/2011	Imes et al.	
	229	2011/0202185	08/18/2011	Imes et al.	
	230	2011/0214060	09/01/2011	Imes et al.	
	231	2011/0224838	09/15/2011	Imes et al.	
	232	2011/0246898	10/06/2011	Imes et al.	
	233	2011/0253796	10/20/2011	Posa et al.	
	234	2011/0290893	12/01/2011	Steinberg	
	235	2011/0307101	12/15/2011	Imes et al.	
	236	2012/0023225	01/26/2012	Imes et al.	
	237	2012/0046859	02/23/2012	Imes et al.	
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	239	2012/0065935	03/15/2012	Steinberg et al.	
	240	2012/0066168	03/15/2012	Fadell et al.	
	241	2012/0072033	03/22/2012	Imes et al.	
	242	2012/0086562	04/12/2012	Steinberg	
	243	2012/0093141	04/19/2012	Imes et al.	
	244	2012/0101637	04/26/2012	Imes et al.	
	245	2012/0135759	05/31/2012	Imes et al.	
	246	2012/0186774	07/26/2012	Matsuoka et al.	
	247	2012/0215725	08/23/2012	Imes et al.	
	248	2012/0221718	08/30/2012	Imes et al.	
	249	2012/0252430	10/04/2012	Imes et al.	
	250	2012/0324119	12/20/2012	Imes et al.	
	251	2013/0053054	02/28/2013	Lovitt et al.	
	252	2013/0054758	02/28/2013	Imes et al.	
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Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

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	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 10 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	254	2013/0060387	03/07/2013	Imes et al.	
	255	2013/0073094	03/21/2013	Knapton et al.	
	256	2013/0144453	06/06/2013	Subbloie	
	257	2013/0167035	06/27/2013	Imes et al.	
	258	2013/0173064	07/04/2013	Fadell et al.	
	259	2013/0178985	07/11/2013	Lombard et al.	
	260	2013/0226502 EFACT.006C2	08/29/2013	Steinberg et al.	
	261	2013/0310989 (EFACT.009C1)	11/21/2013	Steinberg et al.	
	262	2014/0039690 (EFACT.012C1)	02/06/2014	Steinberg	
	263	2014/0058567	02/27/2014	Matsuoka et al.	
	264	2014/0074300	03/13/2014	Shilts et al.	
	265	2014/0207292	07/24/2014	Ramagem	
	266	2014/0229018 (EFACT.013C3)	08/20/2014	Steinberg	
	267	2014/0316581	10/26/2014	Fadell et al.	
	268	2015/0025691	01/22/2015	Fadell et al.	
	269	2015/0043615 (EFACT.004C4)	02/12/2015	Steinberg et al.	
	270	2015/0120235 (EFACT.005C4)	04/30/2015	Steinberg et al.	
	271	2015/0142180	05/21/2015	Matsuoka et al.	
	272	2015/0227846	08/13/2015	Mercer et al.	
	273	2015/0300892	10/22/2015	Malhotra et al.	
	274	2015/0378373	12/31/2015	Sprinkle et al.	
	275	2016/0047565	02/18/2016	Robinson	
	276	2016/0061474 (EFACT.010C2)	03/03/2016	Cheung et al.	
	277	2016/0097557 (EFACT.013C4)	04/07/2016	Steinberg	
	278	2016/0138822 (EFACT.011C2)	05/19/2016	Steinberg	
	279	2016/0241538	08/18/2016	Khurana et al.	
	280	2016/0290672	10/06/2016	Arensmeier	

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

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	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 11 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	281	2016/0363337	12/15/2016	Steinberg et al.	
	282	2017/0123391	05/04/2017	Sinha et al.	
	283	2017/0234562	08/17/2017	Ribbich et al.	
	284	2017/0241662	08/24/2017	Steinberg et al.	
	285	2017/0268797	09/21/2017	Mowris et al.	
	286	2017/0322530	11/09/2017	Al-Mohssen et al.	
	287	2017/0328777	11/16/2017	Zeckendorf et al.	
	288	2017/0336090	11/23/2017	Steinberg	
	289	2018/0058711	03/01/2018	Taplin	
	290	2018/0087793	03/29/2018	Okita et al.	
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	292	2018/0216841	08/02/2018	Steinberg	
	293	2018/0245810	08/30/2018	Berka et al.	
	294	2018/0259400	09/13/2018	Steinberg et al.	
	295	2018/0313567	11/01/2018	Steinberg	
	296	2018/0321093	11/08/2018	Steinberg et al.	

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Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	297	EP 0415747 A2	03/06/1991	Shaw et al.		
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	299	EP 2372263 A2	05/10/2011	Mitsubishi Electric Corporation		
	300	GB 2408592 A	06/01/2005	Oswald		
	301	JP 05-189659	07/30/1993	Hitachi Bill Shisetsu Eng. KK.		
	302	JP 2010-038377	02/18/2010	Mitsubishi Heavy Ind. Ltd.		
	303	JP 2010-286218	12/24/2010	Mitsubishi Heavy Ind. Ltd.		
	304	KR 10-1994-0011902	06/22/1994	Koryo Digital Elect. Co.		

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	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 12 OF 14	Attorney Docket No.	EFACT.012C5

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
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	306	KR 10-2000-0059532	10/05/2000	Dang Hae System Co.		
	307	WO 2005/098331 A1	10/20/2005	Zip Ind Aust Pty Ltd.		
	308	WO 2009/036764 A2	03/26/2009	Danfoss A/S		
	309	WO 2011/100427 A2	08/18/2011	Enphase Energy, Inc.		
	310	WO 2011/011404 A1	01/27/2011	Allure Energy, Inc.		
	311	WO 2011/149600 (EFACT.012WO)	12/01/2011	EcoFactor, Inc.		
	312	WO 2012/024534 (EFACT.013WO)	02/23/2012	EcoFactor, Inc.		
	313	WO 2013/187996	12/19/2013	EcoFactor, Inc.		

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
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	317	BRUSH, et al., Preheat – Controlling Home Heating with Occupancy Prediction, 2013.	
	318	CHENG et al., "Smart Sensors Enable Smart Air Conditioning Control", Sensors 2014, ISSN 1424-8220, June 24, 2014, 25 pages.	
	319	Comverge SuperStat Flyer, prior to June 28, 2007.	
	320	Control4 Wireless Thermostat Brochure, 2006.	
	321	Cooper Power Systems Web Page, 2000-2009.	
	322	Emerson Climate Technologies, "Network Thermostat for E2 Building Controller Installation and Operation Manual", 2007.	
	323	Enernoc Web Page, 2004-2009.	

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	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 13 OF 14	Attorney Docket No.	EFACT.012C5

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
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Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.E.N/

T[1] - Place a check mark in this area when an English language Translation is attached.

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	Unknown
	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 14 OF 14	Attorney Docket No.	EFACT.012C5

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
	343	Written Opinion and Search Report for PCT/US2011/032537, dated 12/12/11 (our reference EFACT.012WO).	
	344	Office Action in Canadian Application No. 2800491 dated December 7, 2016 EFACT.012CA).	
	345	Search Report in European Application No. 11787067.5 dated August 14, 2017 (EFACT.012EP).	
	346	Extended Search Report for European Application No. 11818805.1 dated June 9, 2017 (EFACT.013EP).	
	347	Search Report in European Application No. 11818805.1 dated October 11, 2018 (EFACT.013EP).	
	348	International Search Report and Written Opinion for PCT/US2013/035726 (EFACT.014WO), dated 08/06/2013.	
	349	International Preliminary Report on Patentability in PCT/US2013/035726 dated 12/16/2014 (EFACT.014WO).	
	350	Extended Search Report for European Application No. 13804057.1 dated June 1, 2016 (EFACT.014EP).	
	351	Examination Report in Australian Application No. 2013274827 dated April 11, 2017 (EFACT.014AU).	
	352	Written Opinion and Search Report for PCT/US2011/032537, dated 12/12/11 (our reference EFACT.012WO).	

30249567

Examiner Signature	/MARC E NORMAN/	Date Considered	07/01/2019

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.E.N/

T[1] - Place a check mark in this area when an English language Translation is attached.

Bibliographic Data

Application No: 16/374,246

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /MARC E NORMAN/ Examiner's Signature | Initials

Title: SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
04/03/2019	236	3763	EFACT.012C5
RULE			

APPLICANTS

EcoFactor, Inc., Redwood City, CA,

INVENTORS

John Douglas Steinberg Millbrae, CA, UNITED STATES

CONTINUING DATA

This application is a CON of 16264050 01/31/2019

16264050 is a CON of 15616719 06/07/2017ABN

15616719 is a CON of 14491554 09/19/2014 PAT 9709292

14491554 is a CON of 14048932 10/08/2013 PAT 8840033

14048932 is a CON of 12788246 05/26/2010 PAT 8556188

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

04/17/2019

** SMALL ENTITY **

STATE OR COUNTRY

UNITED STATES

ADDRESS

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614
UNITED STATES

FILING FEE RECEIVED

$2,855

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5	6388

20995 7590 06/11/2019

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
ART UNIT	PAPER NUMBER
3763	

NOTIFICATION DATE	DELIVERY MODE
06/11/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

efiling@knobbe.com
jayna.cartee@knobbe.com

Decision Granting Request for Prioritized Examination (Track I)	**Application No.** 16/374,246	**Applicant(s)** Steinberg, John Douglas	
	Examiner JoAnne L Burke	**Art Unit** OPET	**AIA (FITF) Status** No

1. THE REQUEST FILED 03 April 2019 IS **GRANTED** .

The above-identified application has met the requirements for prioritized examination

A. ☑ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination**. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims** , or a multiple dependent claim;

C. filing a **request for continued examination** ;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to JoAnne Burke at (571)272-4584. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.

/JOANNE L BURKE/ Lead Paralegal Specialist, OPET	

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/374,246	04/03/2019	3763	785	EFACT.012C5	20	2

CONFIRMATION NO. 6388

UPDATED FILING RECEIPT

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

OC000000108785319

Date Mailed: 06/10/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

John Douglas Steinberg, Millbrae, CA;

Applicant(s)

EcoFactor, Inc., Redwood City, CA;

Power of Attorney: The patent practitioners associated with Customer Number 20995

Domestic Priority data as claimed by applicant

This application is a CON of 16/264,050 01/31/2019
which is a CON of 15/616,719 06/07/2017 ABN
which is a CON of 14/491,554 09/19/2014 PAT 9709292
which is a CON of 14/048,932 10/08/2013 PAT 8840033
which is a CON of 12/788,246 05/26/2010 PAT 8556188

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 04/17/2019
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/374,246**
Projected Publication Date: 09/19/2019
Non-Publication Request: No
Early Publication Request: No
**** SMALL ENTITY ****
Title

SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

Preliminary Class

236

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

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No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/374,246

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	785		TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/374,246
	Filing Date	April 3, 2019
	First Named Inventor	John Douglas Steinberg
	Art Unit	3763
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 2	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	5,261,481	11/16/1993	Baldwin, et al.	
	2	5,761,083	06/02/1998	Brown, Jr., et al.	
	3	7,055,759	06/06/2006	Wacker, et al.	
	4	7,354,005	04/08/2008	Carey, et al.	
	5	7,565,225	07/21/2009	Dushane, et al.	
	6	7,802,618	09/28/2010	Simon, et al.	
	7	8,386,082	02/26/2013	Oswald	
	8	8,583,288	11/12/2013	Rossi, et al.	
	9	8,880,231	11/04/2014	Boucher, et al.	
	10	9,188,994 (EFACT.013C3)	11/17/2015	Steinberg	
	11	10,254,775 (EFACT.010C2)	04/09/2019	Cheung et al.	
	12	10,289,131 (EFACT.011C2)	05/14/2019	Steinberg	
	13	2003/0131623	07/17/2003	Suppes	
	14	2007/0044501	03/01/2007	Schnell, et al.	
	15	2008/0283621	11/20/2008	Quirino, et al.	
	16	2009/0013703	01/15/2009	Werner	
	17	2009/0216382	08/27/2009	Ng	
	18	2010/0019051	01/28/2010	Rosen	
	19	2011/0202181	08/18/2011	Lee, et al.	
	20	2012/0125592	05/24/2012	Fadell, et al.	
	21	2014/0352340	12/04/2014	Berg, et al.	
	22	2016/0258822 (EFACT.005C5)	09/08/2016	Steinberg, et al.	
	23	2019/0086106	03/21/2019	Okita et al.	
	24	2019/0086108	03/21/2019	Okita et al.	
	25	2019/0086109	03/21/2019	Okita et al.	
	26	2019/0086110	03/21/2019	Okita et al.	
	27	2019/0086882	03/21/2019	Okita et al.	
	28	2019/0089194	03/21/2019	Okita et al.	

Examiner Signature	Date Considered

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	16/374,246
	Filing Date	April 3, 2019
	First Named Inventor	John Douglas Steinberg
	Art Unit	3763
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 2 OF 2	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	29	2019/0137133 (EFACT.007C3)	05/09/2019	Steinberg, et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	**T[1]**

NON PATENT LITERATURE DOCUMENTS		
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
	30	Examination Report No. 2 in Australian Application No. 2013274827, dated May 22, 2017 (EFACT.014AU).

30694052

Examiner Signature	Date Considered

*__Examiner:__ Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

INFORMATION DISCLOSURE STATEMENT

First Inventor	:	John Douglas Steinberg
App. No.	:	16/374,246
Filed	:	April 3, 2019
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Examiner	:	Unknown
Art Unit	:	3763
Conf. No.	:	6388

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Pursuant to 37 CFR 1.56, an Information Disclosure Statement listing references is provided herewith. Copies of any listed foreign and non-patent literature references are being submitted.

No Disclaimers

To the extent that anything in the Information Disclosure Statement or the listed references could be construed as a disclaimer of any subject matter supported by the present application, Applicant hereby rescinds and retracts such disclaimer.

Timing of Disclosure

This Information Disclosure Statement is being filed before the receipt of a First Office Action on the merits, and presumably no fee is required.

If a First Office Action on the merits was mailed before the mailing date of this Statement, the Commissioner is authorized to charge the fee set forth in 37 CFR 1.17(p) to Deposit Account No. 11-1410.

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: June 7, 2019

By:/John R. King/
John R. King
Registration No. 34,362
Registered Practitioner
Customer No. 20,995
(949) 760-0404

30694104

Electronic Acknowledgement Receipt

EFS ID:	36235780
Application Number:	16374246
International Application Number:	
Confirmation Number:	6388
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Customer Number:	20995
Filer:	John R. King/Amy Durrant
Filer Authorized By:	John R. King
Attorney Docket Number:	EFACT.012C5
Receipt Date:	07-JUN-2019
Filing Date:	03-APR-2019
Time Stamp:	13:24:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		EFACT-012C5_IDS.pdf	43312 8a8f32c871d9ffbb1cf01b192c14b07730afd37c	yes	4

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Information Disclosure Statement (IDS) Form (SB08)		3	4	
	Transmittal Letter		1	2	
Warnings:					
Information:					
2	Non Patent Literature	EFACT-012C5_REF.pdf	177778 af5b3d2a80ebe1fc77eaaa57415d25a5afcc58f9	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	221090		

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.

Please Direct All Correspondence to Customer Number 20,995

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

First Inventor	:	John Douglas Steinberg
App. No.	:	16/374,246
Filed	:	April 3, 2019
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Art Unit	:	3763
Conf No.	:	6388

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice to File Corrected Application Papers, mailed April 18, 2019, Applicant submits the following:

(X) Replacement Drawings.

Applicant submits that no new matter has been added to the Application.

The Commissioner is also hereby authorized to charge any additional fees which may be required, now or in the future, or credit any overpayment, to Account No. 11-1410.

Dated: June 6, 2019

By:/John R. King/
John R. King
Registration No. 34,362
Registered Practitioner
Customer No. 20,995
(949) 760-0404

30682312

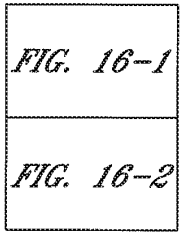


FIG. 16

1602 1604

FIG. 16-1

Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour		Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour		Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour		Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour
-99	-1.20945425		-49	0.61355475		1	2.43656376		51	4.25957277
-98	-1.17299407		-48	0.65001493		2	2.47302394		52	4.29603295
-97	-1.13653389		-47	0.68647511		3	2.50948412		53	4.33249313
-96	-1.10007371		-46	0.72293529		4	2.5459443		54	4.36895331
-95	-1.06361353		-45	0.75939547		5	2.58240448		55	4.40541349
-94	-1.02715335		-44	0.79585565		6	2.61886466		56	4.44187367
-93	-0.99069317		-43	0.83231583		7	2.65532484		57	4.47833385
-92	-0.95423299		-42	0.86877602		8	2.69178502		58	4.51479403
-91	-0.91777281		-41	0.9052362		9	2.7282452		59	4.55125421
-90	-0.88131263		-40	0.94169638		10	2.76470538		60	4.58771439
-89	-0.84485245		-39	0.97815656		11	2.80116556		61	4.62417457
-88	-0.80839227		-38	1.01461674		12	2.83762574		62	4.66063475
-87	-0.77193209		-37	1.05107692		13	2.87408592		63	4.69709493
-86	-0.73547191		-36	1.0542371		14	2.9105461		64	4.73355511
-85	-0.69901173		-35	1.12399728		15	2.94700628		65	4.77001529
-84	-0.66255155		-34	1.16045746		16	2.98346646		66	4.80647547
-83	-0.62609137		-33	1.19691764		17	3.01992664		67	4.84293565
-82	-0.58963119		-32	1.23337782		18	3.05638682		68	4.87939583
-81	-0.55317101		-31	1.269838		19	3.092847		69	4.91585601
-80	-0.51671083		-30	1.30629818		20	3.12930718		70	4.95231619
-79	-0.48025065		-29	1.34275836		21	3.16576736		71	4.98877637
-78	-0.44379047		-28	1.37921854		22	3.20222754		72	5.02523655

-77	-0.40733029	-27	1.41567872	23	3.23868772	73	5.06169673
-76	-0.37087011	-26	1.4521389	24	3.27514791	74	5.09815691
-75	-0.33440993	-25	1.48859908	25	3.31160809	75	5.13461709
-74	-0.29794975	-24	1.52505926	26	3.34806827	76	5.17107727
-73	-0.26148957	-23	1.56151944	27	3.38452845	77	5.20753745
-72	-0.22502939	-22	1.59797962	28	3.42098863	78	5.24399763
-71	-0.18856921	-21	1.6344398	29	3.45744881	79	5.28045781
-70	-0.15210903	-20	1.67089998	30	3.49390899	80	5.31691799
-69	-0.11564885	-19	1.70736016	31	3.53036917	81	5.35337817
-68	-0.07918867	-18	1.74382034	32	3.56682935	82	5.38983835
-67	-0.04272849	-17	1.78028052	33	3.60328953	83	5.42629853
-66	-0.00626831	-16	1.8167407	34	3.63974971	84	5.46275871
-65	0.03019187	-15	1.85320088	35	3.67620989	85	5.49921889
-64	0.06665205	-14	1.88966106	36	3.74913025	86	5.53567907
-63	0.10311223	-13	1.92612124	37	3.74913025	87	5.57213925
-62	0.13957241	-12	1.96258142	38	3.78559043	88	5.60859943
-61	0.17603259	-11	1.9990416	39	3.82205061	89	5.64505962
-60	0.21249277	-10	2.03550178	40	3.85851079	90	5.6815198
-59	0.24895295	-9	2.07196196	41	3.89497097	91	5.71797998
-58	0.28541313	-8	2.10842214	42	3.93143115	92	5.75444016
-57	0.32187331	-7	2.14488232	43	3.96789133	93	5.79090034
-56	0.35833349	-6	2.1813425	44	4.00435151	94	5.82736052
-55	0.39479367	-5	2.21780268	45	4.04081169	95	5.8638207
-54	0.43125385	-4	2.25426286	46	4.07727187	96	5.90028088
-53	0.46771403	-3	2.29072304	47	4.11373205	97	5.93674106
-52	0.50417421	-2	2.32718322	48	4.15019223	98	5.97320124
-51	0.54063439	-1	2.3636434	49	4.18665241	99	6.00966142
-50	0.57709457	0	2.40010358	50	4.22311259		

FIG. 16-2

Electronic Acknowledgement Receipt

EFS ID:	36224095
Application Number:	16374246
International Application Number:	
Confirmation Number:	6388
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Customer Number:	20995
Filer:	John R. King/tony do
Filer Authorized By:	John R. King
Attorney Docket Number:	EFACT.012C5
Receipt Date:	06-JUN-2019
Filing Date:	03-APR-2019
Time Stamp:	15:05:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	EFACT-012C5_response.pdf	13888 7646bbc8574cfee5355a3a53c3f541d20a4210cc	no	1

Warnings:

Information:					
2	Drawings-only black and white line drawings	EFACT-012C5_drawings.pdf	294106 9b83c5178773b8f3e8ebbfb0dd81ce921e24f9d5	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	307994	

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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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/374,246	04/03/2019	3763	785	EFACT.012C5	20	2

CONFIRMATION NO. 6388

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

FILING RECEIPT

OC000000107480582

Date Mailed: 04/18/2019

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

John Douglas Steinberg, Millbrae, CA;

Applicant(s)

EcoFactor, Inc., Redwood City, CA;

Power of Attorney: The patent practitioners associated with Customer Number 20995

Domestic Priority data as claimed by applicant

This application is a CON of 16/264,050 01/31/2019
which is a CON of 15/616,719 06/07/2017 ABN
which is a CON of 14/491,554 09/19/2014 PAT 9709292
which is a CON of 14/048,932 10/08/2013 PAT 8840033
which is a CON of 12/788,246 05/26/2010 PAT 8556188

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 04/17/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/374,246**

Projected Publication Date: To Be Determined - pending completion of Corrected Papers

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

Preliminary Class

236

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/374,246

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	785		TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/374,246	04/03/2019	John Douglas Steinberg	EFACT.012C5

CONFIRMATION NO. 6388

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

FORMALITIES LETTER

OC000000107480583

Date Mailed: 04/18/2019

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Filing Date Granted

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given TWO MONTHS from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - The drawings submitted to the Office are not electronically reproducible because portions of figures 16-1, 16-2 are missing and/or blurry.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice". https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tqlam/

Doc Code: TRACK1.REQ
Document Description: TrackOne Request

PTO/AIA/424 (04-14)

CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

First Named Inventor:	John Douglas Steinberg	Nonprovisional Application Number (if known):	EFACT.012C5
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently $0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.

2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.

3. The applicable box is checked below:

I. ☑ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, **or** the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /John R. King/	Date April 3, 2019
Name (Print/Typed) John R. King	Practitioner Registration Number 34,362

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

☑ *Total of 1 forms are submitted.

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.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Filer:	John R. King/Amy Durrant
Attorney Docket Number:	EFACT.012C5

Filed as Small Entity

Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
REQUEST FOR PRIORITIZED EXAMINATION	2817	1	2000	2000
Pages:				
Claims:				
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	2830	1	70	70
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**2855**

Electronic Acknowledgement Receipt

EFS ID:	35616351
Application Number:	16374246
International Application Number:	
Confirmation Number:	6388
Title of Invention:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
First Named Inventor/Applicant Name:	John Douglas Steinberg
Customer Number:	20995
Filer:	John R. King/Melissa Ramirez
Filer Authorized By:	John R. King
Attorney Docket Number:	EFACT.012C5
Receipt Date:	03-APR-2019
Filing Date:	
Time Stamp:	15:52:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$2855
RAM confirmation Number	040419INTEFSW15555700
Deposit Account	111410
Authorized User	Melissa Ramirez
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)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	EFACT-012C5_ADS.pdf	1256427 0f1c6a16f2ee65b9f0c2fdcf1d11dbae8a8e6fab	no	9
Warnings:					
Information:					
2		EFACT-012C5_specification.pdf	276383 e329bfd1c1c5e5c1bd55ece17f9005978ddb7d7c	yes	58

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	52
	Claims	53	57
	Abstract	58	58

Warnings:					
Information:					
3	Drawings-only black and white line drawings	EFACT-012C5_drawings.pdf	1080912 21a790b9a14aaaf2f2a6b1045772738d8dccb22e	no	47
Warnings:					
Information:					
4	Oath or Declaration filed	EFACT-012C5_declaration.pdf	82519 491d501a26497642f4008c1df6786bce75432ead	no	1
Warnings:					
Information:					
5	Power of Attorney	EFACT-012C5_POA.pdf	263411 9c69346501d4fe703db897b4c0c0beafb5cc08cb	no	2

Warnings:					
Information:					
6		EFACT-012C5_IDS.pdf	138997 fc326d62aa8d8ea75f11c426d35bc50b4d2d4796	yes	16
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	16	
Warnings:					
Information:					
7	Foreign Reference	EFACT-012C5_ref298.pdf	2607437 3df20116fb4b8a485bf8222c1e0005bab345fb47	no	18
Warnings:					
Information:					
8	Foreign Reference	EFACT-012C5_ref299.pdf	1078389 b9c79908df482b14b51795a7cd641bf000d9e411	no	11
Warnings:					
Information:					
9	Foreign Reference	EFACT-012C5_ref300.pdf	4903432 e9eaef210c4ff01128f70b0e40841daac69bc991	no	47
Warnings:					
Information:					
10	Foreign Reference	EFACT-012C5_ref308.pdf	1691500 d40e5d725a0ec518699088c3a4d2adee1342271c	no	15
Warnings:					
Information:					
11	Foreign Reference	EFACT-012C5_ref309.pdf	2734299 2b16e9c80fd1acf022fa1a8d3c24e5ddfa78dc7e	no	26
Warnings:					

Information:					
12	Foreign Reference	EFACT-012C5_ref310.pdf	11975464 2f25531ba9bffa03361139e1d6a2b483eeb6c343	no	138
Warnings:					
Information:					
13	Non Patent Literature	EFACT-012C5_ref314.pdf	249715 e8afb66344ec71a3262dc78e49c555068f3f00e8	no	2
Warnings:					
Information:					
14	Non Patent Literature	EFACT-012C5_ref345.pdf	5687915 e4c42be07a8bb036b4efa838b49910b58cc78bbc	no	11
Warnings:					
Information:					
15	Non Patent Literature	EFACT-012C5_ref347.pdf	899815 5a2ab75966efb0f302db4508402aaa9182c18697	no	11
Warnings:					
Information:					
16	TrackOne Request	EFACT-012C5_trackone.pdf	114118 7fc21a9faafadc421477be6e6a5d056fa79142a2	no	2
Warnings:					
Information:					
17	Fee Worksheet (SB06)	fee-info.pdf	40194 2702325693e4dcd0702b0cacb4dedac84687daec	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	35080927	

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.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

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
	John	Douglas	Steinberg	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	Millbrae	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	873 Hacienda Way		
Address 2			
City	Millbrae	**State/Province**	CA
Postal Code	94030	**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).

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

Customer Number	20995		
Email Address	efiling@knobbe.com	Add Email	Remove Email

Application Information:

Title of the Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM		
Attorney Docket Number	EFACT.012C5	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	47	**Suggested Figure for Publication (if any)**	

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

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	20995		

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	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16/264050	2019-01-31

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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	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

Prior Application Status	Abandoned		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
16/264050	Continuation of	15/616719	2017-06-07

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15/616719	Continuation of	14/491554	2014-09-19	9709292	2017-07-18

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14/491554	Continuation of	14/048932	2013-10-08	8840033	2014-09-23

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14/048932	Continuation of	12/788246	2010-05-26	8556188	2013-10-15

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).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

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

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Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

☐ 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.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

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.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

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	EcoFactor, Inc.		
Mailing Address Information For Applicant:			
Address 1	1450 Veteran's Blvd.		
Address 2	Suite 100		
City	Redwood City	**State/Province**	CA
Country	US	Postal Code	94063
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.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

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:

Remove

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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	EFACT.012C5
	Application Number	
Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM	

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SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

Cross-Reference to Related Applications

[0001] Any and all applications for which a foreign or domestic priority claim is identified in the Application Data Sheet, or any correction thereto, are hereby incorporated by reference under 37 CFR 1.57.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] This invention relates to the use of thermostatic HVAC and other energy management controls that are connected to a computer network. More specifically, the present invention pertains to the use of geographic movement of network-connected mobile devices to occupancy to inform an energy management system, to provide enhanced efficiency, and to verify demand response.

Description of the Related Art

[0003] Heating and cooling systems for buildings (heating, ventilation and cooling, or HVAC systems) have been controlled for decades by thermostats. At the most basic level, a thermostat includes a means to allow a user to set a desired temperature, a means to sense actual temperature, and a means to signal the heating and/or cooling devices to turn on or off in order to try to change the actual temperature to equal the desired temperature. The most basic versions of thermostats use components such as a coiled bi-metallic spring to measure actual temperature and a mercury switch that opens or completes a circuit when the spring coils or uncoils with temperature changes. More recently, electronic digital thermostats have become prevalent. These thermostats use solid-state devices such as thermistors or thermal diodes to measure temperature, and microprocessor-based circuitry to control the switch and to store and operate based upon user-determined protocols for temperature vs. time.

[0004] These programmable thermostats generally offer a very restrictive user interface, limited by the cost of the devices, the limited real estate of the small wall-mounted boxes, and the inability to take into account more than two variables: the desired temperature set by the user, and the ambient temperature sensed by the thermostat. Users can generally only set one series of commands per day, and in order to change one parameter (e.g., to change the late-night temperature) the user often has to cycle through several other parameters by repeatedly pressing one or two buttons.

[0005] Because the interface of programmable thermostats is so poor, the significant theoretical savings that are possible with them (sometimes cited as 25% of heating and cooling costs) are rarely realized. In practice, studies have found that more than 50% of users never program their thermostats at all. Significant percentages of the thermostats that are programmed are programmed sub-optimally, in part because, once programmed, people tend to not to re-invest the time needed to change the settings very often.

[0006] A second problem with standard programmable thermostats is that they represent only a small evolutionary step beyond the first, purely mechanical thermostats. Like the first thermostats, they only have two input signals - ambient temperature and the preset desired temperature. The entire advance with programmable thermostats is that they can shift between multiple present temperatures at different times without real-time involvement of a human being.

[0007] Because most thermostats control HVAC systems that do not offer infinitely variable output, traditional thermostats are designed to permit the temperature as seen by the thermostat to vary above and below the setpoint to prevent the HVAC system from constantly and rapidly cycling on and off, which is inefficient and harmful to the HVAC system. The temperature range in which the thermostat allows the controlled environment to drift is known as both the dead zone and, more formally, the hysteresis zone. The hysteresis zone is frequently set at +/- 1 degree Fahrenheit. Thus if the setpoint is 68 degrees, in the heating context the thermostat will allow the inside temperature to fall to 67 degrees before turning the heating system on, and will allow it to rise to 69 degrees before turning it off again.

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[0008] As energy prices rise, more attention is being paid to ways of reducing energy consumption. Because energy consumption is directly proportional to setpoint - that is, the further a given setpoint diverges from the balance point (the inside temperature assuming no HVAC activity) in a given house under given conditions, the higher energy consumption will be to maintain temperature at that setpoint), energy will be saved by virtually any strategy that over a given time frame lowers the average heating setpoint or raises the average cooling setpoint. Conventional programmable thermostats allow homeowners to save money and energy by pre-programming setpoint changes based upon comfort or schedule. For example, in the summer, allowing the setpoint to rise by several degrees (or even shutting off the air conditioner) when the home is unoccupied will generally save significantly on energy. But such thermostats have proven to be only minimally effective in practice. Because they have such primitive user interfaces, they are difficult to program, and so many users never bother at all, or set them up once and do not alter the programming even if their schedules change.

[0009] In the hotel industry, the heating and cooling decisions made in hundred or even thousands of individual rooms with independently controlled HVAC systems are aggregated into a single energy bill, so hotel owners and managers are sensitive to energy consumption by those systems. Hotel guests often turn the air conditioner to a low temperature setting and then leave the room for hours at a time, thereby wasting considerable energy. An approach commonly used outside of the United States to combat this problem is to use a keycard to control the HVAC system, such that guests place the keycard into a slot mounted on the wall near the door of the room which then triggers the lights and HVAC system to power up, and turn them off when the guest removes the card upon leaving the room. However, because most hotels give each guest two cards, it is easy to simply leave the extra card in the slot, thus defeating the purpose of the system. Recently, systems have been introduced in which a motion sensor is connected to the control circuitry for the HVAC system. If no motion is detected in the room for some predetermined interval, the system concludes that the room is unoccupied, and turns off the HVAC system or alters the setpoint to a more economical level. When the motion sensor detects motion (which is assumed to

coincide with the return of the guest), the HVAC system resets to the guest's chosen setting.

[0010] Adding occupancy detection capability to residential HVAC systems could also add considerable value in the form of energy savings without significant tradeoff in terms of comfort. But the systems used in hotels do not easily transfer to the single-family residential context. Hotel rooms tend to be small enough that a single motion sensor is sufficient to determine with a high degree of accuracy whether or not the room is occupied. A single motion sensor in the average home today would have limited value because there are likely to be many places one or more people could be home and active yet invisible to the motion sensor. The most economical way to include a motion sensor in a traditional programmable thermostat would be to build it into the thermostat itself. But thermostats are generally located in hallways, and thus are unlikely to be exposed to the areas where people tend to spend their time. Wiring a home with multiple motion sensors in order to maximize the chances of detecting occupants would involve considerable expense, both for the sensors themselves and for the considerable cost of installation, especially in the retrofit market. Yet if control is ceded to a single-sensor system that cannot reliably detect presence, the resulting errors would likely lead the homeowner to reject the system.

[0011] Although progress in residential HVAC control has been slow, tremendous technological change has come to the tools used for personal communication. When programmable thermostats were first offered, telephones were virtually all tethered by wires to a wall jack. But now a large percentage of the population carries at least one mobile device capable of sending and receiving voice or data or even video (or a combination thereof) from almost anywhere by means of a wireless network. These devices create the possibility that a consumer can, with an appropriate mobile device and a network-enabled HVAC system, control his or her HVAC system even when away from home. But systems that relay on active management decisions by consumers are likely to yield sub-optimal energy management outcomes, because consumers are unlikely to devote the attention and effort required to fully optimize energy use on a daily basis.

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[0012] Many new mobile devices now incorporate another significant new technology – the ability to geolocate the device (and thus, presumably, the user of the device). One method of locating such devices uses the Global Positioning System (GPS). The GPS system uses a constellation of orbiting satellites with very precise clocks to triangulate the position of a device anywhere on earth based upon arrival times of signals received from those satellites by the device. Another approach to geolocation triangulates using signals from multiple cell phone towers. Such systems can enable a variety of so-called "location based services" to users of enabled devices. These services are generally thought of as aids to commerce like pointing users to restaurants or gas stations, etc.

[0013] It would be desirable to provide a system that could detect the location of regular occupants of a home or other structure without requiring the installation of additional hardware; that could accurately use such geospatial information in order to detect and predict occupancy, and could optimize energy consumption based upon dynamic and individually configurable heuristics.

SUMMARY OF THE INVENTION

[0014] In one embodiment, the invention comprises a thermostat attached to an HVAC system, a local network connecting the thermostat to a larger network such as the Internet, and one or more geolocation-enabled mobile devices attached to the network, and a server in bi-directional communication with a plurality of such thermostats and devices. The server pairs each thermostat with one or more geolocation-enabled mobile devices which are determined to be associated with the occupants of home in which the thermostat is located.

[0015] The server logs the ambient temperature sensed by each thermostat vs. time and the signals sent by the thermostats to their HVAC systems. The server also monitors and logs the geolocation data related to the geolocation-enabled mobile devices associated with each thermostat. Based on the locations and movement evidenced by geolocation data, the server instructs the thermostat to change temperature settings between those optimized for occupied and unoccupied states at the appropriate times based on the evolving geolocation data.

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[0016] One embodiment of the invention is directed to a method for varying temperature setpoints for an HVAC system. The method comprises determining the geographic location of a mobile electronic device that is connected to a network and associating said mobile electronic device to a structure having a known geographic location that contains one or more networked climate control devices. In addition, the method comprises determining whether the location of said mobile electronic device indicates occupancy of said structure by a person associated with said mobile electronic device and adjusting the temperature setpoint on said controller for an HVAC system for said structure based upon whether or not said structure is deemed to be occupied.

[0017] In another embodiment, the mobile electronic device is a telephone. In an additional embodiment, the networked mobile electronic device is a personal digital assistant. In a further embodiment, the mobile electronic device is connected to the Internet.

[0018] In one embodiment the method for determining the geographic location of a mobile electronic device uses the global positioning system. In another embodiment, the method for determining the geographic location of a mobile electronic device is based upon estimation of the distance between the mobile electronic device and one or more antennas used to receive radio signals from said mobile electronic device. In a further embodiment, the mobile electronic device communicates with a remote server.

[0019] In yet another embodiment, the variation of temperature setpoints is logged to a database. In a further embodiment, the variation of temperature setpoints is initiated by a remote computer. In a different embodiment, the temperature setpoints are varied automatically. In a further embodiment, an occupant is prompted to confirm occupancy prior to adjustment of said temperature setpoint.

[0020] In one embodiment, a system for altering the setpoint on a thermostat for space conditioning of a structure comprises at least one said thermostat having at least one temperature setting associated with the presence of one or more occupants in said structure, and at least one temperature setting associated with the absence of occupants in said structure. The system also comprises one or more mobile electronic

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devices having at least a user interface, where the mobile electronic devices and said thermostat are connected to a network and where the setpoint on said thermostat is adjusted between said temperature setting associated with the presence of one or more occupants in said structure and said temperature setting associated with the absence of occupants in said structure based upon the geographic location of said electronic device.

[0021] In a further embodiment, the mobile electronic device is a telephone. In yet another embodiment, the networked mobile electronic device is a personal digital assistant. In still a further embodiment, the mobile electronic device is connected to the Internet.

[0022] In one embodiment, the method for determining the geographic location of a mobile electronic device is the global positioning system. In another embodiment, the method for determining the geographic location of a mobile electronic device is based upon estimation of the distance between the mobile electronic device and one or more antennas used to receive radio signals from said mobile electronic device. In a further embodiment, the mobile electronic device communicates with a remote server.

[0023] In a different embodiment, the variation of temperature setpoints is logged to a database. In another embodiment, the variation of temperature setpoints is initiated by a remote computer. In a further embodiment, the temperature setpoints are varied automatically. In still another embodiment, an occupant is prompted to confirm occupancy prior to adjustment of said temperature setpoint.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Figure 1 shows an example of an overall environment in which an embodiment of the invention may be used.

[0025] Figure 2 shows a high-level illustration of the architecture of a network showing the relationship between the major elements of one embodiment of the subject invention.

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[0026] Figures 3a and 3b show an embodiment of the website to be used as part of the subject invention.

[0027] Figure 4 shows a high-level schematic of the thermostat used as part of an embodiment of the subject invention.

[0028] Figure 5 shows one embodiment of the database structure used as part of an embodiment of the subject invention.

[0029] Figures 6a and 6b illustrate pages of a website that may be used with an embodiment of the subject invention.

[0030] Figure 7 is a flowchart showing the steps involved in the operation of one embodiment of the subject invention.

[0031] Figure 8 is a flowchart that shows how the invention can be used to select different HVAC settings based upon its ability to identify which of multiple potential occupants is using the mobile device connected to the system.

[0032] Figures 9a and 9b show how comparing inside temperature against outside temperature and other variables permits calculation of dynamic signatures.

[0033] Figure 10 shows a flow chart for a high level version of the process of calculating the appropriate turn-on time in a given home.

[0034] Figure 11 shows a more detailed flowchart listing the steps in the process of calculating the appropriate turn-on time in a given home for a just-in-time event.

[0035] Figures 12a, 12b, 12c and 12d show the steps shown in the flowchart in Figure 11 in the form of a graph of temperature and time.

[0036] Figure 13 shows a table of some of the data used by an embodiment of the subject invention to predict temperatures.

[0037] Figure 14 shows an embodiment of the subject invention as applied in a specific home on a specific day.

[0038] Figure 15 shows an embodiment of the subject invention as applied in a different specific home on a specific day.

[0039] Figure 16, which includes Figures 16-1 and 16-2, shows a table of predicted rates of change in temperature inside a given home for a range of temperature differentials between inside and outside.

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[0040] Figure 17 shows how manual inputs can be recognized and recorded by an embodiment of the subject invention.

[0041] Figure 18 shows how an embodiment of the subject invention uses manual inputs to interpret manual overrides and make short-term changes in response thereto.

[0042] Figure 19 shows how an embodiment of the subject invention uses manual inputs to make long-term changes to interpretive rules and to setpoint scheduling.

[0043] Figure 20 shows a flowchart illustrating the steps required to initiate a compressor delay adjustment event.

[0044] Figure 21a, 21b, and 21c illustrate how changes in compressor delay settings affect HVAC cycling behavior by plotting time against temperature.

[0045] Figure 22 is a flow chart illustrating the steps involved in generating a demand reduction event for a given subscriber.

[0046] Figure 23 is a flow chart illustrating the steps involved in confirming that a demand reduction event has taken place.

[0047] Figure 24 is a representation of the movement of messages and information between the components of an embodiment of the subject invention.

[0048] Figures 25a and 25b show graphical representations of inside and outside temperatures in two different homes, one with high thermal mass and one with low thermal mass.

[0049] Figures 26a and 26b show graphical representations of inside and outside temperatures in the same homes as in Figures 25a and 25b, showing the cycling of the air conditioning systems in those houses.

[0050] Figures 27a and 27b show graphical representations of inside and outside temperatures in the same home as in Figures 25a and 26a, showing the cycling of the air conditioning on two different days in order to demonstrate the effect of a change in operating efficiency on the parameters measured by the thermostat.

[0051] Figures 28a and 28b show the effects of employing a pre-cooling strategy in two different houses.

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[0052] Figures 29a and 29b show graphical representations of inside and outside temperatures in two different homes in order to demonstrate how the system can correct for erroneous readings in one house by referencing readings in another.

[0053] Figure 30 is a flowchart illustrating the steps involved in calculating the effective thermal mass of a home using an embodiment of the subject invention.

[0054] Figure 31 is a flowchart illustrating the steps involved in determining whether an HVAC system has developed a problem that impairs efficiency using an embodiment of the subject invention.

[0055] Figure 32 is a flowchart illustrating the steps involved in correcting for erroneous readings in one house by referencing readings in another using an embodiment of the subject invention.

[0056] Figure 33 shows the conventional programming of a programmable thermostat over a 24-hour period.

[0057] Figure 34 shows the programming of a programmable thermostat over a 24-hour period using ramped setpoints.

[0058] Figure 35 shows the steps required for the core function of the ramped setpoint algorithm.

[0059] Figure 36 shows a flowchart listing steps in the process of deciding whether to implement the ramped setpoint algorithm using an embodiment of the subject invention.

[0060] Figure 37 shows the browser as seen on the display of the computer used as part of an embodiment of the subject invention.

[0061] Figure 38 is a flowchart showing the steps involved in the operation of one embodiment of the subject invention.

[0062] Figure 39 is a flowchart that shows how an embodiment of the invention can be used to select different HVAC settings based upon its ability to identify which of multiple potential occupants is using the computer attached to the system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0063] **Figure 1** shows an example of an overall environment 100 in which an embodiment of the invention may be used. The environment 100 includes an

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interactive communication network 102 with computers 104 connected thereto. Also connected to network 102 are mobile devices 105, and one or more server computers 106, which store information and make the information available to computers 104 and mobile devices 105. The network 102 allows communication between and among the computers 104, mobile devices 105 and servers 106.

[0064] Presently preferred network 102 comprises a collection of interconnected public and/or private networks that are linked to together by a set of standard protocols to form a distributed network. While network 102 is intended to refer to what is now commonly referred to as the Internet, it is also intended to encompass variations which may be made in the future, including changes additions to existing standard protocols. It also includes various networks used to connect mobile and wireless devices, such as cellular networks.

[0065] When a user of an embodiment of the subject invention wishes to access information on network 102 using computer 104, the user initiates connection from his computer 104. For example, the user invokes a browser, which executes on computer 104. The browser, in turn, establishes a communication link with network 102. Once connected to network 102, the user can direct the browser to access information on server 106.

[0066] One popular part of the Internet is the World Wide Web. The World Wide Web contains a large number of computers 104 and servers 106, which store HyperText Markup Language (HTML) documents capable of displaying graphical and textual information. HTML is a standard coding convention and set of codes for attaching presentation and linking attributes to informational content within documents.

[0067] The servers 106 that provide offerings on the World Wide Web are typically called websites. A website is often defined by an Internet address that has an associated electronic page. Generally, an electronic page is a document that organizes the presentation of text graphical images, audio and video.

[0068] In addition to the Internet, the network 102 can comprise a wide variety of interactive communication media. For example, network 102 can include local area networks, interactive television networks, telephone networks, wireless data systems, two-way cable systems, and the like.

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[0069] In one embodiment, computers 104 and servers 106 are conventional computers that are equipped with communications hardware such as modem or a network interface card. The computers include processors such as those sold by Intel and AMD. Other processors may also be used, including general-purpose processors, multi-chip processors, embedded processors and the like.

[0070] Computers 104 can also be microprocessor- controlled home entertainment equipment including advanced televisions, televisions paired with home entertainment/media centers, and wireless remote controls.

[0071] Computers 104 may utilize a browser configured to interact with the World Wide Web. Such browsers may include Microsoft Explorer, Mozilla, Firefox, Opera or Safari. They may also include browsers or similar software used on handheld, home entertainment and wireless devices.

[0072] The storage medium may comprise any method of storing information. It may comprise random access memory (RAM), electronically erasable programmable read only memory (EEPROM), read only memory (ROM), hard disk, floppy disk, CD-ROM, optical memory, or other method of storing data.

[0073] Computers 104 and 106 may use an operating system such as Microsoft Windows, Apple Mac OS, Linux, Unix or the like.

[0074] Computers 106 may include a range of devices that provide information, sound, graphics and text, and may use a variety of operating systems and software optimized for distribution of content via networks.

[0075] Mobile devices 105 can also be handheld and wireless devices such as personal digital assistants (PDAs), cellular telephones and other devices capable of accessing the network. Mobile devices 105 can use a variety of means for establishing the location of each device at a given time. Such methods may include the Global Positioning System (GPS), location relative to cellular towers, connection to specific wireless access points, or other means

[0076] **Figure 2** illustrates in further detail the architecture of the specific components connected to network 102 showing the relationship between the major elements of one embodiment of the subject invention. Attached to the network are thermostats 108 and computers 104 of various users. Connected to thermostats 108

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are HVAC units 110. The HVAC units may be conventional air conditioners, heat pumps, or other devices for transferring heat into or out of a building. Each user is connected to the server 106 via wired or wireless connection such as Ethernet or a wireless protocol such as IEEE 802.11, a gateway 110 that connects the computer and thermostat to the Internet via a broadband connection such as a digital subscriber line (DSL), cellular radio or other form of broadband connection to the World Wide Web. Server 106 contains the content to be served as web pages and viewed by computers 104, software to manage thermostats 108, as well as databases containing information used by the servers.

[0077] Also attached to the Network are cellular radio towers 120, or other means to transmit and receive wireless signals in communication with mobile devices 105. Such communication may use GPRS, GSM, CDMA, EvDO, EDGE or other protocols and technologies for connecting mobile devices to a network.

[0078] **Figures 3a** and **3b** shows a representative mobile device 105 from the front and back, respectively. The front of the device includes a display 202, and may include a physical keyboard 204. Alternatively, a virtual keyboard may be included in a display with touchscreen functionality. For devices with voice capabilities, such as a smart phone, a microphone 206 and speaker 208 enable audio communications. An antenna 210, which may be mounted entirely within the mobile device, aids wireless communications. Modules included within mobile device 105 but not visible from the outside may include memory cards, microprocessors, GPS receivers, battery, etc.

[0079] **Figure 4** shows a high-level block diagram of thermostat 108 used as part of an embodiment of the subject invention. Thermostat 108 includes temperature sensing means 252, which may be a thermistor, thermal diode or other means commonly used in the design of electronic thermostats. It includes a microprocessor 254, memory 256, a display 258, a power source 260, a relay 262, which turns the HVAC system on and off in response to a signal from the microprocessor, and contacts by which the relay is connected to the wires that lead to the HVAC system.

[0080] To allow the thermostat to communicate bi-directionally with the computer network, the thermostat also includes means 264 to connect the thermostat to a local computer or to a wireless network. Such means could be in the form of

Ethernet, wireless protocols such as IEEE 802.11, IEEE 802.15.4, Bluetooth, cellular systems such as CDMA, GSM and GPRS, or other wireless protocols. The thermostat 250 may also include controls 266 allowing users to change settings directly at the thermostat, but such controls are not necessary to allow the thermostat to function.

[0081] The data used to manage the subject invention is stored on one or more servers 106 within one or more databases. As shown in **Figure 5**, the overall database structure 300 may include temperature database 400, thermostat settings database 500, energy bill database 600, HVAC hardware database 700, weather database 800, user database 900, transaction database 1000, product and service database 1100, user location database 1200 and such other databases as may be needed to support these and additional features.

[0082] Users of connected thermostats 250 may create personal accounts. Each user's account will store information in database 900, which tracks various attributes relative to users of the site. Such attributes may include the make and model of the specific HVAC equipment in the user's home; the age and square footage of the home, the solar orientation of the home, the location of the thermostat in the home, the user's preferred temperature settings, whether the user is a participant in a demand response program, etc.

[0083] User personal accounts may also associate one or more mobile devices with such personal accounts. For mobile devices with the capability for geopositioning awareness, these personal accounts will have the ability log such positioning data over time in database 1200.

[0084] In one embodiment, a background application installed on mobile device 105 shares geopositioning data for the mobile device with the application running on server 106 that logs such data. Based upon this data, server 106 runs software that interprets said data (as described in more detail below). Server 106 may then, depending on context, (a) transmit a signal to thermostat 108 changing setpoint because occupancy has been detected at a time when the system did not expect occupancy; or (b) transmit a message to mobile device 105 that asks the user if the server should change the current setpoint, alter the overall programming of the system

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based upon a new occupancy pattern, etc. Such signalling activity may be conducted via email, text message, pop-up alerts, voice messaging, or other means.

[0085] **Figures 6a** and **6b** illustrate a website that may be provided to assist homeowners and others to interact with an embodiment of the subject invention. The website will permit thermostat users to perform through the web browser substantially all of the programming functions traditionally performed directly at the physical thermostat, such as temperature set points, the time at which the thermostat should be at each set point, etc. Preferably the website will also allow users to accomplish more advanced tasks such as allow users to program in vacation settings for times when the HVAC system may be turned off or run at more economical settings, and to set macros that will allow changing the settings of the temperature for all periods with a single gesture such as a mouse click.

[0086] As shown in **Figure 6a**, screen 351 of website 350 displays current temperature 352 as sensed by thermostat 108. Clicking on "up" arrow 354 raises the setpoint 358; clicking the down arrow 356 lowers setpoint 358. Screen 351 may also convey information about the outside weather conditions, such as a graphic representation 360 of the sun, clouds, etc. In homes with multiple thermostats, screen 351 may allow users to select different devices to adjust or monitor. Users will be able to use screen 351 by selecting, for example, master bedroom thermostat 362, living room thermostat 364, game room thermostat 366, or basement thermostat 368.

[0087] As shown in **Figure 6b**, screen 370 allows users to establish programming schedules. Row 372 shows a 24-hour period. Programming row 374 displays various programming periods and when they are scheduled, such as away setting 376, which begins at approximately 8AM and runs until approximately 5:30PM. When the away setting 376 is highlighted, the user can adjust the starting time and ending time for the setting by dragging the beginning time 378 to the left to choose an earlier start time, and dragging it to the right to make it later. Similarly, the user can drag ending time 380 to the left to make it earlier, and to the right to make it later. While away setting 376 is highlighted, the user can also change heating setpoint 382 by clicking on up arrow 384 or down arrow 386, and cooling setpoint 388 by clicking on up

Ex. 1004.0208

arrow 390 or down arrow 392. The user can save the program by clicking on save button 394.

[0088] **Figure 7** is a high-level flowchart showing the steps involved in the operation of one embodiment of the subject invention. In step 1302, mobile device 105 transmits geopositioning information to server 106 via the Internet. In step 1304 the server compares the latest geopositioning data point to previous data points in order to determine whether a change in location or vector of movement has occurred. In step 1306 the server evaluates the geopositioning data in order to determine whether the temperature settings for the HVAC system for the structure associated with the mobile device 105 should be optimized for an unoccupied structure, or for an occupied structure in light of the movement (or lack thereof) in the geopositioning data.

[0089] If the server 106 determines that the home should be in occupied or "home" mode, then in step 1308 the server queries database 300 to determine whether thermostat 108 is already set for home or away mode. If thermostat 108 is already in home mode, then the application terminates for a specified interval. If the HVAC settings then in effect are intended to apply when the home is unoccupied, then in step 1310 the application will retrieve from database 300 the user's specific preferences for how to handle this situation.

[0090] If the user has previously specified (at the time that the program was initially set up or subsequently modified) that the user prefers that the system automatically change settings under such circumstances, the application then proceeds to step 1316, in which it changes the programmed setpoint for the thermostat to the setting intended for the house when occupied. If the user has previously specified that the application should not make such changes without further user input, then in step 1312 the application transmits a command to the location specified by the user (generally mobile device 105) directing the device display a message informing the user that the current setting assumes an unoccupied house and asking the user to choose whether to either keep the current settings or revert to the pre-selected setting for an occupied home.

[0091] If the user elects to retain the current setting, then in step 1318 the application will write to database 300 the fact that the user has so elected and

terminate. If the user elects to change the setting, then in step 1316 the application transmits the revised setpoint to the thermostat. In step 1318 the application writes the updated setting information to database 300.

[0092] If the server 106 determines in step 1306 that the home should be in unoccupied or away mode, then in step 1350 the server queries database 300 to determine whether thermostat 108 is set for set for home or away mode. If thermostat 108 is already in away mode, then the application terminates for a specified interval. If the HVAC settings then in effect are intended to apply when the home is occupied, then in step 1352 the application will retrieve from database 300 the user's specific preferences for how to handle this situation.

[0093] If the user has previously specified (at the time that the program was initially set up or subsequently modified) that the user prefers that the system automatically change settings under such circumstances, the application then proceeds to step 1358, in which it changes the programmed setpoint for the thermostat to the setting intended for the house when unoccupied. If the user has previously specified that the application should not make such changes without further user input, then in step 1354 the application transmits a command to the location specified by the user (generally mobile device 105) directing the device display a message informing the user that the current setting assumes an unoccupied house and asking the user to choose whether to either keep the current settings or revert to the pre-selected setting for an occupied home. If the user selects to retain the current setting, then in step 1318 the application will write to database 300 the fact that the user has so elected and terminate.

[0094] If the user elects to change the setting, then in step 1316 the application transmits the revised setpoint to the thermostat. In step 1318 the application writes the updated setting information to database 300.If thermostat 108 is already in away mode, the program ends. If it was in home mode, then in step 1314 server 108 initiates a state change to put thermostat 108 in away mode. In either case, the server then in step 1316 writes the state change to database 300. In each case the server can also send a message to the person who owns the mobile device requesting, confirming or announcing the state change.

Ex. 1004.0210

[0095] **Figure 8** is a flowchart that shows one process by which an embodiment of the invention can be used to select different HVAC settings based upon its ability to identify which of multiple potential occupants is using the mobile device attached to the system. The process shown assumes (a) a static hierarchy of temperature preferences as between multiple occupants: that is, that for a given home/structure, mobile user #1's preferences will always control the outcome if mobile user #1 is present, that mobile user #2's preferences yield to #1's, but always prevail over user #3, etc; and (b) that there are no occupants to consider who are not associated with a mobile device. Other heuristics may be applied in order to account for more dynamic interactions of preferences.

[0096] In step 1402 server 106 retrieves the most recent geospatial coordinates from the mobile device 105 associated with mobile user #1. In step 1404 server 106 uses current and recent coordinates to determine whether mobile user #1's "home" settings should be applied. If server 106 determines that User #1's home settings should be applied, then in step 1406 server 106 applies the correct setting and transmits it to the thermostat(s).

[0097] In step 1408, server 106 writes to database 300 the geospatial information used to adjust the programming. If after performing step 1404, the server concludes that mobile user #1's "home" settings should not be applied, then in step 1412 server 106 retrieves the most recent geospatial coordinates from the mobile device 105 associated with mobile user #2.

[0098] In step 1414 server 106 uses current and recent coordinates to determine whether mobile user #2's "home" settings should be applied. If server 106 determines that User #2's home settings should be applied, then in step 1416 server 106 applies the correct setting and transmits it to the thermostat(s).

[0099] In step 1408, server 106 writes to database 300 the geospatial and other relevant information used to adjust the programming. If after performing step 1414, the server concludes that mobile user #2's "home" settings should not be applied, then in step 1422 server 106 retrieves the most recent geospatial coordinates from the mobile device 105 associated with mobile user #N.

Ex. 1004.0211

[0100] In step 1424 server 106 uses current and recent coordinates to determine whether mobile user #N's "home" settings should be applied. If server 106 determines that User #N's home settings should be applied, then in step 1426 server 106 applies the correct setting and transmits it to the thermostat(s). In step 1408, server 106 writes to database 300 the geospatial information used to adjust the programming.

[0101] If none of the mobile devices associated with a given home or other structure report geospatial coordinates consistent with occupancy, then in step 1430 the server instructs the thermostat(s) to switch to or maintain the "away" setting.

[0102] One embodiment of the invention is capable of delivering additional benefits for homeowners in terms of increased comfort and efficiency. In addition to using the system to allow better signaling and control of the HVAC system, which relies primarily on communication running from the server to the thermostat, the bi-directional communication will also allow the thermostat 108 to regularly measure and send to the server information about the temperature in the building. By comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system, and other variables, the system will be capable of numerous diagnostic and controlling functions beyond those of a standard thermostat.

[0103] For example, **Figure 9a** shows a graph of inside temperature, outside temperature and HVAC activity for a 24 hour period. When outside temperature 1502 increases, inside temperature 1504 follows, but with some delay because of the thermal mass of the building, unless the air conditioning 1506 operates to counteract this effect. When the air conditioning turns on, the inside temperature stays constant (or rises at a much lower rate or even falls) despite the rising outside temperature. In this example, frequent and heavy use of the air conditioning results in only a very slight temperature increase inside the house of 4 degrees, from 72 to 76 degrees, despite the increase in outside temperature from 80 to 100 degrees.

[0104] **Figure 9b** shows a graph of the same house on the same day, but assumes that the air conditioning is turned off from noon to 7PM. As expected, the inside temperature 1504a rises with increasing outside temperatures 1502 for most of that period, reaching 88 degrees at 7PM. Because server 106 logs the temperature

Ex. 1004.0212

readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house.

[0105] The performance data will allow the server 106 to calculate an effective thermal mass for each such structure – that is, the rate at which the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc., the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures.

[0106] The ability to predict the rate of change in inside temperature in a given house under varying conditions may be applied by in effect holding the desired future inside temperature as a constraint and using the ability to predict the rate of change to determine when the HVAC system must be turned on in order to reach the desired temperature at the desired time. The ability of an HVAC system to vary turn-on time in order to achieve a setpoint with minimum energy use may be thought of as Just In Time (JIT) optimization.

[0107] **Figure 10** shows a flowchart illustrating the high-level process for controlling a just-in-time (JIT) event. In step 1512, the server determines whether a specific thermostat 108 is scheduled to run the preconditioning program. If, not, the program terminates. If it so scheduled, then in step 1514 the server retrieves the predetermined target time when the preconditioning is intended to have been completed (TT).

[0108] Using TT as an input, in step 1516 the server then determines the time at which the computational steps required to program the preconditioning event will be performed (ST). In step 1518, performed at start time ST, the server begins the process of actually calculating the required parameters, as discussed in greater detail below. Then in 1520 specific setpoint changes are transmitted to the thermostat so that the temperature inside the home may be appropriately changed as intended.

[0109] **Figure 11** shows a more detailed flowchart of the process. In step 1532, the server retrieves input parameters used to create a JIT event. These

Ex. 1004.0213

parameters include the maximum time allowed for a JIT event for thermostat 108 (MTI); the target time the system is intended to hit the desired temperature (TT); and the desired inside temperature at TT (TempTT). It is useful to set a value for MTI because, for example, it will be reasonable to prevent the HVAC system from running a preconditioning event if it would be expected to take 8 hours, which might be prohibitively expensive.

[0110] In step 1534, the server retrieves data used to calculate the appropriate start time with the given input parameters. This data includes a set of algorithmic learning data (ALD), composed of historic readings from the thermostat, together with associated weather data, such as outside temperature, solar radiation, humidity, wind speed and direction, etc; together with weather forecast data for the subject location for the period when the algorithm is scheduled to run (the weather forecast data, or WFD). The forecasting data can be as simple as a listing of expected temperatures for a period of hours subsequent to the time at which the calculations are performed, to more detailed tables including humidity, solar radiation, wind, etc. Alternatively, it can include additional information such as some or all of the kinds of data collected in the ALD.

[0111] In step 1536, the server uses the ALD and the WFD to create prediction tables that determine the expected rate of change or slope of inside temperature for each minute of HVAC cycle time (ΔT) for the relevant range of possible pre-existing inside temperatures and outside climatic conditions. An example of a simple prediction table is illustrated in Fig. 13.

[0112] In step 1538, the server uses the prediction tables created in step 1536, combined with input parameters TT and Temp(TT) to determine the time at which slope ΔT intersects with predicted initial temperature PT. The time between PT and TT is the key calculated parameter: the preconditioning time interval, or PTI.

[0113] In step 1540, the server checks to confirm that the time required to execute the pre-conditioning event PTI does not exceed the maximum parameter MTI. If PTI exceeds MTI, the scheduling routine concludes and no ramping setpoints are transmitted to the thermostat.

Ex. 1004.0214

[0114] If the system is perfect in its predictive abilities and its assumptions about the temperature inside the home are completely accurate, then in theory the thermostat can simply be reprogrammed once – at time PT, the thermostat can simply be reprogrammed to Temp(TT). However, there are drawbacks to this approach.

[0115] First, if the server has been overly conservative in its predictions as to the possible rate of change in temperature caused by the HVAC system, the inside temperature will reach TT too soon, thus wasting energy and at least partially defeating the purpose of running the preconditioning routine in the first place. If the server is too optimistic in its projections, there will be no way to catch up, and the home will not reach Temp(TT) until after TT. Thus it would be desirable to build into the system a means for self-correcting for slightly conservative start times without excessive energy use.

[0116] Second, the use of setpoints as a proxy for actual inside temperatures in the calculations is efficient, but can be inaccurate under certain circumstances. In the winter (heating) context, for example, if the actual inside temperature is a few degrees above the setpoint (which can happen when outside temperatures are warm enough that the home's natural "set point" is above the thermostat setting), then setting the thermostat to Temp(TT) at time PT will almost certainly lead to reaching TT too soon as well.

[0117] The currently preferred solution to both of these possible inaccuracies is to calculate and program a series of intermediate settings between Temp(PT) and Temp(TT) that are roughly related to ΔT.

[0118] Thus if MTI is greater than PTI, then in step 1542 the server calculates the schedule of intermediate setpoints and time intervals to be transmitted to the thermostat. Because thermostats cannot generally be programmed with steps of less than 1 degree F, ΔT is quantized into discrete interval data of at least 1 degree F each. For example, if Temp(PT) is 65 degrees F, Temp(TT) is 72 degrees F, and PT is 90 minutes, the thermostat might be programmed to be set at 66 for 10 minutes, 67 for 12 minutes, 68 for 15 minutes, etc.

[0119] The server may optionally limit the process by assigning a minimum programming interval (e.g., at least ten minutes between setpoint changes) to avoid

frequent switching of the HVAC system, which can reduce accuracy because of the thermostat's compressor delay circuit, which may prevent quick corrections. The duration of each individual step may be a simple arithmetic function of the time PTI divided by the number of whole-degree steps to be taken; alternatively, the duration of each step may take into account second order thermodynamic effects relating to the increasing difficulty of "pushing" the temperature inside a house further from its natural setpoint given outside weather conditions, etc. (that is, the fact that on a cold winter day it may take more energy to move the temperature inside the home from 70 degrees F to 71 than it does to move it from 60 degrees to 61).

[0120] In step 1544, the server schedules setpoint changes calculated in step 1542 for execution by the thermostat.

[0121] With this system, if actual inside temperature at PT is significantly higher than Temp(PT), then the first changes to setpoints will have no effect (that is, the HVAC system will remain off), and the HVAC system will not begin using energy, until the appropriate time, as shown in **Figure 12**. Similarly, if the server has used conservative predictions to generate ΔT, and the HVAC system runs ahead of the predicted rate of change, the incremental changes in setpoint will delay further increases until the appropriate time in order to again minimize unnecessary energy use, as shown in **Figure 11**.

[0122] **Figure 12(a)** through **12(d)** shows the steps in the preconditioning process as a graph of temperature and time. **Figure 12(a)** shows step 1532, in which inputs target time TT 1552, target temperature Temp(TT) 1554, maximum conditioning interval MTI 1556 and the predicted inside temperature during the period of time the preconditioning event is likely to begin Temp(PT) 1558 are retrieved.

[0123] **Figure 12(b)** shows the initial calculations performed in step 1538, in which expected rate of change in temperature ΔT 1560 inside the home is generated from the ALD and WFD using Temp(TT) 1554 at time TT 1552 as the endpoint.

[0124] **Figure 12(c)** shows how in step 1538 ΔT 1560 is used to determine start time PT 1562 and preconditioning time interval PTI 1564. It also shows how in step 1540 the server can compare PTI with MTI to determine whether or not to instantiate the pre-conditioning program for the thermostat.

Ex. 1004.0216

[0125] **Figure 12(d)** shows step 1542, in which specific ramped setpoints 1566 are generated. Because of the assumed thermal mass of the system, actual inside temperature at any given time will not correspond to setpoints until some interval after each setpoint change. Thus initial ramped setpoint 1216 may be higher than Temp(PT) 1558, for example.

[0126] **Figure 13** shows an example of the types of data that may be used by the server in order to calculate ΔT 1560. Such data may include inside temperature 1572, outside temperature 1574, cloud cover 1576, humidity 1578, barometric pressure 1580, wind speed 1582, and wind direction 1584.

[0127] Each of these data points should be captured at frequent intervals. In the preferred embodiment, as shown in **Figure 13**, the interval is once every 60 seconds.

[0128] **Figure 14** shows application of an embodiment of the subject invention in an actual house. Temperature and setpoints are plotted for the 4-hour period from 4AM to 8AM with temperature on the vertical axis and time on the horizontal axis. The winter nighttime setpoint 1592 is 60 degrees F; the morning setpoint temperature 1594 is 69 degrees F. The outside temperature 1596 is approximately 45 degrees F. The target time TT 1598 for the setpoint change to morning setting is 6:45AM. In the absence of embodiments of the subject invention, the homeowner could program the thermostat to change to the new setpoint at 6:45, but there is an inherent delay between a setpoint change and the response of the temperature inside the home. (In this home on this day, the delay is approximately fifty minutes.) Thus if the homeowner truly desired to achieve the target temperature at the target time, some anticipation would be necessary. The amount of anticipation required depends upon numerous variables, as discussed above.

[0129] After calculating the appropriate slope ΔT 1560 by which to ramp inside temperature in order to reach the target as explained above, the server transmits a series of setpoints 1566 to the thermostat because the thermostat is presumed to only accept discrete integers as program settings. (If a thermostat is capable of accepting finer settings, as in the case of some thermostats designed to operate in

Ex. 1004.0217

regions in which temperature is generally denoted in Centigrade rather than Fahrenheit, which accept settings in half-degree increments, tighter control may be possible.)

[0130] In any event, in the currently preferred embodiment of the subject invention, programming changes are quantized such that the frequency of setpoint changes is balanced between the goal of minimizing network traffic and the frequency of changes made on the one hand and the desire for accuracy on the other. Balancing these considerations may result in some cases in either more frequent changes or in larger steps between settings. As shown in Fig. 14, the setpoint "stairsteps" from 60 degrees F to 69 degrees F in nine separate setpoint changes over a period of 90 minutes.

[0131] Because the inside temperature 1599 when the setpoint management routine was instantiated at 5:04 AM was above the "slope" and thus above the setpoint, the HVAC system was not triggered and no energy was used unnecessarily heating the home before such energy use was required. Actual energy usage does not begin until 5:49 AM.

[0132] **Figure 15** shows application of an embodiment of the subject invention in a different house during a similar four hour interval. In **Figure 15**, the predicted slope ΔT 1560 is less conservative relative to the actual performance of the home and HVAC system, so there is no off cycling during the preconditioning event – the HVAC system turns on at approximately 4:35 AM and stays on continuously during the event. The home reaches the target temperature Temp(TT) roughly two minutes prior to target time TT.

[0133] **Figure 16** shows a simple prediction table. The first column 1602 lists a series of differentials between outside and inside temperatures. Thus when the outside temperature is 14 degrees and the inside temperature is 68 degrees, the differential is -54 degrees; when the outside temperature is 94 degrees and the inside temperature is 71 degrees, the differential is 13 degrees. The second column 1604 lists the predicted rate of change in inside temperature ΔT 1210 assuming that the furnace is running in terms of degrees Fahrenheit of change per hour. A similar prediction table will be generated for predicted rates of change when the air conditioner

Ex. 1004.0218

is on; additional tables may be generated that predict how temperatures will change when the HVAC system is off.

[0134] Alternatively, the programming of the just-in-time setpoints may be based not on a single rate of change for the entire event, but on a more complex multivariate equation that takes into account the possibility that the rate of change may be different for events of different durations.

[0135] The method for calculating start times may also optionally take into account not only the predicted temperature at the calculated start time, but may incorporate measured inside temperature data from immediately prior to the scheduled start time in order to update calculations, or may employ more predictive means to extrapolate what inside temperature based upon outside temperatures, etc.

[0136] An additional capability offered by an embodiment of the instant invention is the ability to adapt the programming of the HVAC control system based upon the natural behavior of occupants. Because an embodiment of the instant invention is capable of recording the setpoint actually used at a connected thermostat over time, it is also capable of inferring manual setpoint changes (as, for example, entered by pushing the “up” or “down” arrow on the control panel of the device) even when such overrides of the pre-set program are not specifically recorded as such by the thermostat.

[0137] In order to adapt programming to take into account the manual overrides entered into the thermostat, it is first necessary to determine when a manual override has in fact occurred. Most thermostats, including two-way communicating devices discussed herein, do not record such inputs locally, and neither recognize nor transmit the fact that a manual override has occurred. Furthermore, in a system as described herein, frequent changes in setpoints may be initiated by algorithms running on the server, thereby making it impossible to infer a manual override from the mere fact that the setpoint has changed. It is therefore necessary to deduce the occurrence of such events from the data that an embodiment of the subject invention does have access to.

[0138] **Figure 17** illustrates the currently preferred method for detecting the occurrence of a manual override event. In step 1702, the server retrieves the primary

data points used to infer the occurrence of a manual override from one or more databases in overall database structure 300. The data should include each of the following: for the most recent point at which it can obtain such data (time0) the actual setpoint as recorded at the thermostat at (A0); for the point immediately prior to time0 (time-1), the actual setpoint recorded for the thermostat (A-1); for time0 the setpoint as scheduled by server 106 according to the basic setpoint programming (S0), and for time-1 the setpoint as scheduled by server 106 according to the standard setpoint programming (S-1).

[0139] In step 1704, the server retrieves any additional automated setpoint changes C that have been scheduled for the thermostat by server 106 at time0. Such changes may include algorithmic changes intended to reduce energy consumption, etc.

[0140] In step 1706 the server calculates the difference (dA) between A0 and A-1; for example, if the actual setpoint is 67 degrees at T-1 and 69 at T0, dA is +2; if the setpoint at T-1 is 70 and the setpoint at T0 is 66, dA is –4.

[0141] In step 1708, the server performs similar steps in order to calculate dS, the difference between S0 and S-1. This is necessary because, for example, the setpoint may have been changed because the server itself had just executed a change, such as a scheduled change from “away” to “home” mode. In step 1710 the server evaluates and sums all active algorithms and other server-initiated strategies to determine their net effect on setpoint at time0. For example, if one algorithm has increased setpoint at time0 by 2 degrees as a short-term energy savings measure, but another algorithm has decreased the setpoint by one degree to compensate for expected subjective reactions to weather conditions, the net algorithmic effect sC is +1 degree.

[0142] In step 1712, the server calculates the value for M, where M is equal to the difference between actual setpoints dA, less the difference between scheduled setpoints dS, less the aggregate of algorithmic change sC.

[0143] In step 1714 the server evaluates this difference. If the difference equals zero, the server concludes that no manual override has occurred, and the routine terminates. But if the difference is any value other than zero, then the server concludes that a manual override has occurred. Thus in step 1716 the server logs the

Ex. 1004.0220

occurrence and magnitude of the override to one or more databases in overall database structure 300.

[0144] The process of interpreting a manual override is shown in **Figure 18**. Step 1802 is the detection of an override, as described in detail in **Figure 17**. In step 1804 the server retrieves the stored rules for the subject thermostat 108. Such rules may include weather and time-related inferences such as "if outside temperature is greater than 85 degrees and inside temperature is more than 2 degrees above setpoint and manual override lowers setpoint by 3 or more degrees, then revert to original setpoint in 2 hours," or "if heating setpoint change is scheduled from "away" to "home" within 2 hours after detected override, and override increases setpoint by at least 2 degrees, then change to "home" setting," or the like.

[0145] In step 1806 the server retrieves contextual data required to interpret the manual override. Such data may include current and recent weather conditions, current and recent inside temperatures, etc. This data is helpful because it is likely that manual overrides are at least in part deterministic: that is, that they may often be explained by such contextual data, and that such understanding can permit anticipation of the desire on the part of the occupants to override and to adjust programming accordingly, so as to anticipate and obviate the need for such changes. The amount of data may be for a period of a few hours to as long as several days or more. Recent data may be more heavily weighted than older data in order to assure rapid adaptation to situations in which manual overrides represent stable changes such as changes in work schedules, etc.

[0146] In step 1808 the server retrieves any relevant override data from the period preceding the specific override being evaluated that has not yet been evaluated by and incorporated into the long-term programming and rules engines as described below in **Figure 19**. In step 1810 the server evaluates the override and determines which rule, if any, should be applied as a result of the override.

[0147] In step 1812 the server determines whether to alter the current setpoint as a result of applying the rules in step 1810. If no setpoint change is indicated, then the routine ends. If a setpoint change is indicated, then in step 1814 the server transmits the setpoint change to the thermostat for execution in the home, and in

Ex. 1004.0221

step 1816 it records that change to one or more databases in overall database structure 300.

[0148] In order to ensure that both the stored rules for interpreting manual overrides and the programming itself continue to most accurately reflect the intentions of the occupants, the server will periodically review both the rules used to interpret overrides and the setpoint scheduling employed. **Figure 19** shows the steps used to incorporate manual overrides into the long-term rules and setpoint schedule. In step 1902 the server retrieves the stored programming for a given thermostat as well as the rules for interpreting overrides for that thermostat.

[0149] In step 1904 the server retrieves the recent override data as recorded in **Figures 17** and **18** to be evaluated for possible revisions to the rules and the programming. In step 1906 the server retrieves the contextual data regarding overrides retrieved in step 1904 (Because the process illustrated in **Figure 19** is not presently expected to be executed as a real-time process, and is expected to be run anywhere from once per day to once per month, the range and volume of contextual data to be evaluated is likely to be greater than in the process illustrated in **Figure 18**.

[0150] In step 1908 the server interprets the overrides in light of the existing programming schedule, rules for overrides, contextual data, etc. In step 1910 the server determines whether, as a result of those overrides as interpreted, the rules for interpreting manual overrides should be revised. If the rules are not to be revised, the server moves to step 1914. If the rules are to be revised, then in step 1912 the server revises the rules and the new rules are stored in one or more databases in overall database structure 300.

[0151] In step 1914 the server determines whether any changes to the baseline programming for the thermostat should be revised. If not, the routine terminates. If revisions are warranted, then in step 1916 the server retrieves from database 900 the permissions the server has to make autonomous changes to settings. If the server has been given permission to make the proposed changes, then in step 1918 the server revises the thermostat's programming and writes the changes to one or more databases in overall database structure 300.

Ex. 1004.0222

[0152] If the server has not been authorized to make such changes autonomously, then in step 1920 the server transmits the recommendation to change settings to the customer in the manner previously specified by the customer, such as email, text message, personalized website, etc.

[0153] Additional means of implementing an embodiment of the instant invention may be achieved using variations in system architecture. For example, much or even all of the work being accomplished by remote server 106 may also be done by thermostat 108 if that device has sufficient processing capabilities, memory, etc. Alternatively, these steps may be undertaken by a local processor such as a local personal computer, or by a dedicated appliance having the requisite capabilities, such as gateway 112.

[0154] An additional way in which an embodiment of the instant invention can reduce energy consumption with minimal impact on comfort is to vary the turn-on delay enforced by the thermostat after the compressor is turned off. Compressor delay is usually used to protect compressors from rapid cycling, which can physically damage them.

[0155] The ability to predict the rate of change in inside temperature in a given house under varying conditions may also be applied to permit calculation of the effect of different compressor delay settings on inside temperatures, HVAC cycling and energy consumption.

[0156] **Figure 20** shows a flowchart illustrating the steps required to initiate a compressor delay adjustment event. In step 2002, server 106 retrieves parameters such as weather conditions, the current price per kilowatt-hour of electricity, and the state of the electric grid in terms of supply versus demand for the geographic area that includes a given home. In step 2004 server 106 determines whether to instantiate the compressor delay adjustment program for a certain group of homes in response to those conditions.

[0157] In step 2006, server 106 determines whether a specific home is subscribed to participate in compressor delay events. If a given home is eligible, then in step 2008 the server retrieves the parameters needed to specify the compressor delay routine for that home. These may include user preferences, such as the weather,

Ex. 1004.0223

time of day and other conditions under which the homeowner has elected to permit hysteresis band changes, the maximum length of compressor delay authorized, etc.

[0158] In step 2010 the appropriate compressor delay settings are determined, and in step 2012 the chosen settings are communicated to the thermostat. In step 2014 the server determines if additional thermostats in the given group must still be evaluated. If so, the server returns to step 2006 and repeats the subsequent steps with the next thermostat. If not, the routine ends.

[0159] **Figures 21(a)** through **21(c)** illustrate how changes in compressor delay settings affect HVAC cycling behavior by plotting time against temperature. In **Figure 21(a)**, time is shown on the horizontal axis 2102, and temperature is shown on vertical axis 2104. The setpoint for thermostat 108 is 70 degrees F, which results in the cycling behavior shown for inside temperature 2106. Because compressor delay CD1 2108 is, at approximately 3 minutes, shorter than the natural duration of a compressor off cycle Off1 2110 at approximately 6 minutes for this particular house under the illustrated conditions, the compressor delay has no effect on the operation of the HVAC system.

[0160] Because the hysteresis band operates to so as to maintain the temperature within a range of plus or minus one degree of the setpoint, in the case of air conditioning the air conditioner will switch on when the inside temperature reaches 71 degrees, continue operating until it reaches 69 degrees, then shut off. The system will then remain off until it reaches 71 degrees again, at which time it will again switch on. The percentage of time during which inside temperature is above or below the setpoint will depend on conditions and the dynamic signature of the individual, home. Under the conditions illustrated, the average inside temperature AT1 2112 is roughly equal to the setpoint of 70 degrees.

[0161] **Figure 21(b)** shows how with the same environmental conditions as in **Figure 21(a)**, the cycling behavior of the inside temperature changes when the compressor delay is longer than the natural compressor off cycle Off1 2110. Extended compressor delay CD2 2114 allows inside temperature 2116 to climb above the range normally enforced by the hysteresis band. Because CD2 is roughly 8 minutes, under the given conditions the inside temperature climbs to approximately 72 degrees before

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the compressor delay allows the air conditioner to restart and drive the inside temperature back down. But as before, the air conditioner shuts off when the inside temperature reaches 69 degrees. Thus the average temperature is increased from AT1 2112 to AT2 2118. This change will save energy and reduce cycling because it takes less energy to maintain a higher inside temperature with an air conditioner. However, the setpoint reported by the display of the thermostat will continue to be the occupant's chosen setpoint of 70 degrees.

[0162] **Figure 21(c)** shows how the same compressor delay can result in different thermal cycling with different weather conditions. The greater the amount by which outside temperature exceeds inside temperature in the air conditioning context, the more rapidly the inside temperature will increase during an off cycle, and the slower the air conditioner will be able to cool during the on cycle. Thus as compared to **Figure 21(b)**, when the inside temperature increased to roughly 72 degrees during the extended compressor delay of 8 minutes, a higher outside temperature will cause the inside temperature to increase faster, which results in a peak temperature of roughly 73 degrees, and in wider temperature cycling 2120. The average inside temperature consequently increases from AT(2) 2118 to AT(3) 2122.

[0163] It should be noted that the shape of the actual waveform will most likely not be sinusoidal, but for ease of illustration it is sometimes be presented as such in the figures.

[0164] Residential air conditioning is a major component of peak load. The traditional approach to dealing with high demand on hot days is to increase supply – build new powerplants, or buy additional capacity on the spot market. But because reducing loads has come to be considered by many to be a superior strategy for matching electricity supply to demand when the grid is stressed, the ability to shed load by turning off air conditioners during peak events has become a useful tool for managing loads. A key component of any such system is the ability to document and verify that a given air conditioner has actually turned off. Data logging hardware can accomplish this, but due to the cost is usually only deployed for statistical sampling. An embodiment of the instant invention provides a means to verify demand response without additional hardware such as a data logger.

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[0165] Because server 106 logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. That performance data will allow the server 106 to calculate an effective thermal mass for each such structure – that is, the speed with the temperature inside a given building will change in response to changes in outside temperature. Because the server will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures. This will permit remote verification of load shedding by the air conditioner without directly measuring or recording the electrical load drawn by the air conditioner.

[0166] **Figure 22** shows the steps followed in order to initiate air conditioner shutoff. When a summer peak demand situation occurs, the utility will transmit an email 2202 or other signal to server 106 requesting a reduction in load. Server 106 will determine 2204 if the user's house is served by the utility seeking reduction; determine 2206 if a given user has agreed to reduce peak demand; and determine 2208 if a reduction of consumption by the user is required or desirable in order to achieve the reduction in demand requested by the utility. The server will transmit 2210 a signal to the user's thermostat 108 signaling the thermostat to shut off the air conditioner 110.

[0167] **Figure 23** shows the steps followed in order to verify that the air conditioner has in fact been shut off. Server 106 will receive and monitor 2302 the temperature readings sent by the user's thermostat 108. The server then calculates 2304 the temperature reading to be expected for that thermostat given inputs such as current and recent outside temperature, recent inside temperature readings, the calculated thermal mass of the structure, temperature readings in other houses, etc. The server will compare 2306 the predicted reading with the actual reading. If the server determines that the temperature inside the house is rising at the rate predicted if the air conditioning is shut off, then the server confirms 2308 that the air conditioning has been shut off. If the temperature reading from the thermostat shows no increase, or significantly less increase than predicted by the model, then the server concludes

2310 that the air conditioning was not switched off, and that no contribution to the demand response request was made.

[0168] For example, assume that on at 3PM on date Y utility X wishes to trigger a demand reduction event. A server at utility X transmits a message to the server at demand reduction service provider Z requesting W megawatts of demand reduction. The demand reduction service provider server determines that it will turn off the air conditioner at house A in order to achieve the required demand reduction. At the time the event is triggered, the inside temperature as reported by the thermostat in house A is 72 degrees F. The outside temperature near house A is 96 degrees Fahrenheit. The inside temperature at House B, which is not part of the demand reduction program, but is both connected to the demand reduction service server and located geographically proximate to House A, is 74F. Because the air conditioner in house A has been turned off, the temperature inside House A begins to rise, so that at 4PM it has increased to 79F. Because the server is aware of the outside temperature, which remains at 96F, and of the rate of temperature rise inside house A on previous days on which temperatures have been at or near 96F, and the temperature in house B, which has risen only to 75F because the air conditioning in house B continues to operate normally, the server is able to confirm with a high degree of certainty that the air conditioner in house A has indeed been shut off.

[0169] In contrast, if the HVAC system at house A has been tampered with, so that a demand reduction signal from the server does not actually result in shutting off the air conditioner in house A, when the server compares the rate of temperature change at house A against the other data points, the server will receive data inconsistent with the rate of increase predicted. As a result, it will conclude that the air conditioner has not been shut off in house A as expected, and may not credit house A with the financial credit that would be associated with demand reduction compliance, or may trigger a business process that could result in termination of house A's participation in the demand reduction program.

[0170] **Figure 24** illustrates the movement of signals and information between the components of one embodiment of the subject invention to trigger and verify a demand reduction response. Where demand response events are undertaken on

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behalf of a utility by a third party, participants in the communications may include electric utility server 2400, demand reduction service server 106, and thermostat 108. In step 2402 the electric utility server 2400 transmits a message to demand reduction service server 106 requesting a demand reduction of a specified duration and size. Demand reduction service server 106 uses database 300 to determine which subscribers should be included in the demand reduction event. For each included subscriber, the server then sends a signal 2404 to the subscriber's thermostat 108 instructing it (a) to shut down at the appropriate time or (b) to allow the temperature as measured by the thermostat to increase to a certain temperature at the specified time, depending upon the agreement between the homeowner and the utility and/or demand reduction aggregator.

[0171] The server then receives 2406 temperature signals from the subscriber's thermostat. At the conclusion of the demand reduction event, the server transmits a signal 2408 to the thermostat permitting the thermostat to signal its attached HVAC system to resume cooling, if the system has been shut off, or to reduce the target temperature to its pre-demand reduction setting, if the target temperature was merely increased. If thermostat 108 is capable of storing scheduling information, these instructions may be transmitted prior to the time they are to be executed and stored locally. After determining the total number of subscribers actually participating in the DR event, the server then calculates the total demand reduction achieved and sends a message 2410 to the electric utility confirming such reduction.

[0172] Additional steps may be included in the process. For example, if the subscriber has previously requested that notice be provided when a peak demand reduction event occurs, the server will also send an alert, which may be in the form of an email or text message or an update to the personalized web page for that user, or both. If the server determines that a given home has (or has not) complied with the terms of its demand reduction agreement, the server may send a message to the subscriber confirming that fact.

[0173] It should also be noted that in some climate zones, peak demand events occur during extreme cold weather rather than (or in addition to) during hot

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weather. The same process as discussed above could be employed to reduce demand by shutting off electric heaters and monitoring the rate at which temperatures fall.

[0174] It should also be noted that the peak demand reduction service can be performed directly by an electric utility, so that the functions of server 106 can be combined with the functions of server 2400.

[0175] The system installed in a subscriber's home may optionally include additional temperature sensors at different locations within the building. These additional sensors may we connected to the rest of the system via a wireless system such as 802.11 or 802.15.4, or may be connected via wires. Additional temperature and/or humidity sensors may allow increased accuracy of the system, which can in turn increase user comfort, energy savings or both.

[0176] The bi-directional communication between server 106 and thermostat 108 will also allow thermostat 108 to regularly measure and send to server 106 information about the temperature in the building. By comparing outside temperature, inside temperature, thermostat settings, cycling behavior of the HVAC system, and other variables, the system will be capable of numerous diagnostic and controlling functions beyond those of a standard thermostat.

[0177] For example, **Figure 25a** shows a graph of inside temperature and outside temperature for a 24-hour period in House A, assuming no HVAC activity. House A has double-glazed windows and is well-insulated. When outside temperature 2502 increases, inside temperature 2504 follows, but with significant delay because of the thermal mass of the building.

[0178] **Figure 25b** shows a graph of inside temperature and outside temperature for the same 24-hour period in House B. House B is identical to House A except that it (i) is located a block away and (ii) has single-glazed windows and is poorly insulated. Because the two houses are so close to each other, outside temperature 2502 is the same in **Figure 25a** and **Figure 25b**. But the lower thermal mass of House B means that the rate at which the inside temperature 2506 changes in response to the changes in outside temperature is much greater.

[0179] The differences in thermal mass will affect the cycling behavior of the HVAC systems in the two houses as well. **Figure 26a** shows a graph of inside

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temperature and outside temperature in House A for the same 24-hour period as shown in **Figure 6a**, but assuming that the air conditioning is being used to try to maintain an internal temperature of 70 degrees. Outside temperatures 2502 are the same as in **Figures 25a** and **25b**. Inside temperature 2608 is maintained within the range determined by thermostat 108 by the cycling of the air conditioner. Because of the high thermal mass of the house, the air conditioning does not need to run for very long to maintain the target temperature, as shown by shaded areas 2610.

[0180] **Figure 26b** shows a graph of inside temperature 2612 and outside temperature 2502 for the same 24-hour period in House B, assuming use of the air conditioning as in **Figure 26a**. Because of the lower thermal mass of House B, the air conditioning system in House B has to run longer in order to maintain the same target temperature range, as shown by shaded areas 2614.

[0181] Because server 106 logs the temperature readings from inside each house (whether once per minute or over some other interval), as well as the timing and duration of air conditioning cycles, database 300 will contain a history of the thermal performance of each house. That performance data will allow the server 106 to calculate an effective thermal mass for each such structure – that is, the speed with the temperature inside a given building will change in response to changes in outside temperature and differences between inside and outside temperatures. Because the server 106 will also log these inputs against other inputs including time of day, humidity, etc. the server will be able to predict, at any given time on any given day, the rate at which inside temperature should change for given inside and outside temperatures.

[0182] The server will also record the responses of each house to changes in outside conditions and cycling behavior over time. That will allow the server to diagnose problems as and when they develop. For example, **Figure 27a** shows a graph of outside temperature 2702, inside temperature 2704 and HVAC cycle times 2706 in House A for a specific 24-hour period on date X. Assume that, based upon comparison of the performance of House A on date X relative to House A's historical performance, and in comparison to the performance of House A relative to other nearby houses on date X, the HVAC system in House A is presumed to be operating at normal

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efficiency, and that House A is in the 86th percentile as compared to those other houses.

[0183] **Figure 27b** shows a graph of outside temperature 2708, inside temperature 2710 and HVAC cycle times 2712 in House A for the 24-hour period on date X+1. House A's HVAC system now requires significantly longer cycle times in order to try to maintain the same internal temperature. If those longer cycle times were due to higher outside temperatures, those cycle times would not indicate the existence of any problems. But because server 106 is aware of the outside temperature, the system can eliminate that possibility as an explanation for the higher cycle times.

[0184] Because server 106 is aware of the cycle times in nearby houses, it can determine that, for example, on date X+1 the efficiency of House A is only in the 23rd percentile. The server will be programmed with a series of heuristics, gathered from predictive models and past experience, correlating the drop in efficiency and the time interval over which it has occurred with different possible causes. For example, a 50% drop in efficiency in one day may be correlated with a refrigerant leak, especially if followed by a further drop in efficiency on the following day. A reduction of 10% over three months may be correlated with a clogged filter. Based upon the historical data recorded by the server, the server 106 will be able to alert the homeowner that there is a problem and suggest a possible cause.

[0185] Because the system will be able to calculate effective thermal mass, it will be able to determine the cost effectiveness of strategies such as pre-cooling for specific houses under different conditions. **Figure 28a** shows a graph of outside temperature 2802, inside temperature 2804 and HVAC cycling times 2806 in House A for a specific 24-hour period on date Y assuming that the system has used a pre-cooling strategy to avoid running the air conditioning during the afternoon, when rates are highest. Because House A has high thermal mass, the house is capable of "banking" cooling, and energy consumed during off-peak hours is in effect stored, allowing the house to remain cool even when the system is turned off. Temperatures keep rising during the period the air conditioning is off, but because thermal mass is high, the rate of increase is low, and the house is still comfortable six hours later.

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[0186] Although the pre-cooling cycle time in a given home may be relatively long, the homeowner may still benefit if the price per kilowatt during the morning pre-cooling phase is lower than the price during the peak load period. **Figure 28b** shows a graph of the same outside temperature 2802 in House B as in House A in **Figure 28a** for the same 24-hour period and using the same pre-cooling strategy as shown by cycling times 2806. But because House B has minimal thermal mass, using additional electricity in order to pre-cool the house does not have the desired effect; inside temperature 2808 warms up so fast that the cooling that had been banked is quickly lost. Thus the system will recommend that House A pre-cool in order to save money, but not recommend pre-cooling for House B.

[0187] The system can also help compensate for anomalies such as measurement inaccuracies due to factors such as poor thermostat location. It is well known that thermostats should be placed in a location that will be likely to experience "average" temperatures for the overall structure, and should be isolated from windows and other influences that could bias the temperatures they "see." But for various reasons, not all thermostat installations fit that ideal. **Figure 29a** shows a graph of outside temperature 2902, the actual average inside temperature for the entire house 2904, and inside temperature as read by the thermostat 2906 in House C for a specific 24-hour period on September 15th, assuming that the thermostat is located so that for part of the afternoon on that day the thermostat is in direct sunlight.

[0188] Until the point at which the sun hits the thermostat, the average inside temperature and temperature as read by the thermostat track very closely. But when the direct sunlight hits the thermostat, the thermostat and the surrounding area can heat up, causing the internal temperature as read by the thermostat to diverge significantly from the average temperature for the rest of the house. A conventional thermostat has no way of distinguishing this circumstance from a genuinely hot day, and will both over-cool the rest of the house and waste considerable energy when it cycles the air conditioner in order to reduce the temperature as sensed by the thermostat.

[0189] If the air conditioning is turned off, this phenomenon will manifest as a spike in temperature as measured by the thermostat. If the air conditioning is turned on

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(and has sufficient capacity to respond to the distorted temperature signal caused by the sunlight), this phenomenon will likely manifest as relatively small changes in the temperature as sensed by the thermostat, but significantly increased HVAC usage (as well as excessively lowered temperatures in the rest of the house, but this result may not be directly measured in a single sensor environment).

[0190] An embodiment of the system, in contrast, has multiple mechanisms that will allow it to correct for such distortions. First, because an embodiment of the subject system compares the internal readings from House C with the external temperature, it will be obvious that the rise in temperature at 4:00PM is not correlated with a corresponding change in outside temperature. Second, because the system is also monitoring the readings from the thermostat in nearby House D, which (as shown in **Figure 29b**) is exposed to the same outside temperature 602, but has no sudden rise in measured internal afternoon temperature 2908, the system has further validation that the temperature increase is not caused by climatic conditions. And finally, because the system has monitored and recorded the temperature readings from the thermostat in House C for each previous day, and has compared the changing times of the aberration with the progression of the sun, the system can distinguish the patterns likely to indicate solar overheating from other potential causes.

[0191] **Figure 30** illustrates the steps involved in calculating comparative thermal mass, or the thermal mass index. In step 3002, the server retrieves climate data related to home X. Such data may include current outside temperature, outside temperature during the preceding hours, outside humidity, wind direction and speed, whether the sun is obscured by clouds, and other factors. In step 3004, the server retrieves HVAC duty cycle data for home X. Such data may include target settings set by the thermostat in current and previous periods, the timing of switch-on and switch-off events and other data.

[0192] In step 3006, the server retrieves data regarding recent temperature readings as recorded by the thermostat in home X. In step 3008, the server retrieves profile data for home X. Such data may include square footage and number of floors, when the house was built and/or renovated, the extent to which it is insulated, its

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address, make, model and age of its furnace and air conditioning hardware, and other data.

[0193] In step 3010, the server retrieves the current inside temperature reading as transmitted by the thermostat. In step 3012, the server calculates the thermal mass index for the home under those conditions; that is, for example, it calculates the likely rate of change for internal temperature in home X from a starting point of 70 degrees when the outside temperature is 85 degrees at 3:00PM on August 10th when the wind is blowing at 5 mph from the north and the sky is cloudy. The server accomplishes this by applying a basic algorithm that weighs each of these external variables as well as variables for various characteristics of the home itself (such as size, level of insulation, method of construction, etc.) and data from other houses and environments.

[0194] **Figure 31** illustrates the steps involved in diagnosing defects in the HVAC system for specific home X. In step 3102, the server retrieves climate data related to home X. Such data may include current outside temperature, outside temperature during the preceding hours, outside humidity, wind direction and speed, whether the sun is obscured by clouds, and other factors. In step 3104, the server retrieves HVAC duty cycle data for home X. Such data may include target settings set by the thermostat in current and previous periods, the timing of switch-on and switch-off events and other data.

[0195] In step 3106, the server retrieves data regarding current and recent temperature readings as recorded by the thermostat in home X. In step 3108, the server retrieves profile data for home X. Such data may include square footage and number of floors, when the house was built and/or renovated, the extent to which it is insulated, its address, make, model and age of its furnace and air conditioning hardware, and other data. In step 3110, the server retrieves comparative data from other houses that have thermostats that also report to the server.

[0196] Such data may include interior temperature readings, outside temperature for those specific locations, duty cycle data for the HVAC systems at those locations, profile data for the structures and HVAC systems in those houses and the calculated thermal mass index for those other houses. In step 3112, the server

calculates the current relative efficiency of home X as compared to other homes. Those comparisons will take into account differences in size, location, age, etc in making those comparisons.

[0197] The server will also take into account that comparative efficiency is not absolute, but will vary depending on conditions. For example, a house that has extensive south-facing windows is likely to experience significant solar gain. On sunny winter days, that home will appear more efficient than on cloudy winter days. That same house will appear more efficient at times of day and year when trees or overhangs shade those windows than it will when summer sun reaches those windows. Thus the server will calculate efficiency under varying conditions.

[0198] In step 3114 the server compares the HVAC system's efficiency, corrected for the relevant conditions, to its efficiency in the past. If the current efficiency is substantially the same as the historical efficiency, the server concludes 3116 that there is no defect and the diagnostic routine ends. If the efficiency has changed, the server proceeds to compare the historical and current data against patterns of changes known to indicate specific problems. For example, in step 3118, the server compares that pattern of efficiency changes against the known pattern for a clogged air filter, which is likely to show a slow, gradual degradation over a period of weeks or even months.

[0199] If the pattern of degradation matches the clogged filter paradigm, the server creates and transmits to the homeowner a message 3120 alerting the homeowner to the possible problem. If the problem does not match the clogged filter paradigm, the system compares 3122 the pattern to the known pattern for a refrigerant leak, which is likely to show a degradation over a period of a few hours to a few days. If the pattern of degradation matches the refrigerant leak paradigm, the server creates and transmits to the homeowner a message 3124 alerting the homeowner to the possible problem.

[0200] If the problem does not match the refrigerant leak paradigm, the system compares 3126 the pattern to the known pattern for an open window or door, which is likely to show significant changes for relatively short periods at intervals uncorrelated with climatic patterns. If the pattern of degradation matches the open

door/window paradigm, the server creates and transmits to the homeowner a message 3128 alerting the homeowner to the possible problem. If the problem does not match the refrigerant leak paradigm, the system continues to step through remaining know patterns N 3130 until either a pattern is matched 3132 or the list has been exhausted without a match 3134.

[0201] **Figure 32** illustrates the steps involved in diagnosing inaccurate thermostat readings due to improper location. In step 3202, the server retrieves climate data related to home X. Such data may include current outside temperature, outside temperature during the preceding hours, outside humidity, wind direction and speed, whether the sun is obscured by clouds, and other factors. In step 3204, the server retrieves HVAC duty cycle data for home X. Such data may include target settings set by the thermostat in current and previous periods, the timing of switch-on and switch-off events and other data.

[0202] In step 3206, the server retrieves data regarding current and recent temperature readings as recorded by the thermostat in home X. In step 3208, the server retrieves profile data for home X. Such data may include square footage and number of floors, when the house was built and/or renovated, the extent to which it is insulated, its address, make, model and age of its furnace and air conditioning hardware, and other data.

[0203] In step 3210, the server retrieves comparative data from other houses that have thermostats that also report to the server. Such data may include interior temperature readings, outside temperature for those specific locations, duty cycle data for the HVAC systems at those locations, profile data for the structures and HVAC systems in those houses and the calculated thermal mass index for those other houses.

[0204] In step 3212, the server calculates the expected thermostat temperature reading based upon the input data. In step 3214, the server compares the predicted and actual values. If the calculated and actual values are at least roughly equivalent, the server concludes 3216 that there is no thermostat-related anomaly. If the calculated and actual values are not roughly equivalent, the server retrieves additional historical information about past thermostat readings in step 3218.

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[0205] In step 3220, the server retrieves solar progression data, i.e., information regarding the times at which the sun rises and sets on the days being evaluated at the location of the house being evaluated, and the angle of the sun at that latitude, etc. In step 3222, the server compares the characteristics of the anomalies over time, to see if, for example, abnormally high readings began at 3:06 on June 5th, 3:09 on June 6th, 3:12 on June 7th, and the solar progression data suggests that at the house being analyzed, that sun would be likely to reach a given place in that house three minutes later on each of those days.

[0206] If the thermostat readings do not correlate with the solar progression data, the server concludes 3224 that the sun is not causing the distortion by directly hitting the thermostat. If the thermostat readings do correlate with solar progression, the server then calculates 3226 the predicted duration of the distortion caused by the sun.

[0207] In step 3228, the server calculates the appropriate setpoint information to be used by the thermostat to maintain the desired temperature and correct for the distortion for the expected length of the event. For example, if the uncorrected setpoint during the predicted event is 72 degrees, and the sun is expected to elevate the temperature reading by eight degrees, the server will instruct the thermostat to maintain a setpoint of 80 degrees. In step 3230, the server sends the homeowner a message describing the problem.

[0208] One or more embodiments of the invention may be used to implement additional energy savings by implementing small, repeated changes in setpoint. Because energy consumption is directly proportional to setpoint – that is, the further a given setpoint diverges from the balance point (the natural inside temperature assuming no HVAC activity) in a given house under given conditions, the higher energy consumption will be to maintain temperature at that setpoint), energy will be saved by any strategy that over a given time frame lowers the average heating setpoint or raises the cooling setpoint.

[0209] It is therefore possible to save energy by adopting a strategy that takes advantage of human insensitivity to slow temperature ramping by incorporating a user's desired setpoint within the range of the ramp, but setting the average target

temperature below the desired setpoint in the case of heating, and above it in the case of cooling. For example, a ramped summer setpoint that consisted of a repeated pattern of three phases of equal length set at 72°F, 73°F, and 74°F would create an effective average setpoint of 73°F, but would generally be experienced by occupants as yielding at least roughly equivalent comfort as in a room set at a constant 72°F. Energy savings resulting from this approach have been shown to be in the range of 4-6%.

[0210] Embodiments of the invention can automatically generate optimized ramped setpoints that could save energy without compromising the comfort of the occupants. It would also be advantageous to create a temperature control system that could incorporate adaptive algorithms that could automatically determine when the ramped setpoints should not be applied due to a variety of exogenous conditions that make application of such ramped setpoints undesirable.

[0211] **Figure 33** represents the conventional programming of a thermostat and the resulting behavior of a home's HVAC system in the air conditioning context. The morning setpoint 3302 of 74 degrees remains constant from midnight until 9:00AM, and the inside temperature 3304 varies more or less within the limits of the hysteresis band during that entire period. When the setpoint changes to 80 degrees 3306, the inside temperature 3308 varies within the hysteresis band around the new setpoint, and so on. Whether the average temperature is equal to, greater or less than the nominal setpoint will depend on weather conditions, the dynamic signature of the structure, and the efficiency and size of the HVAC system. But in most cases the average temperature will be at least roughly equivalent to the nominal setpoint.

[0212] **Figure 34** represents implementation of a three-phase ramped setpoint derived from the same user preferences as manifested by the settings shown in **Figure 33**. Thus the user-selected setpoint for the morning is still 74 degrees, and is reflected in the setpoint 3404 at the start of each three-step cycle, but because (in the air conditioning context) the setpoint requested by the user is the lowest of the three discrete steps, rather than the middle step, the average setpoint will be one degree higher 3402, and the resulting average inside temperature will be roughly one degree warmer than the average temperature without use of the ramped setpoints, thereby saving energy.

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[0213] In the currently preferred embodiment, the implementation of the ramped setpoints may be dynamic based upon both conditions inside the structure and other planned setpoint changes. Thus, for example, the ramped setpoints 3406, 3408 and 3410 may be timed so that the 9AM change in user-determined setpoint from 74 degrees to 80 degrees is in effect anticipated, and the period in which the air conditioner is not used can be extended prior to the scheduled start time for the less energy-intensive setpoint. Similarly, because the server 106 is aware that a lower setpoint will begin at 5PM. The timing can be adjusted to avoid excessively warm temperatures immediately prior to the scheduled setpoint change, which could cause noticeable discomfort relative to the new setpoint if the air conditioner is incapable of quickly reducing inside temperature on a given day based upon the expected slope of inside temperatures at that time 3412.

[0214] In order to implement such ramped setpoints automatically, algorithms may be created. These algorithms may be generated and/or executed as instructions on remote server 106 and the resulting setpoint changes can be transmitted to a given thermostat on a just-in-time basis or, if the thermostat 108 is capable of storing future settings, they may be transferred in batch mode to such thermostats. Basic parameters used to generate such algorithms include:

[0215] the number of discrete phases to be used;

[0216] the temperature differential associated with each phase; and

[0217] the duration of each phase

[0218] In order to increase user comfort and thus maximize consumer acceptance, additional parameters may be considered, including:

[0219] time of day

[0220] outside weather conditions

[0221] recent history of manual inputs

[0222] recent pre-programmed setpoint changes.

[0223] Time of day may be relevant because, for example, if the home is typically unoccupied at a given time, there is no need for perceptual programming. Outside weather is relevant because comfort is dependent not just on temperature as sensed by a thermostat, but also includes radiant differentials. On extremely cold days,

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even if the inside dry-bulb temperature is within normal comfort range, radiant losses due to cold surfaces such as single-glazed windows can cause subjective discomfort; thus on such days occupants may be more sensitive to ramping. Recent manual inputs (e.g., programming overrides) may create situations in which exceptions should be taken; depending on the context, recent manual inputs may either suspend the ramping of setpoints or simply alter the baseline temperature from which the ramping takes place.

[0224] **Figure 35** shows the steps used in the core ramped setpoint algorithm in the context of a remotely managed thermostat system. In step 3502 the application determines whether to instantiate the algorithm based upon external scheduling criteria. In step 3504 the application running on a remote server retrieves from the thermostat the data generated by or entered into the thermostat, including current temperature settings, HVAC status and inside temperature. The algorithm performs preliminary logical tests at that point to determine whether further processing is required. For example, in the heating context, if the inside temperature as reported by the thermostat 108 is more than 1 degree higher than the current setpoint, the algorithm may determine that running the ramped setpoint program will have no effect and therefore terminate.

[0225] In step 3506 the algorithm advances to the next phase from the most recent phase; i.e., if the algorithm is just starting, the phase changes from "0" to "1"; if it has just completed the third phase of a three-phase ramp, the phase will change from "2" to "0". In step 3508 the application determines if the current phase is "0". If it is, then in step 3510 the algorithm determines whether current setpoint equals the setpoint in the previous phase. If so, which implies no manual overrides or other setpoint adjustments have occurred during the most recent phase, then in step 3512 the algorithm sets the new setpoint back to the previous phase "0" setpoint. If not, then in step 3514, the algorithm keeps the current temperature setting as setpoint for this new phase. In step 3516, the algorithm logs the resulting new setpoint as the new phase "0" setpoint for use in subsequent phases.

[0226] Returning to the branch after step 3508, if the current phase at that point is not phase "0", then in step 3520, the algorithm determines whether the current

Ex. 1004.0240

setpoint is equal to the setpoint temperature in the previous phase. If not, which implies setpoints have been adjusted by the house occupants, thermostat schedules, or other events, then in step 3522, the application resets the phase to "0", resets the new setpoint associated with phase "0" to equal the current temperature setting, and sets the current setting to that temperature. Alternatively, if the current temperature setting as determined in step 3520 is equal to the setpoint in the previous phase, then in step 3524 new setpoint is made to equal current setpoint plus the differential associated with each phase change. In step 3526 the "previous-phase setpoint" variable is reset to equal the new setpoint in anticipation of its use during a subsequent iteration.

[0227] **Figure 36** shows one embodiment of the overall control application implementing the algorithm described in **Figure 35**. In step 3602, the control application retrieves the current setting from the thermostat. In step 3604, the setting is logged in database 300. In step 3606, the control program determines whether other algorithms that have higher precedence than the ramped setpoint algorithm are to be run. If another algorithm is to be run prior to the ramped setpoint algorithm, then the other program is executed in step 3608. If there are no alternate algorithms that should precede the ramped setpoint application then in step 1310, the control program determines whether the thermostat has been assigned to execute the ramped setpoint program. If not, the control program skips the remaining actions in the current iteration. If the program is set to run, then in step 3612 the algorithm retrieves from database 300 the rules and parameters governing the implementation of the algorithm for the current application of the program.

[0228] In step 3614, the algorithm determines whether one or more conditions that preclude application of the algorithm, such as extreme outside weather conditions, whether the home is likely to be occupied, etc. If any of the exclusionary conditions apply, the application skips execution of the ramped setpoint algorithm for the current iteration. If not, the application proceeds to step 3616 in which the application determines whether the setpoint has been altered by manual overrides, thermostat setback schedule changes, or other algorithms as compared to the previous value as stored in database 300. If setpoint has been altered, the application proceeds to step 3620 discussed below.

Ex. 1004.0241

[0229] In step 3618, the program described in **Figure 35** is executed. In step 3620, the application resets the phase to "0". Certain temperature setting variables are reset in anticipation of their use in subsequent phases. These variables include the new phase 0 temperature setting which is anchored to the current actual temperature setting, and the new previous-phase setpoint which will be used for identifying setpoint overrides in the subsequent phase.

[0230] In step 3622, the system records the changes to the thermostat settings to database 300. In step 3624, the system records the changes to the phase status of the algorithm to database 300. In step 3626, the application determines whether the new temperature setting differs from the current setting. If they are the same, the application skips applying changes to the thermostat. If they are different, then in step 3628, the application transmits revised settings to the thermostat. In step 3630, the application then hibernates for the specified duration until it is invoked again by beginning at step 3602 again.

[0231] An embodiment of the subject invention may also be used to detect occupancy through the use of software related to electronic devices located inside the conditioned structure, such as the browser running on computer or other device 104. **Figure 37** represents the screen of a computer or other device 104 using a graphical user interface connected to the Internet. The screen shows that a browser 3700 is displayed on computer 104. In one embodiment, a background application installed on computer 104 detects activity by a user of the computer, such as cursor movement, keystrokes or otherwise, and signals the application running on server 106 that activity has been detected. Server 106 may then, depending on context, (a) transmit a signal to thermostat 108 changing setpoint because occupancy has been detected at a time when the system did not expect occupancy; (b) signal the background application running on computer 104 to trigger a software routine that instantiates a pop-up window 3702 that asks the user if the server should change the current setpoint, alter the overall programming of the system based upon a new occupancy pattern, etc. The user can respond by clicking the cursor on "yes" button 3704 or "No" button 3706. Equilvalent means of signalling activity may be employed with interactive television programming, gaming systems, etc.

Ex. 1004.0242

[0232] **Figure 38** is a flowchart showing the steps involved in the operation of one embodiment of the subject invention. In step 3802, computer 104 transmits a message to server 106 via the Internet indicating that there is user activity on computer 104. This activity can be in the form of keystrokes, cursor movement, input via a television remote control, etc. In step 3804 the application queries database 300 to retrieve setting information for the HVAC system. In step 3806 the application determines whether the current HVAC program is intended to apply when the home is occupied or unoccupied.

[0233] If the HVAC settings then in effect are intended to apply for an occupied home, then the application terminates for a specified interval. If the HVAC settings then in effect are intended to apply when the home is unoccupied, then in step 3808 the application will retrieve from database 300 the user's specific preferences for how to handle this situation. If the user has previously specified (at the time that the program was initially set up or subsequently modified) that the user prefers that the system automatically change settings under such circumstances, the application then proceeds to step 3816, in which it changes the programmed setpoint for the thermostat to the setting intended for the house when occupied. If the user has previously specified that the application should not make such changes without further user input, then in step 3810 the application transmits a command to computer 104 directing the browser to display a message informing the user that the current setting assumes an unoccupied house and asking the user in step 3812 to choose whether to either keep the current settings or revert to the pre-selected setting for an occupied home. If the user selects to retain the current setting, then in step 3814 the application will write to database 300 the fact that the users has so elected and terminate. If the user elects to change the setting, then in step 3816 the application transmits the revised setpoint to the thermostat. In step 3814 the application writes the updated setting information to database 300.

[0234] **Figure 39** is a flowchart that shows how an embodiment of the invention can be used to select different HVAC settings based upon its ability to identify which of multiple potential occupants is using the computer attached to the system. In step 3902 computer 104 transmits to server 106 information regarding the type of

Ex. 1004.0243

activity detected on computer 104. Such information could include the specific program or channel being watched if, for example, computer 104 is used to watch television. The information matching, for example, TV channel 7 at 4:00 PM on a given date to specific content may be made by referring to Internet-based or other widely available scheduling sources for such content. In step 3904 server 106 retrieves from database 300 previously logged data regarding viewed programs. In step 3906 server 106 retrieves previously stored data regarding the residents of the house.

[0235] For example, upon initiating the service, one or more users may have filled out online questionnaires sharing their age, gender, schedules, viewing preferences, etc. In step 3908, server 106 compares the received information about user activity to previously stored information retrieved from database 300 about the occupants and their viewing preferences. For example, if computer 104 indicates to server 106 that the computer is being used to watch golf, the server may conclude that an adult male is watching; if computer 104 indicates that it is being used to watch children's programming, server 106 may conclude that a child is watching.

[0236] In step 3910 the server transmits a query to the user in order to verify the match, asking, in effect, "Is that you Bob?" In step 3912, based upon the user's response, the application determines whether the correct user has been identified. If the answer is no, then the application proceeds to step 3916. If the answer is yes, then in step 3914 the application retrieves the temperature settings for the identified occupant. In step 3916 the application writes to database 300 the programming information and information regarding matching of users to that programming.

[0237] In an alternative embodiment, the application running on computer 104 may respond to general user inputs (that is, inputs not specifically intended to instantiate communication with the remote server) by querying the user whether a given action should be taken. For example, in a system in which the computer 104 is a web-enabled television or web-enabled set-top device connected to a television as a display, software running on computer 104 detects user activity, and transmits a message indicating such activity to server 106. The trigger for this signal may be general, such as changing channels or adjusting volume with the remote control or a power-on event. Upon receipt by server 106 of this trigger, server 106 transmits instructions to computer

104 causing it to display a dialog box asking the user whether the user wishes to change HVAC settings.

[0238] Additional functionality is also envisioned as part of different embodiments of the invention. For example, information from historic data may be used to predict how long it will take a user to reach home from the current coordinates, and the estimated arrival time may be used to calculate optimal cycling strategies for the HVAC system. In addition, information about traffic conditions may be integrated into these calculations, so that the geospatial data relative to mobile device 105 may indicate that a user is taking his or her normal route, but because of a traffic jam, is likely to come home later than would otherwise be expected. The characteristics of a given location may be used to infer arrival times as well. For example, if the geospatial data indicates that the user of mobile device 105 has arrived at the supermarket on his way home, a delay of 20 minutes is likely, whereas if the user has parked at a restaurant, the delay is likely to be one hour.

[0239] It is also possible to incorporate more sophisticated heuristics in incorporating the varying preferences of multiple occupants of a given home or other structure. For example, rules can be structured so that User #1's preferences control during the heating season, but not during the cooling season; User #2's preferences might control during certain times of the day but not others; User #3's preferences amy take precedence whenever they result in a more energy efficient strategy, but not when they result in increased energy use, and so on.

[0240] While particular embodiments of the present invention have been shown and described, it is apparent that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, that the invention may be carried out in other ways without departing from the true spirit and scope. These and other equivalents are intended to be covered by the following claims:

WHAT IS CLAIMED IS:

1. A thermostat comprising:

a housing;

contacts configured to connect the thermostat with wires that allow for at least two electrical connections from a building's HVAC system to the contacts;

a display unit configured to present information to a user;

a memory configured to store data;

a wireless radio compatible with the IEEE 802.11 wireless protocol and configured to communicate bi-directionally with a remote device;

a temperature sensor; and

one or more processors;

the one or more processors configured to receive a first data from the temperature sensor;

the one or more processors further configured to receive a second data from a network connection, wherein the second data from the network connection is collected from a source external to the building, wherein the second data comprises an outdoor temperature;

the one or more processors further configured to receive a first temperature setpoint for the building, wherein the first setpoint includes a first temperature value and a first time value;

the one or more processors further configured to receive a second temperature setpoint for the building, wherein the second setpoint includes a second temperature value and a second time value;

the one or more processors further configured to receive commands through the Internet by way of a remote interface; wherein the interface is configured to allow the user to adjust temperature setpoints for the HVAC system;

the one or more processors further configured to send user-specific data through the Internet, wherein user-specific information about the building and HVAC system is generated based at least in part on the user-specific data,

Ex. 1004.0246

wherein the user-specific information is presented on a website accessible through the Internet;

the one or more processors further configured to automatically adjust a temperature setpoint to a third temperature setpoint without user intervention; and

the one or more processors further configured to control the HVAC system to provide heating or cooling to the building in accordance with the third temperature setpoint.

2. The thermostat of claim 1, wherein the one or more processors is further configured to determine whether the building is occupied or unoccupied.

3. The thermostat of claim 1, wherein the one or more processors is further configured to receive a third data from a first sensor, wherein the third data from the first sensor includes a measurement of at least one characteristic of a building within which the thermostat is located.

4. The thermostat of claim 3, wherein the third data from the first sensor comprises a measurement of the humidity of the building.

5. The thermostat of claim 3, wherein the third data from the first sensor comprises a measurement of sunlight.

6. The thermostat of claim 5, wherein the second data from the network connection further comprises a measurement of the outdoor humidity.

7. The thermostat of claim 1, wherein the third temperature setpoint is the first temperature setpoint for the building corresponding to a desired temperature setting when the building is occupied, in the event the one or more processors determines that the building is occupied.

8. The thermostat of claim 1, wherein the third temperature setpoint is the second temperature setpoint for the building corresponding to a desired temperature setting when the building is unoccupied, in the event the one or more processors determines that the building is unoccupied.

9. The thermostat of claim 2, wherein the interface is configured to allow the user to input that the building is currently unoccupied.

Ex. 1004.0247

10. The thermostat of claim 9, wherein the determination of whether the building is occupied or unoccupied by the one or more processors is based at least in part on a fourth data received from a motion sensor.

11. The thermostat of claim 1, wherein the memory is further configured to store historical values of the first data and second data.

12. The thermostat of claim 1, wherein the one or more processors is further configured to predict, based at least on the first data, the second data from the network connection, and the first temperature setpoint, the time necessary for the HVAC system to operate in order for the building to reach the first temperature value by the first time value.

13. The thermostat of claim 12, wherein the one or more processors' prediction of the time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value is further based on calculating a rate of change value necessary for the building to reach the first temperature value by the first time value.

14. The thermostat of claim 12, wherein the automatic adjustment of the temperature setpoint is based at least in part on the prediction of time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value.

15. The thermostat of claim 13, wherein the automatic adjustment of the temperature setpoint is based at least in part on the rate of change value.

16. The thermostat of claim 12, wherein the memory is further configured to store historical values of the first data and second data; and wherein the one or more processors' prediction of the time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value is further based on historical values of the first data and second data.

17. The thermostat of claim 16 wherein the one or more processors calculates one or more intermediate temperature setpoints that have a temperature value between a current temperature of the building and the first temperature setpoint.

18. The thermostat of claim 16, wherein the automatic adjustment of the temperature setpoint is based at least in part on the prediction of time necessary for the

Ex. 1004.0248

HVAC system to operate in order to reach the first temperature value by the first time value.

19. The thermostat of claim 1, wherein the one or more processors is further configured to receive a fifth data generated based at least in part on a previous operation of the HVAC system, wherein the fifth data includes at least one performance characteristic of the HVAC system.

20. A system for controlling an HVAC system at a user's building, the system comprising:

a memory configured to store data; and

one or more processors;

the one or more processors configured to receive a first data from a temperature sensor located within the building;

the one or more processors further configured to receive a second data from a network connection, wherein the second data from the network connection is collected from a source external to the building, wherein the second data comprises an outdoor temperature;

the memory further configured to store historical values of the first data and second data;

the one or more processors further configured to receive a first temperature setpoint for the building, wherein the first setpoint includes a first temperature value and a first time value;

the one or more processors further configured to receive a second temperature setpoint for the building, wherein the second setpoint includes a second temperature value and a second time value;

the one or more processors further configured to receive commands through the Internet by way of a remote interface; wherein the interface is configured to allow the user to adjust temperature setpoints for the HVAC system;

the one or more processors further configured to send user-specific data through the Internet, wherein user-specific information about the building and HVAC system is generated based at least in part on the user-specific data,

Ex. 1004.0249

wherein the user-specific information is presented on a website accessible through the Internet;

the one or more processors further configured to predict, based at least on the first data, the second data from the network connection, and the first temperature setpoint, the time necessary for the HVAC system to operate in order for the building to reach the first temperature value by the first time value;

the one of more processors further configured to automatically adjust a temperature setpoint to a third temperature setpoint without user intervention; and

the one or more processors further configured to control the HVAC system to provide heating or cooling to the building in accordance with the third temperature setpoint.

SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

ABSTRACT OF THE DISCLOSURE

Embodiments of the invention comprise systems and methods for using the geographic location of networked consumer electronics devices as indications of occupancy of a structure for purposes of automatically adjusting the temperature setpoint on a thermostatic HVAC control. At least one thermostat is located inside a structure and is used to control an HVAC system in the structure. At least one mobile electronic device is used to indicate the state of occupancy of the structure. The state of occupancy is used to alter the setpoint on the thermostatic HVAC control to reduce unneeded conditioning of unoccupied spaces.

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Ex. 1004.0251

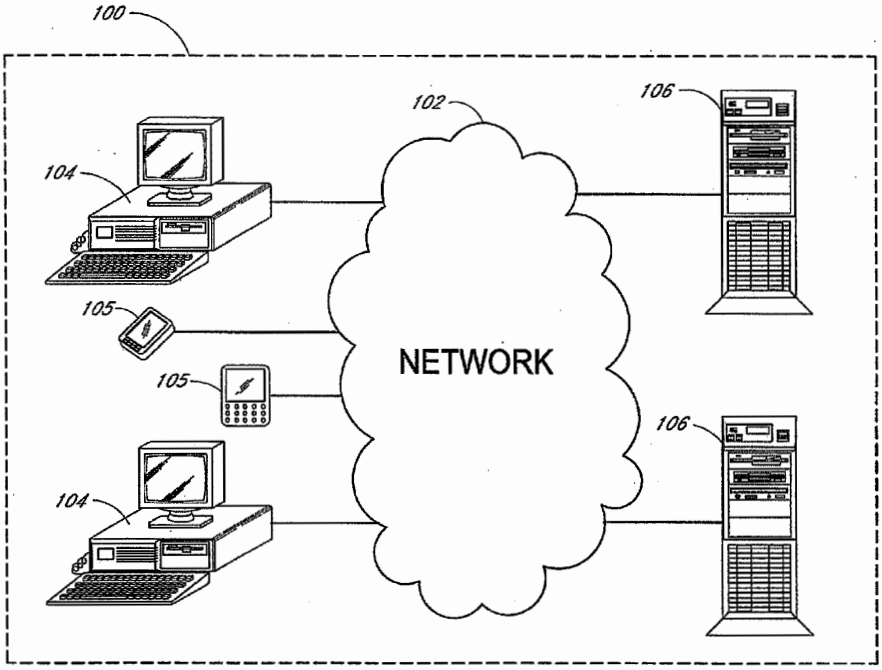


FIG. 1

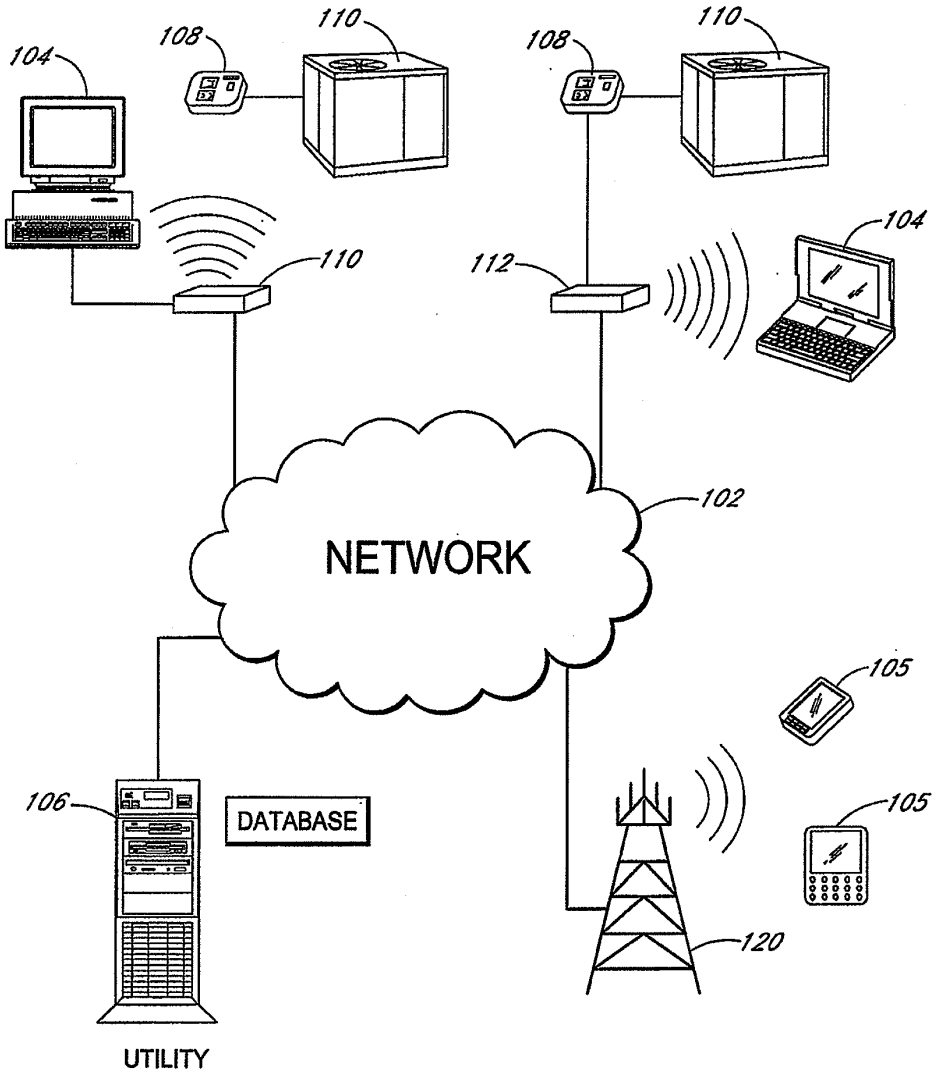

104
108
110
108
110
110
112
104
NETWORK
102
105
105
106
DATABASE
120
UTILITY

FIG. 2

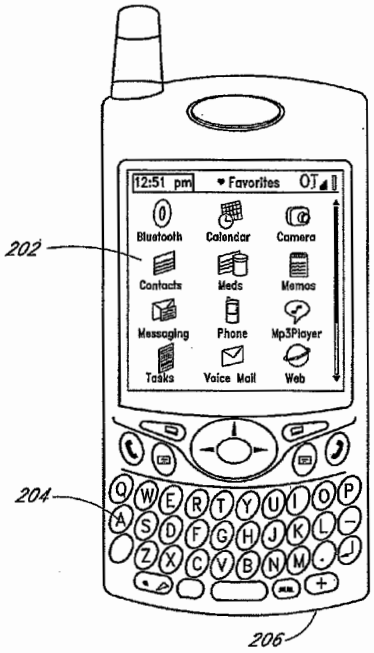

12:51 pm
Favorites
Bluetooth
Calendar
Camera
Contacts
Meds
Memos
Messaging
Phone
Mp3Player
Tasks
Voice Mail
Web
202
204
206

FIG. 3A

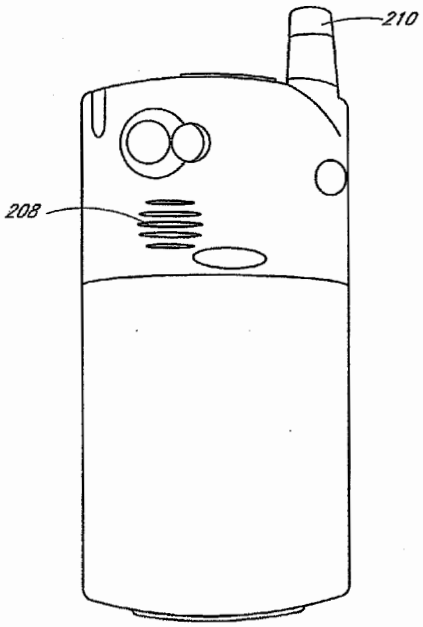

208
210

FIG. 3B

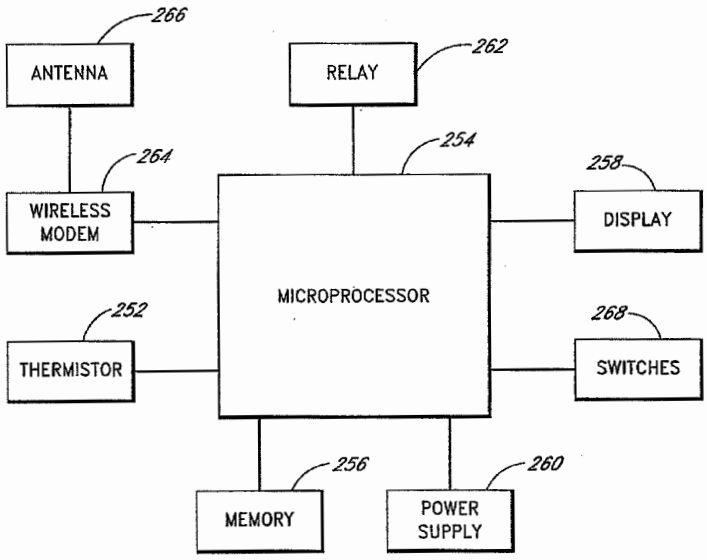

266
ANTENNA
RELAY
262
254
264
WIRELESS MODEM
258
DISPLAY
MICROPROCESSOR
252
THERMISTOR
268
SWITCHES
256
MEMORY
260
POWER SUPPLY

FIG. 4

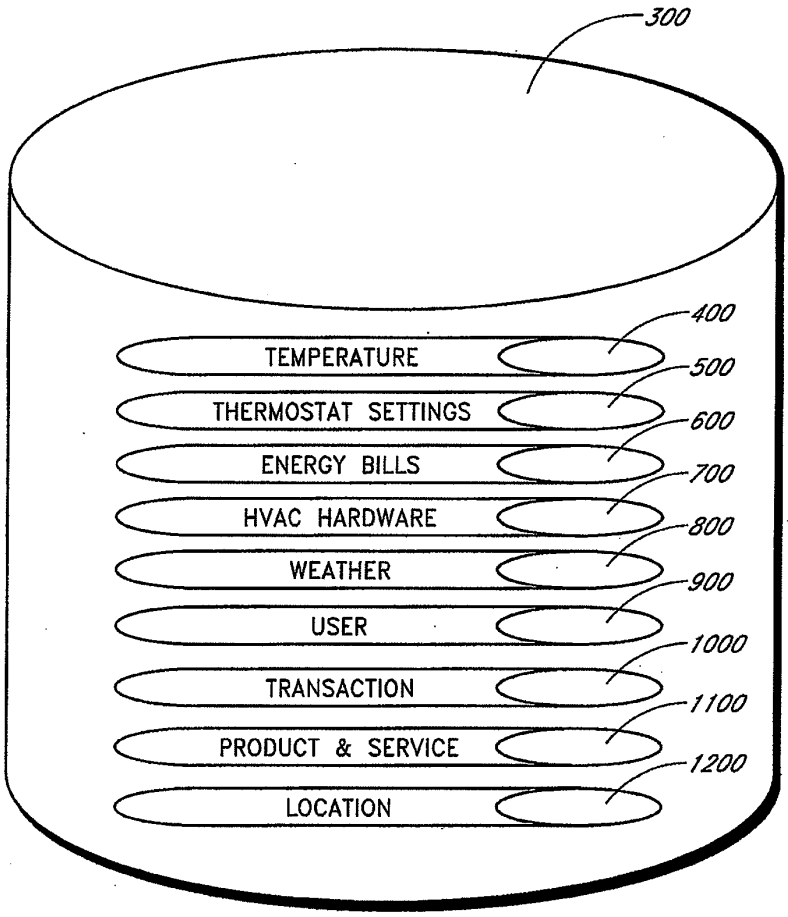

300
400
TEMPERATURE
500
THERMOSTAT SETTINGS
600
ENERGY BILLS
700
HVAC HARDWARE
800
WEATHER
900
USER
1000
TRANSACTION
1100
PRODUCT & SERVICE
1200
LOCATION

FIG. 5

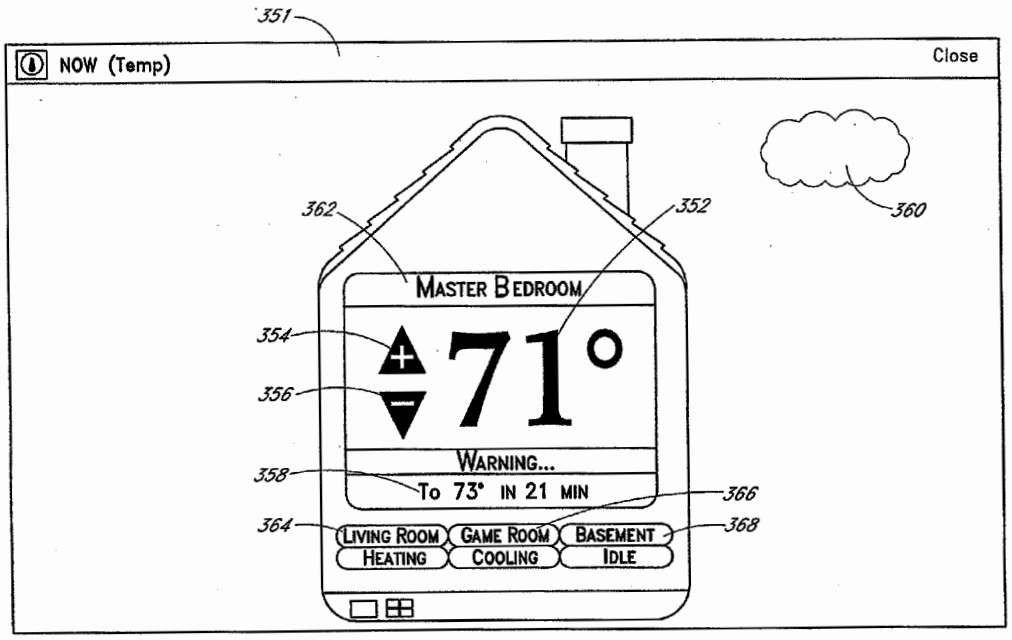

351
NOW (Temp)
Close
362
352
360
MASTER BEDROOM
354
71°
356
WARNING...
358
To 73° IN 21 MIN
366
364
LIVING ROOM
GAME ROOM
BASEMENT
368
HEATING
COOLING
IDLE

FIG. 6A

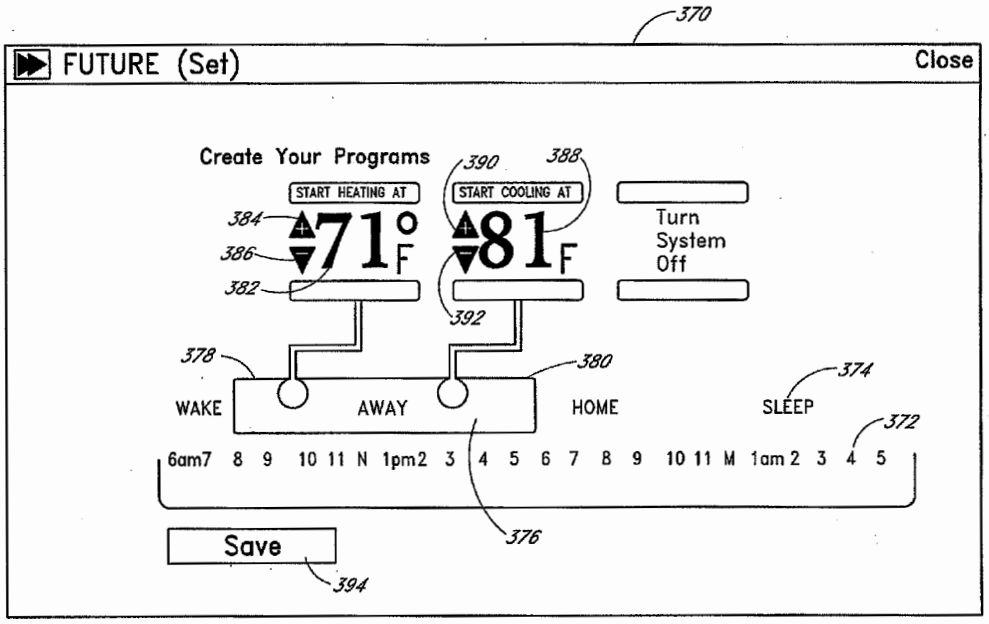

370
FUTURE (Set)
Close
Create Your Programs
390
388
START HEATING AT
START COOLING AT
384
386
382
71°F
81F
Turn
System
Off
392
378
380
374
WAKE
AWAY
HOME
SLEEP
372
6am 7 8 9 10 11 N 1pm 2 3 4 5 6 7 8 9 10 11 M 1am 2 3 4 5
376
Save
394

FIG. 6B

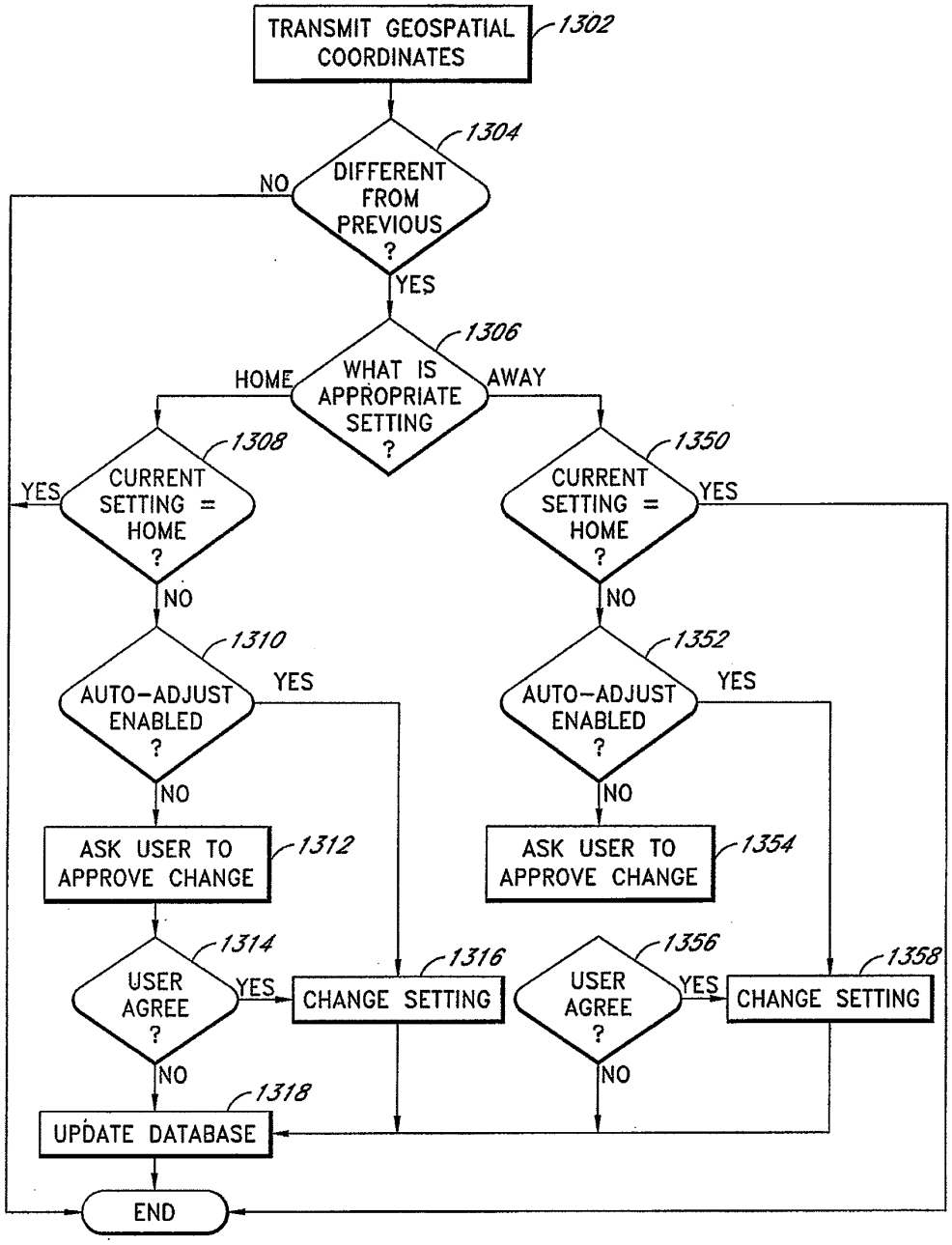

TRANSMIT GEOSPATIAL COORDINATES
1302
DIFFERENT FROM PREVIOUS ?
1304
NO
YES
WHAT IS APPROPRIATE SETTING ?
1306
HOME
AWAY
CURRENT SETTING = HOME ?
1308
YES
NO
AUTO-ADJUST ENABLED ?
1310
YES
NO
ASK USER TO APPROVE CHANGE
1312
USER AGREE ?
1314
YES
NO
CHANGE SETTING
1316
UPDATE DATABASE
1318
CURRENT SETTING = HOME ?
1350
YES
NO
AUTO-ADJUST ENABLED ?
1352
YES
NO
ASK USER TO APPROVE CHANGE
1354
USER AGREE ?
1356
YES
NO
CHANGE SETTING
1358
END

FIG. 7

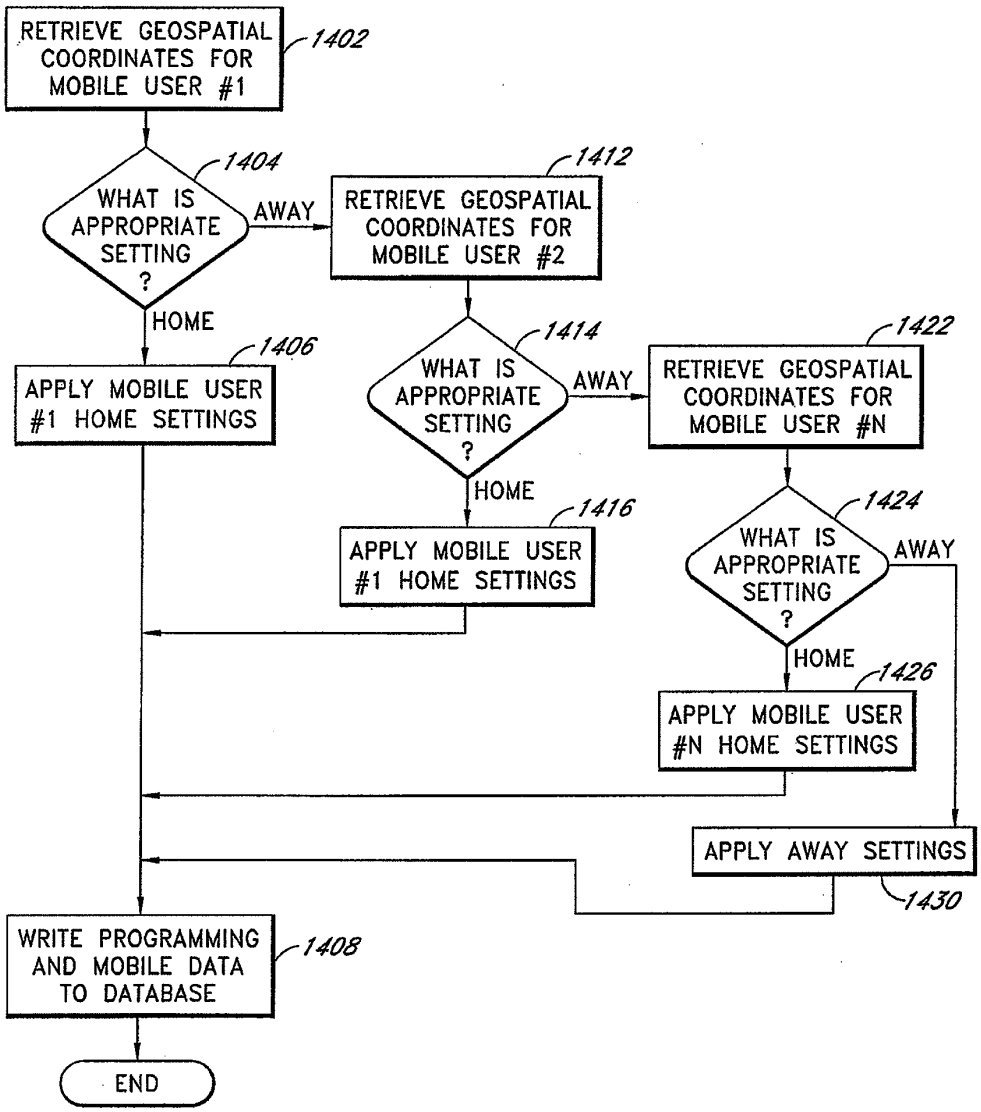

RETRIEVE GEOSPATIAL COORDINATES FOR MOBILE USER #1
1402
WHAT IS APPROPRIATE SETTING ?
1404
AWAY
HOME
RETRIEVE GEOSPATIAL COORDINATES FOR MOBILE USER #2
1412
APPLY MOBILE USER #1 HOME SETTINGS
1406
WHAT IS APPROPRIATE SETTING ?
1414
AWAY
HOME
RETRIEVE GEOSPATIAL COORDINATES FOR MOBILE USER #N
1422
APPLY MOBILE USER #1 HOME SETTINGS
1416
WHAT IS APPROPRIATE SETTING ?
1424
AWAY
HOME
APPLY MOBILE USER #N HOME SETTINGS
1426
APPLY AWAY SETTINGS
1430
WRITE PROGRAMMING AND MOBILE DATA TO DATABASE
1408
END

FIG. 8

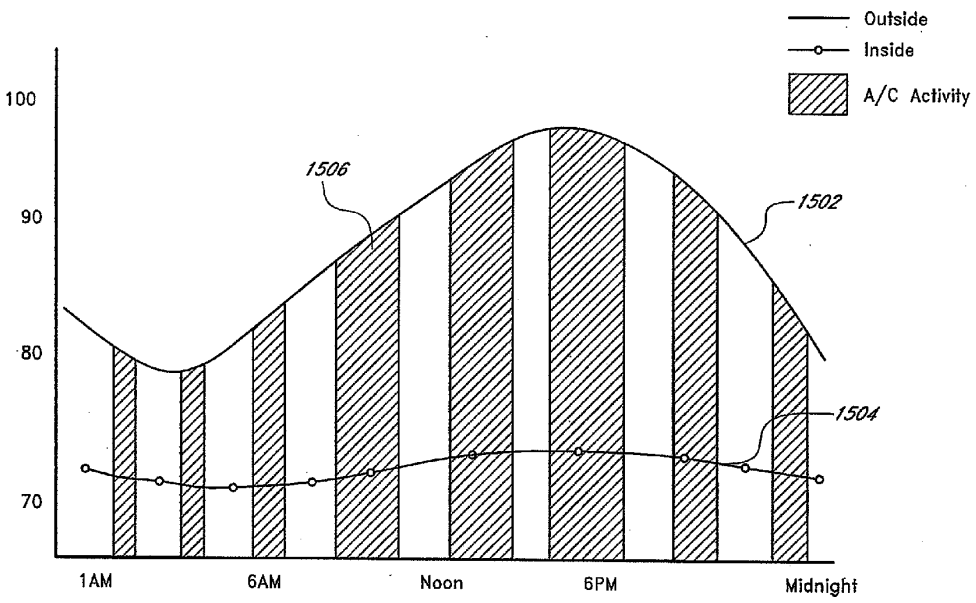

Outside
Inside
A/C Activity
100
90
80
70
1506
1502
1504
1AM
6AM
Noon
6PM
Midnight

FIG. 9A

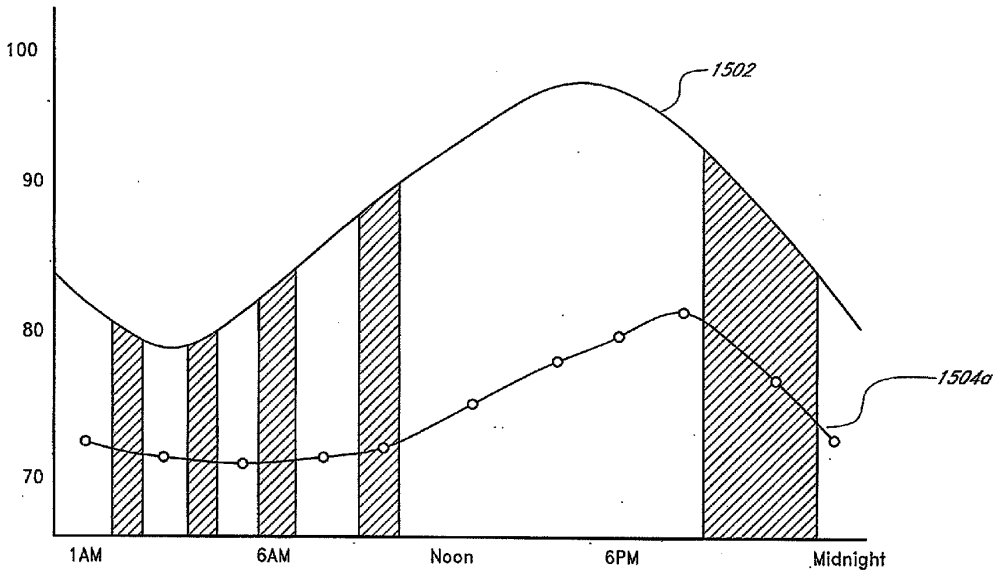


FIG. 9B

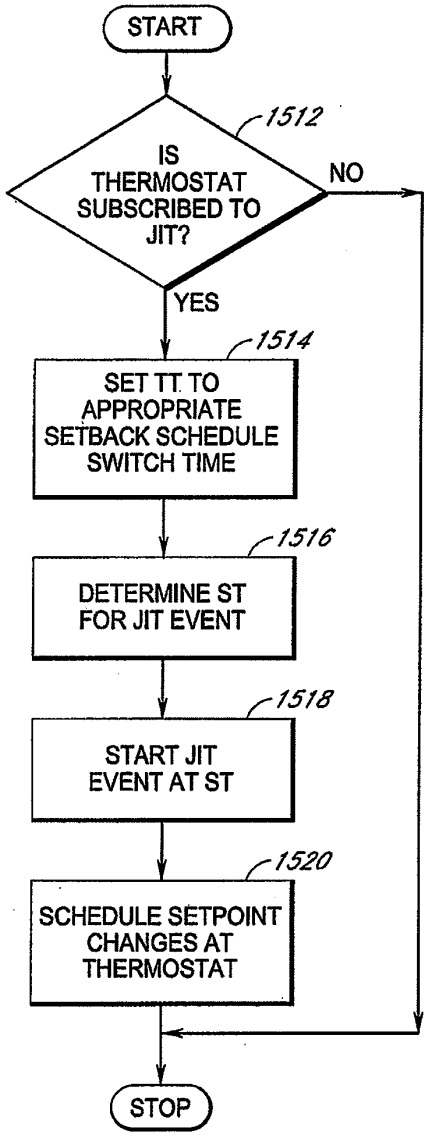

START
1512
IS THERMOSTAT SUBSCRIBED TO JIT?
NO
YES
1514
SET TT TO APPROPRIATE SETBACK SCHEDULE SWITCH TIME
1516
DETERMINE ST FOR JIT EVENT
1518
START JIT EVENT AT ST
1520
SCHEDULE SETPOINT CHANGES AT THERMOSTAT
STOP

FIG. 10

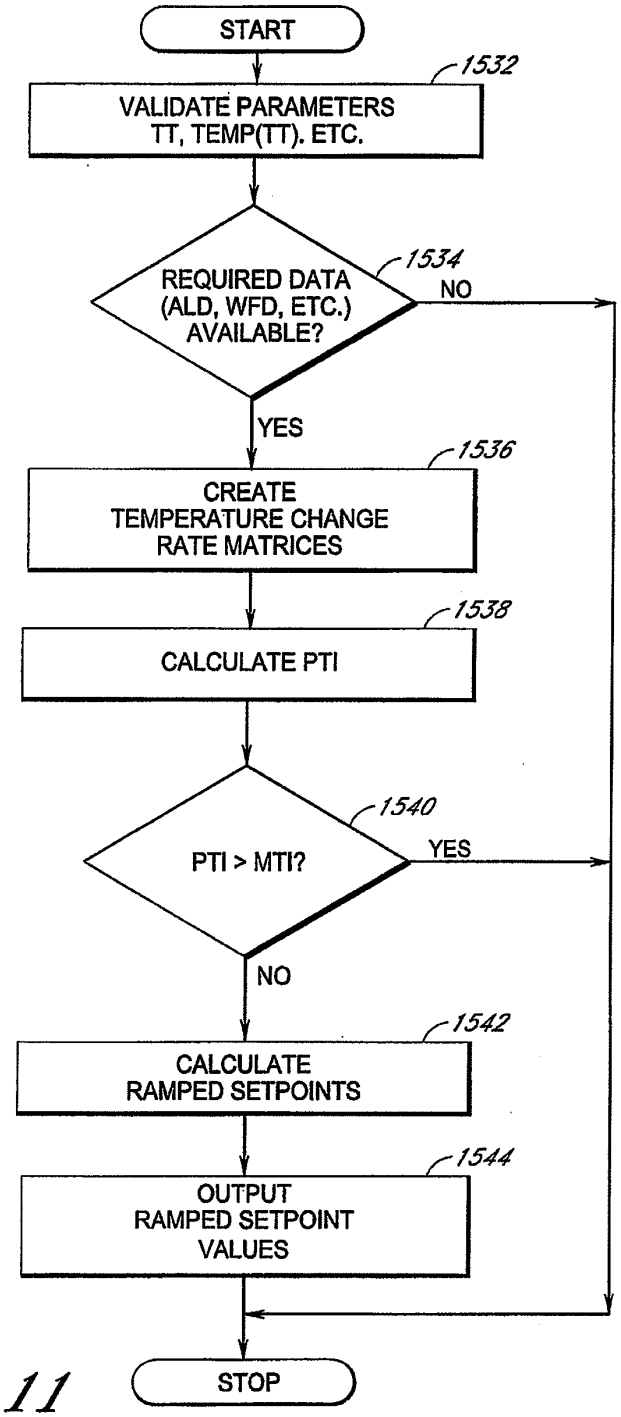

START
1532
VALIDATE PARAMETERS
TT, TEMP(TT). ETC.
1534
REQUIRED DATA
(ALD, WFD, ETC.)
AVAILABLE?
NO
YES
1536
CREATE
TEMPERATURE CHANGE
RATE MATRICES
1538
CALCULATE PTI
1540
PTI > MTI?
YES
NO
1542
CALCULATE
RAMPED SETPOINTS
1544
OUTPUT
RAMPED SETPOINT
VALUES
STOP

FIG. 11

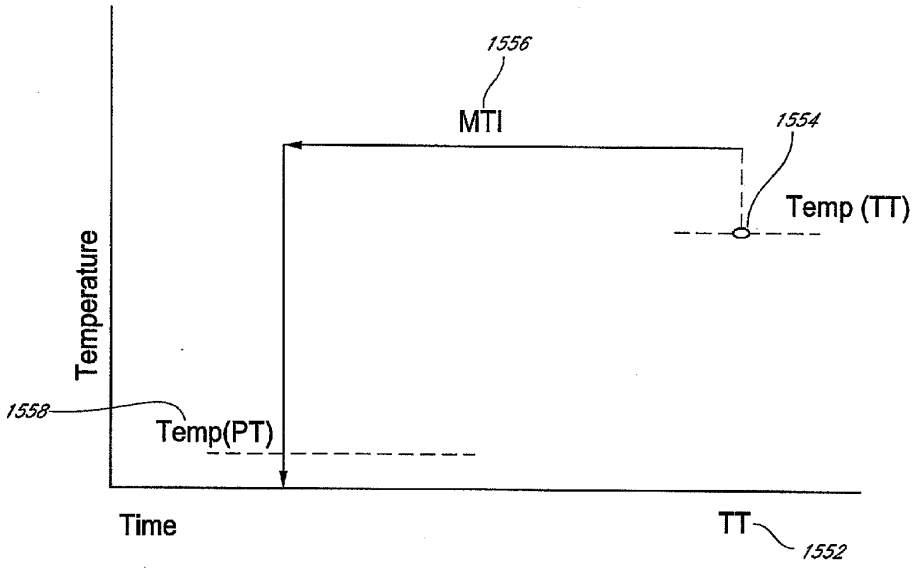


FIG. 12A

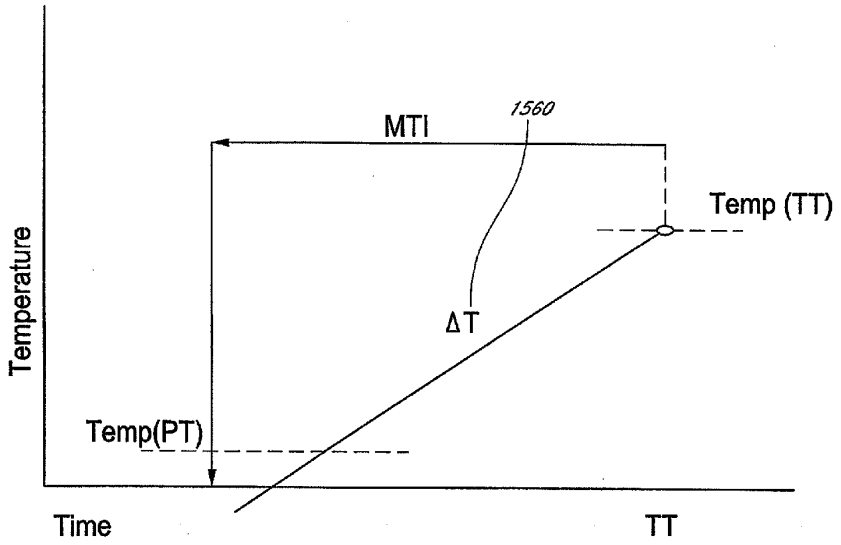


FIG. 12B

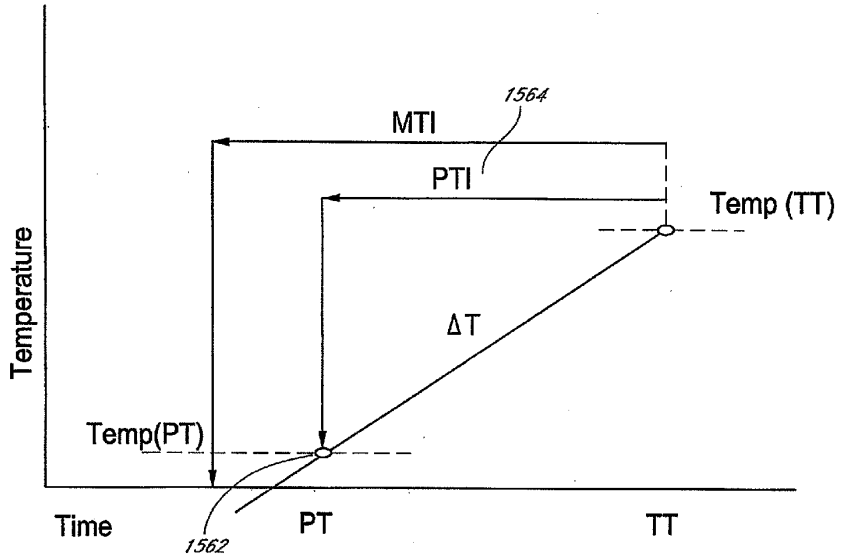


FIG. 12C

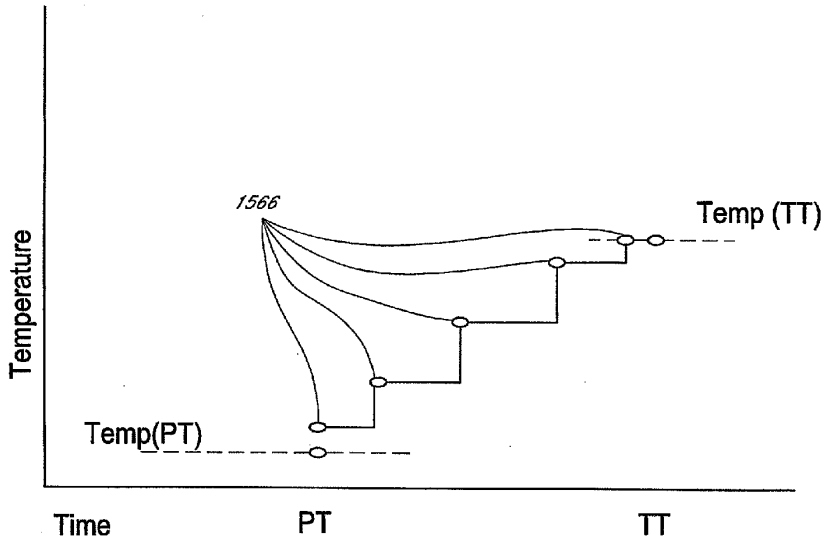


FIG. 12D

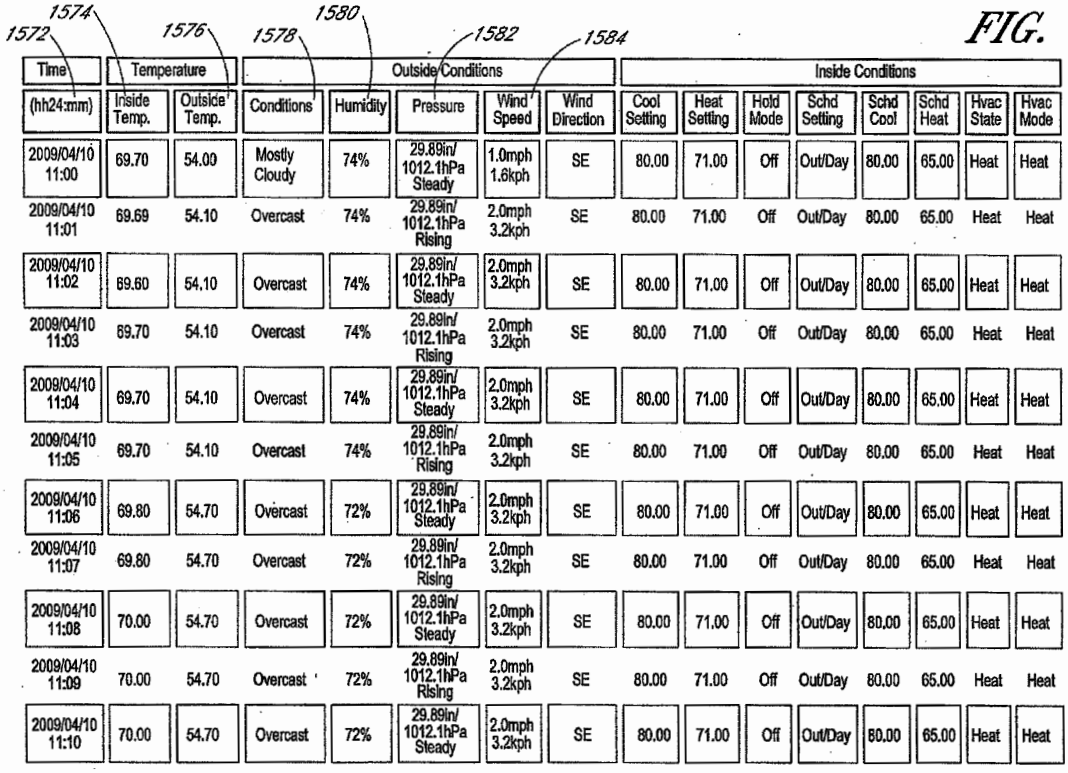


FIG. 13

Time	Temperature		Outside Conditions					Inside Conditions							
(hh24:mm)	Inside Temp.	Outside Temp.	Conditions	Humidity	Pressure	Wind Speed	Wind Direction	Cool Setting	Heat Setting	Hold Mode	Schd Setting	Schd Cool	Schd Heat	Hvac State	Hvac Mode
2009/04/10 11:00	69.70	54.00	Mostly Cloudy	74%	29.89in/ 1012.1hPa Steady	1.0mph 1.6kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:01	69.69	54.10	Overcast	74%	29.89in/ 1012.1hPa Rising	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:02	69.60	54.10	Overcast	74%	29.89in/ 1012.1hPa Steady	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:03	69.70	54.10	Overcast	74%	29.89in/ 1012.1hPa Rising	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:04	69.70	54.10	Overcast	74%	29.89in/ 1012.1hPa Steady	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:05	69.70	54.10	Overcast	74%	29.89in/ 1012.1hPa Rising	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:06	69.80	54.70	Overcast	72%	29.89in/ 1012.1hPa Steady	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:07	69.80	54.70	Overcast	72%	29.89in/ 1012.1hPa Rising	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:08	70.00	54.70	Overcast	72%	29.89in/ 1012.1hPa Steady	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:09	70.00	54.70	Overcast	72%	29.89in/ 1012.1hPa Rising	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat
2009/04/10 11:10	70.00	54.70	Overcast	72%	29.89in/ 1012.1hPa Steady	2.0mph 3.2kph	SE	80.00	71.00	Off	Out/Day	80.00	65.00	Heat	Heat

Ex. 1004.0269

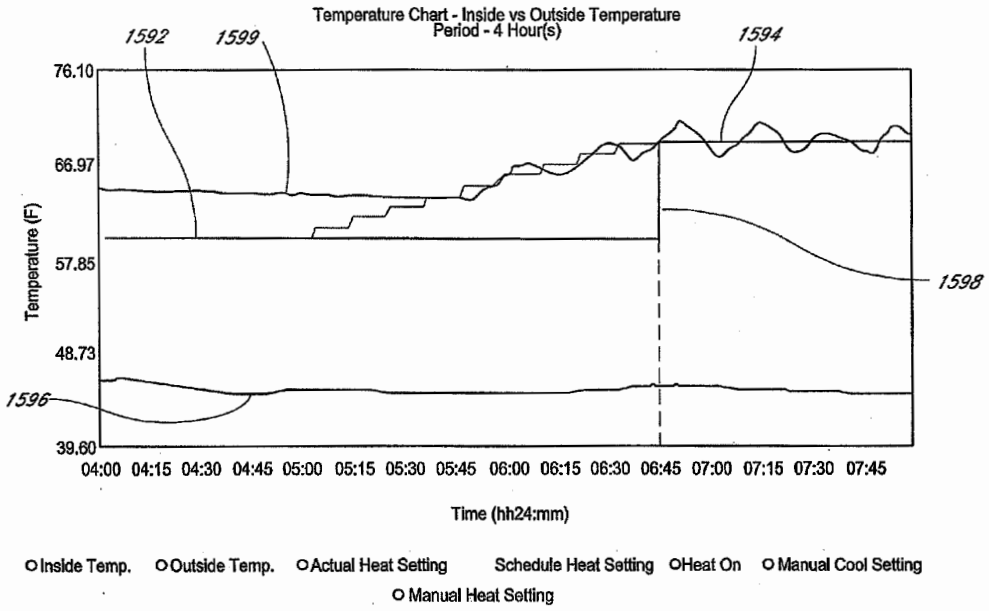

Temperature Chart - Inside vs Outside Temperature
Period - 4 Hour(s)
1592
1599
1594
1598
1596
76.10
66.97
57.85
48.73
39.60
Temperature (F)
04:00 04:15 04:30 04:45 05:00 05:15 05:30 05:45 06:00 06:15 06:30 06:45 07:00 07:15 07:30 07:45
Time (hh24:mm)
Inside Temp.
Outside Temp.
Actual Heat Setting
Schedule Heat Setting
Heat On
Manual Cool Setting
Manual Heat Setting

FIG. 14

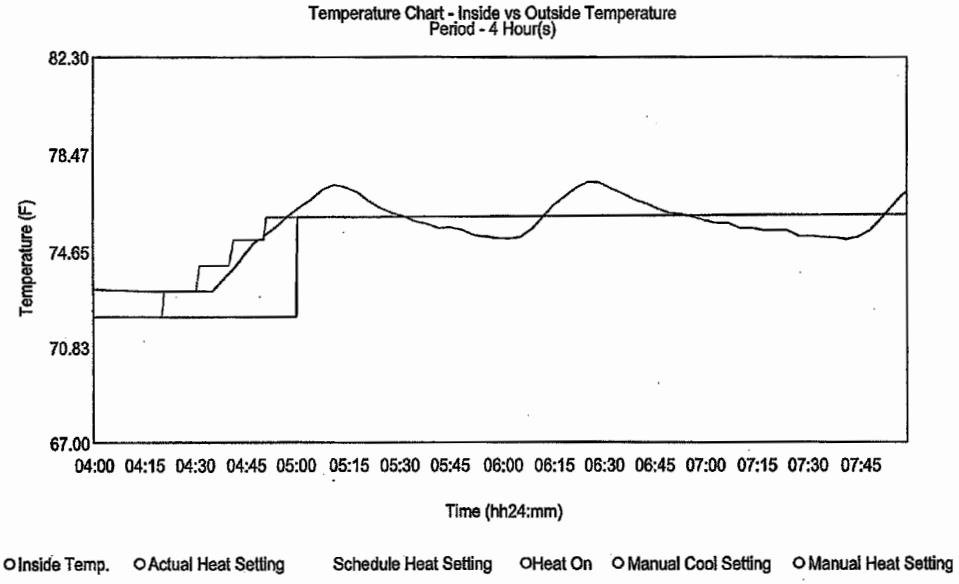

Temperature Chart - Inside vs Outside Temperature
Period - 4 Hour(s)
82.30
78.47
74.65
70.83
67.00
Temperature (F)
04:00 04:15 04:30 04:45 05:00 05:15 05:30 05:45 06:00 06:15 06:30 06:45 07:00 07:15 07:30 07:45
Time (hh24:mm)
Inside Temp.
Actual Heat Setting
Schedule Heat Setting
Heat On
Manual Cool Setting
Manual Heat Setting

FIG. 15

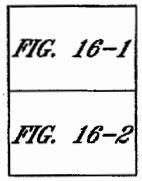


FIG. 16

1602 1604

FIG. 16-1

Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour	Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour	Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour	Outside/Inside Difference, Degrees F	Predicted Inside Temp Change, Degrees F/hour
-99	-1.20945425	-49	0.61355475	1	2.43656376	51	4.25957277
-98	-1.17299407	-48	0.65001493	2	2.47302394	52	4.29603295
-97	-1.13653389	-47	0.68647511	3	2.50948412	53	4.33249313
-96	-1.10007371	-46	0.72293529	4	2.5459443	54	4.36895331
-95	-1.06361353	-45	0.75939547	5	2.58240448	55	4.40541349
-94	-1.02715335	-44	0.79585565	6	2.61886466	56	4.44187367
-93	-0.99069317	-43	0.83231583	7	2.65532484	57	4.47833385
-92	-0.95423299	-42	0.86877602	8	2.69178502	58	4.51479403
-91	-0.91777281	-41	0.9052362	9	2.7282452	59	4.55125421
-90	-0.88131263	-40	0.94169638	10	2.76470538	60	4.58771439
-89	-0.84485245	-39	0.97815656	11	2.80116556	61	4.62417457
-88	-0.80839227	-38	1.01461674	12	2.83762574	62	4.66063475
-87	-0.77193209	-37	1.05107692	13	2.87408592	63	4.69709493
-86	-0.73547191	-36	1.0542371	14	2.9105461	64	4.73355511
-85	-0.69901173	-35	1.12399728	15	2.94700628	65	4.77001529
-84	-0.66255155	-34	1.16045746	16	2.98346646	66	4.80647547
-83	-0.62609137	-33	1.19691764	17	3.01992664	67	4.84293565
-82	-0.58963119	-32	1.23337782	18	3.05638682	68	4.87939583
-81	-0.55317101	-31	1.269838	19	3.092847	69	4.91585601
-80	-0.51671083	-30	1.30629818	20	3.12930718	70	4.95231619
-79	-0.48025065	-29	1.34275836	21	3.16576736	71	4.98877637
-78	-0.44379047	-28	1.37921854	22	3.20222754	72	5.02523655

-77	-0.40733029	-27	1.41567872	23	3.23868772	73	5.06169673
-76	-0.37087011	-26	1.4521389	24	3.27514791	74	5.09815691
-75	-0.33440993	-25	1.48859908	25	3.31160809	75	5.13461709
-74	-0.29794975	-24	1.52505926	26	3.34806827	76	5.17107727
-73	-0.26148957	-23	1.56151944	27	3.38452845	77	5.20753745
-72	-0.22502939	-22	1.59797962	28	3.42098863	78	5.24399763
-71	-0.18856921	-21	1.6344398	29	3.45744881	79	5.28045781
-70	-0.15210903	-20	1.67089998	30	3.49390899	80	5.31691799
-69	-0.11564885	-19	1.70736016	31	3.53036917	81	5.35337817
-68	-0.07918867	-18	1.74382034	32	3.56682935	82	5.38983835
-67	-0.04272849	-17	1.78028052	33	3.60328953	83	5.42629853
-66	-0.00626831	-16	1.8167407	34	3.63974971	84	5.46275871
-65	0.03019187	-15	1.85320088	35	3.67620989	85	5.49921889
-64	0.06665205	-14	1.88966106	36	3.74913025	86	5.53567907
-63	0.10311223	-13	1.92612124	37	3.74913025	87	5.57213925
-62	0.13957241	-12	1.96258142	38	3.78559043	88	5.60859943
-61	0.17603259	-11	1.9990416	39	3.82205061	89	5.64505962
-60	0.21249277	-10	2.03550178	40	3.85851079	90	5.6815198
-59	0.24895295	-9	2.07196196	41	3.89497097	91	5.71797998
-58	0.28541313	-8	2.10842214	42	3.93143115	92	5.75444016
-57	0.32187331	-7	2.14488232	43	3.96789133	93	5.79090034
-56	0.35833349	-6	2.1813425	44	4.00435151	94	5.82736052
-55	0.39479367	-5	2.21780268	45	4.04081169	95	5.8638207
-54	0.43125385	-4	2.25426286	46	4.07727187	96	5.90028088
-53	0.46771403	-3	2.29072304	47	4.11373205	97	5.93674106
-52	0.50417421	-2	2.32718322	48	4.15019223	98	5.97320124
-51	0.54063439	-1	2.3636434	49	4.18665241	99	6.00966142
-50	0.57709457	0	2.40010358	50	4.22311259		

FIG. 16-2

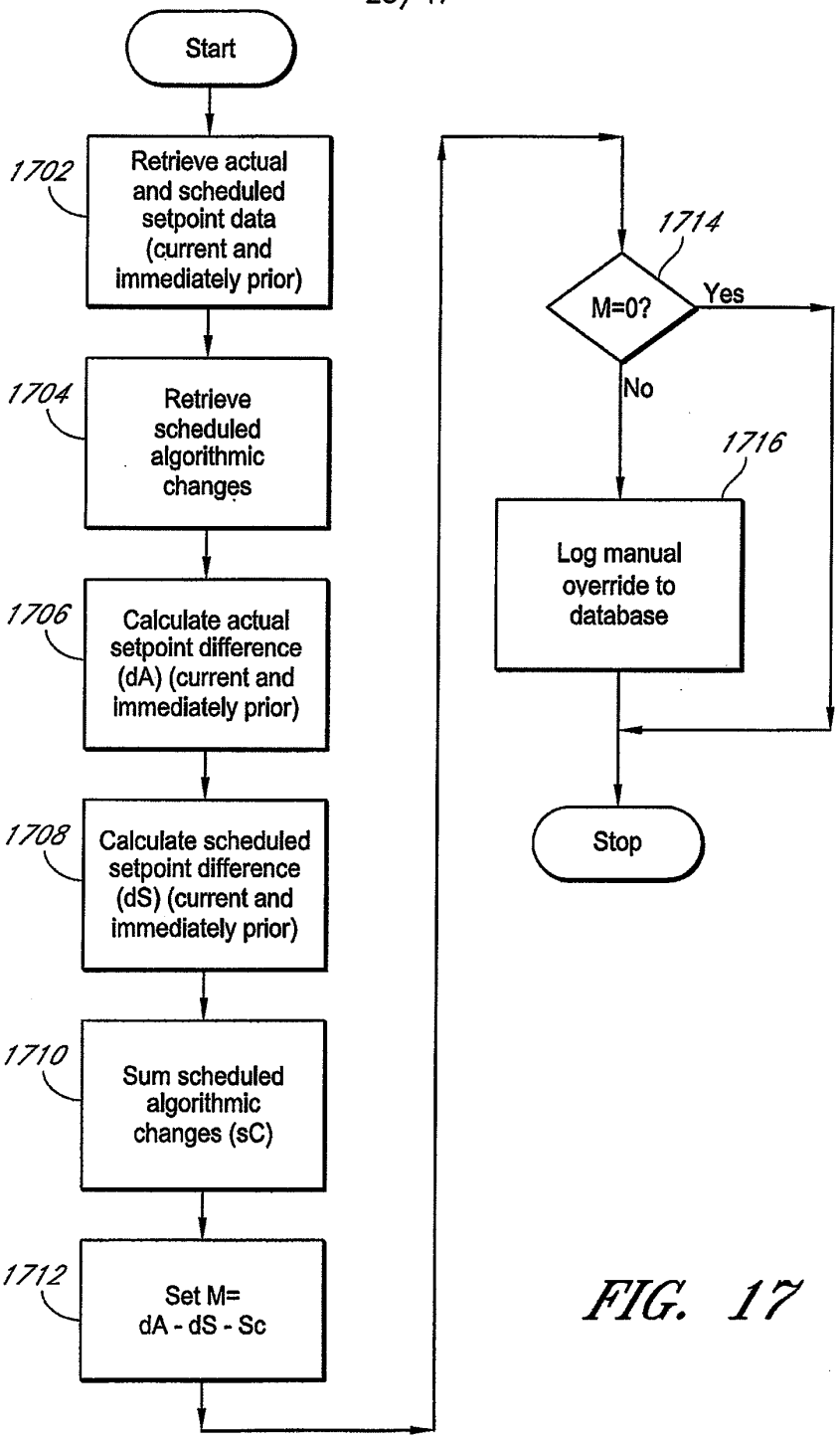

Start
1702
Retrieve actual and scheduled setpoint data (current and immediately prior)
1704
Retrieve scheduled algorithmic changes
1706
Calculate actual setpoint difference (dA) (current and immediately prior)
1708
Calculate scheduled setpoint difference (dS) (current and immediately prior)
1710
Sum scheduled algorithmic changes (sC)
1712
Set M= dA - dS - Sc
1714
M=0?
Yes
No
1716
Log manual override to database
Stop

FIG. 17

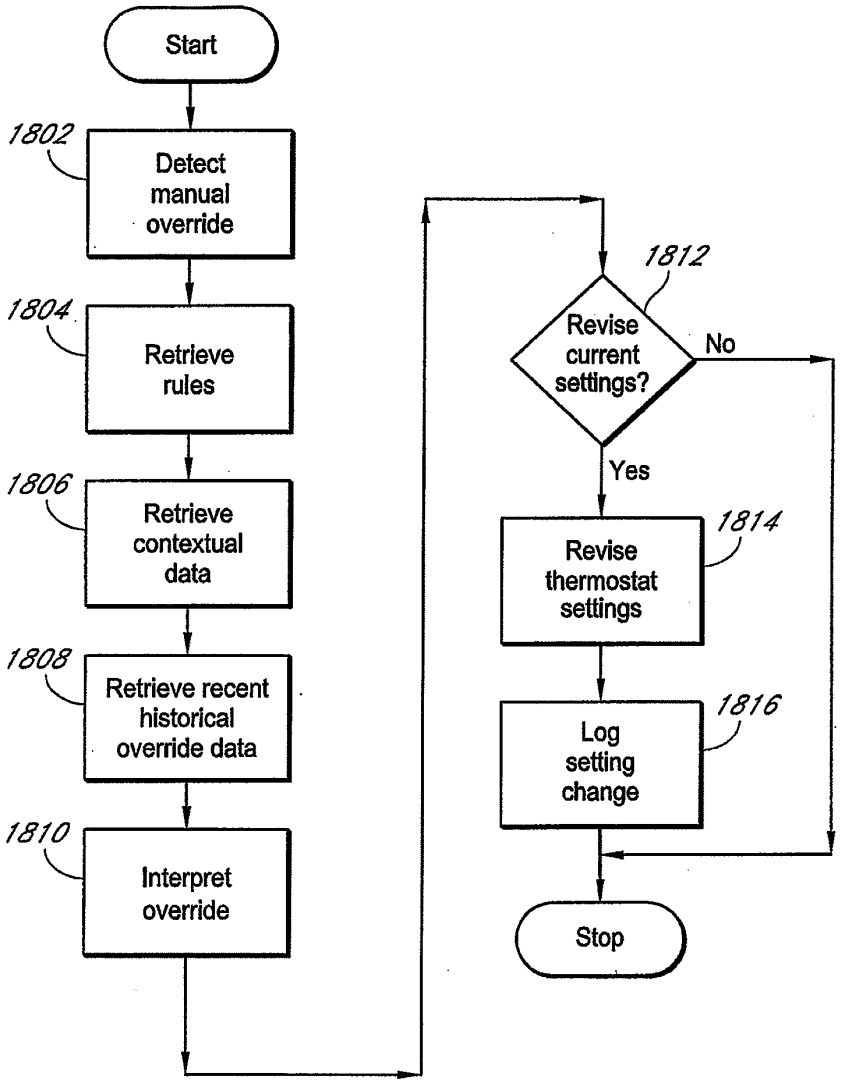

Start
1802
Detect manual override
1804
Retrieve rules
1806
Retrieve contextual data
1808
Retrieve recent historical override data
1810
Interpret override
1812
Revise current settings?
No
Yes
1814
Revise thermostat settings
1816
Log setting change
Stop

FIG. 18

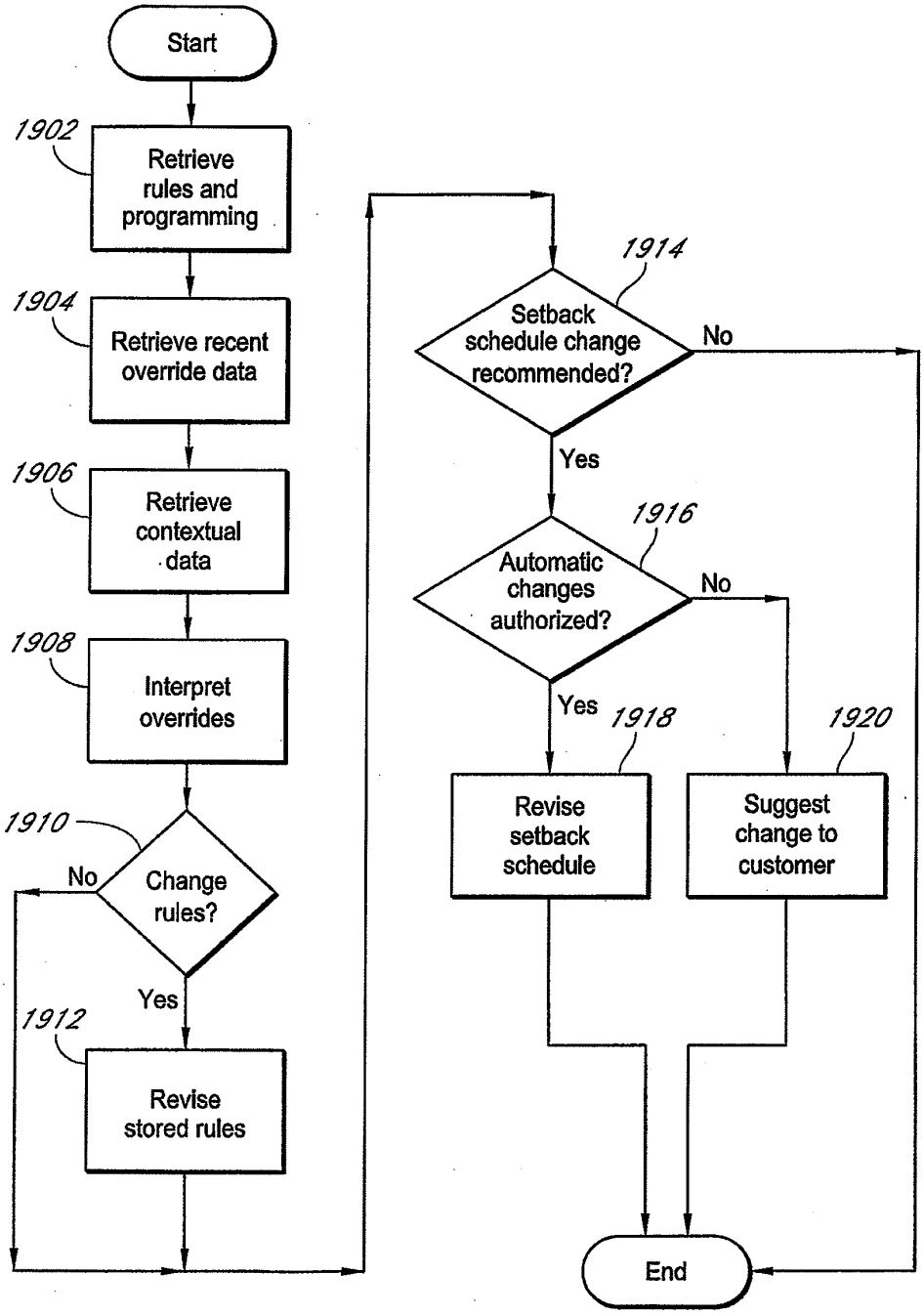

Start
1902
Retrieve rules and programming
1904
Retrieve recent override data
1906
Retrieve contextual data
1908
Interpret overrides
1910
Change rules?
No
Yes
1912
Revise stored rules
1914
Setback schedule change recommended?
No
Yes
1916
Automatic changes authorized?
No
Yes
1918
Revise setback schedule
1920
Suggest change to customer
End

FIG. 19

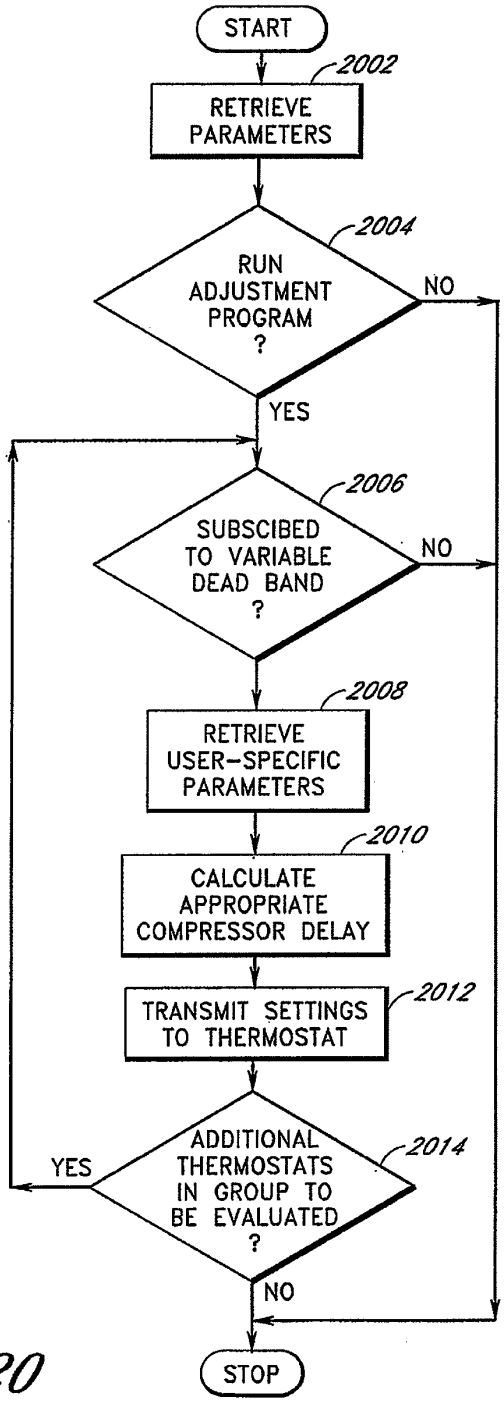

START
2002
RETRIEVE PARAMETERS
2004
RUN ADJUSTMENT PROGRAM ?
NO
YES
2006
SUBSCIBED TO VARIABLE DEAD BAND ?
NO
2008
RETRIEVE USER-SPECIFIC PARAMETERS
2010
CALCULATE APPROPRIATE COMPRESSOR DELAY
2012
TRANSMIT SETTINGS TO THERMOSTAT
2014
ADDITIONAL THERMOSTATS IN GROUP TO BE EVALUATED ?
YES
NO
STOP

FIG. 20

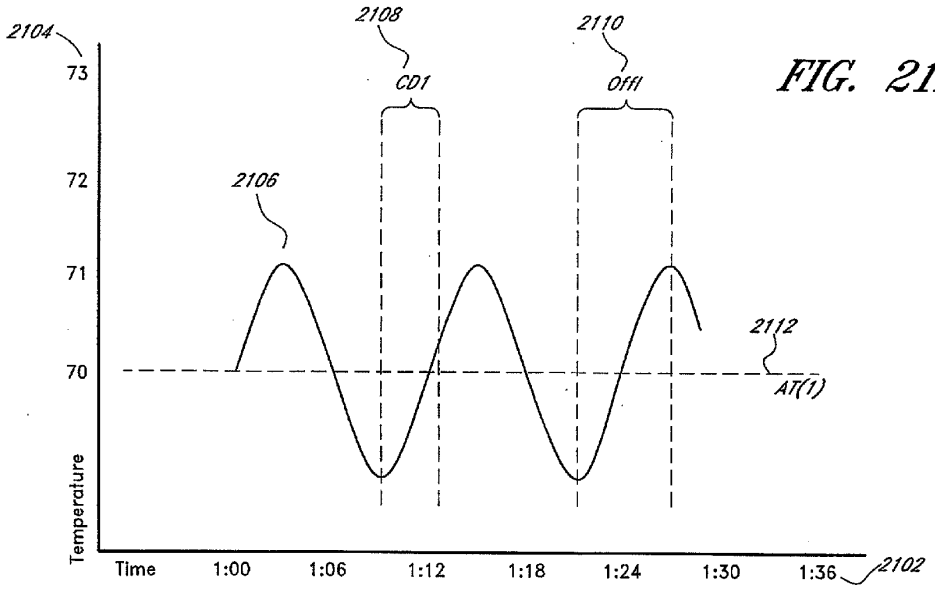

2104
73
72
71
70
Temperature
2108
CD1
2110
Off1
2106
2112
AT(1)
Time
1:00
1:06
1:12
1:18
1:24
1:30
1:36
2102

FIG. 21A

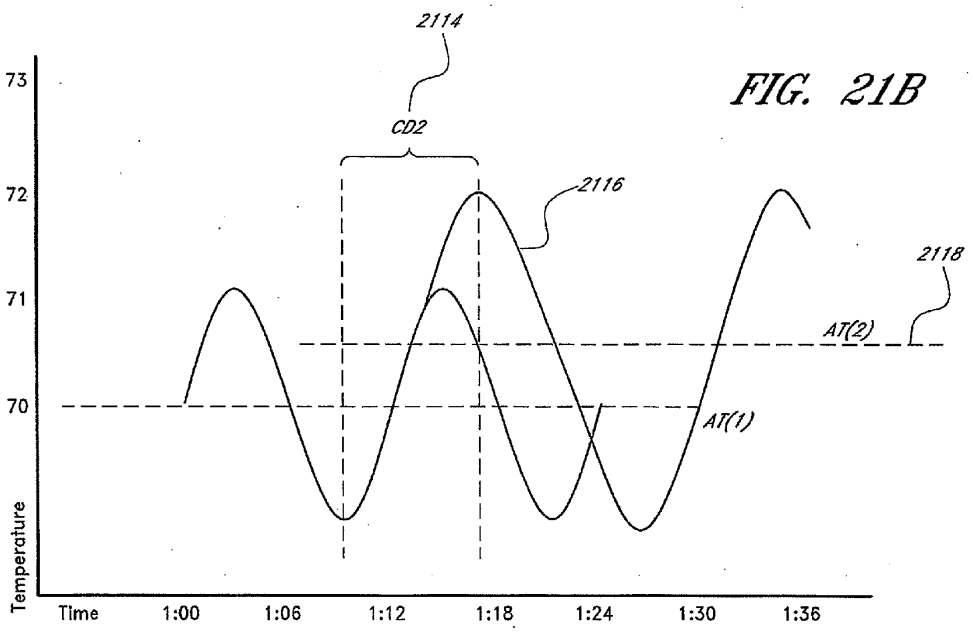


FIG. 21B

Ex. 1004.0279

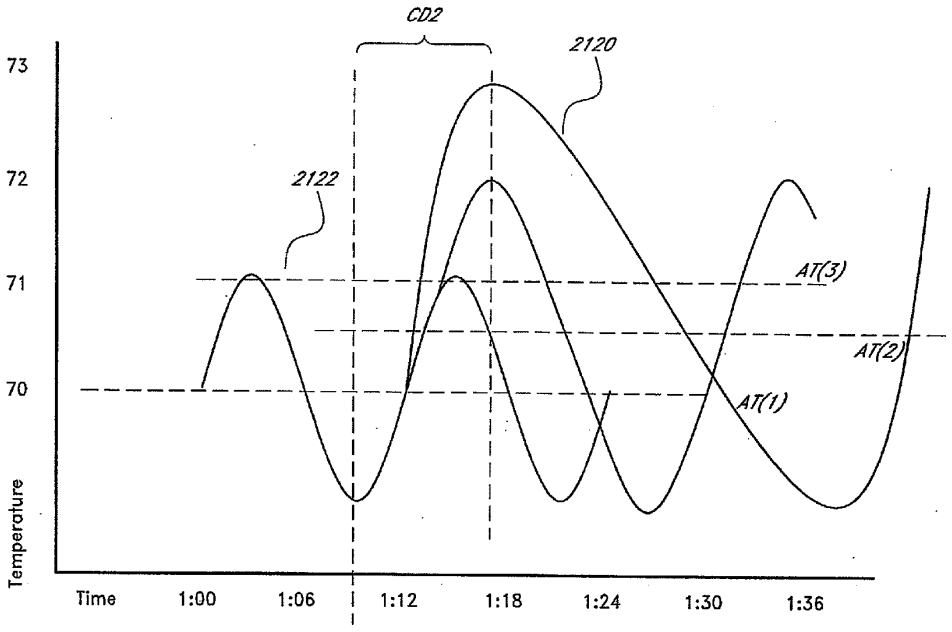

CD2
2120
2122
73
72
71
70
AT(3)
AT(2)
AT(1)
Temperature
Time
1:00
1:06
1:12
1:18
1:24
1:30
1:36

FIG. 21C

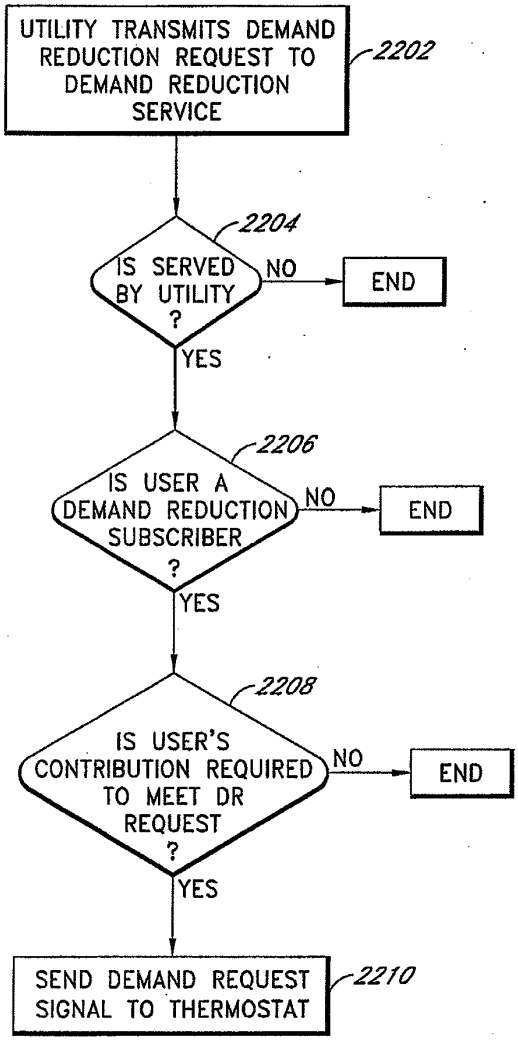

UTILITY TRANSMITS DEMAND REDUCTION REQUEST TO DEMAND REDUCTION SERVICE
2202
2204
IS SERVED BY UTILITY ?
NO
END
YES
2206
IS USER A DEMAND REDUCTION SUBSCRIBER ?
NO
END
YES
2208
IS USER'S CONTRIBUTION REQUIRED TO MEET DR REQUEST ?
NO
END
YES
SEND DEMAND REQUEST SIGNAL TO THERMOSTAT
2210

FIG. 22

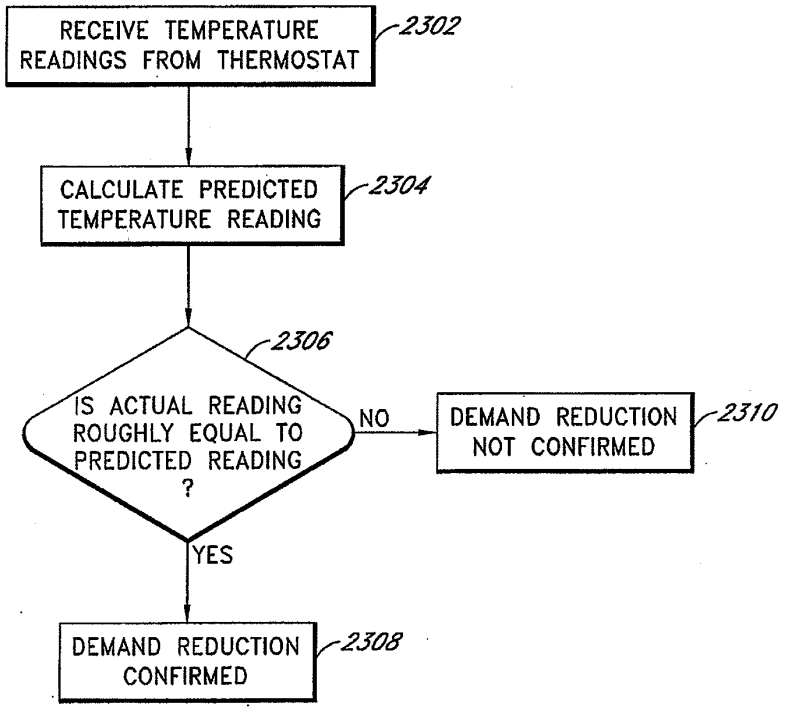

RECEIVE TEMPERATURE READINGS FROM THERMOSTAT
2302
CALCULATE PREDICTED TEMPERATURE READING
2304
2306
IS ACTUAL READING ROUGHLY EQUAL TO PREDICTED READING ?
NO
DEMAND REDUCTION NOT CONFIRMED
2310
YES
DEMAND REDUCTION CONFIRMED
2308

FIG. 23

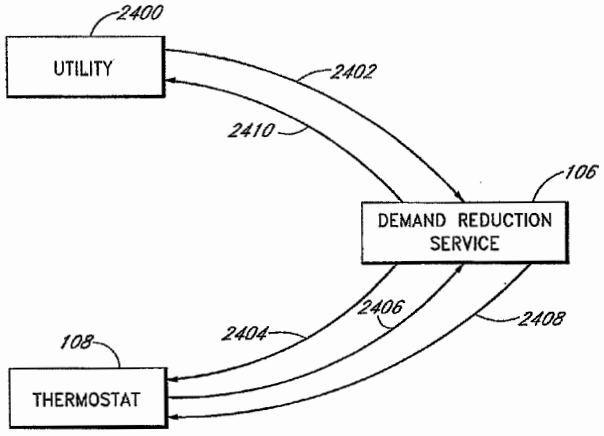

2400
UTILITY
2402
2410
106
DEMAND REDUCTION SERVICE
2406
2408
2404
108
THERMOSTAT

FIG. 24

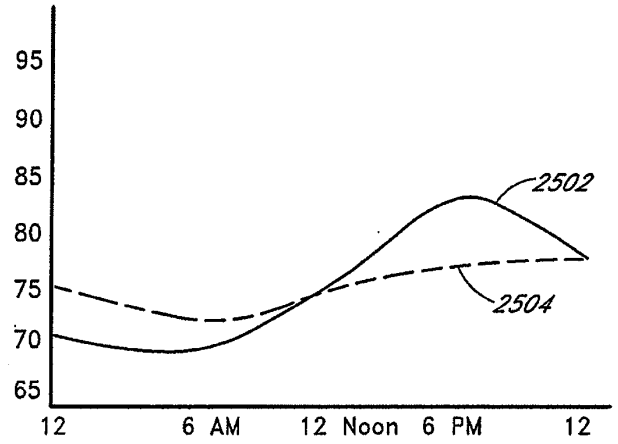


FIG. 25A

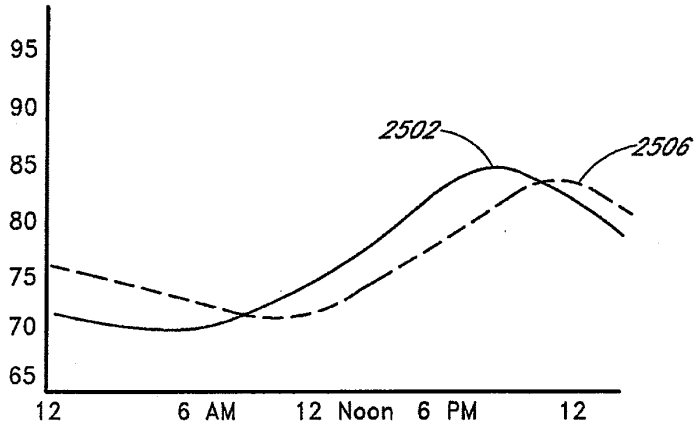


FIG. 25B

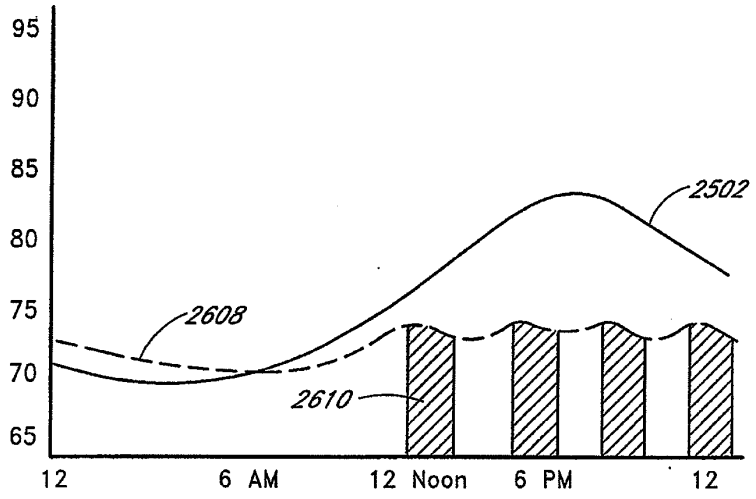


FIG. 26A

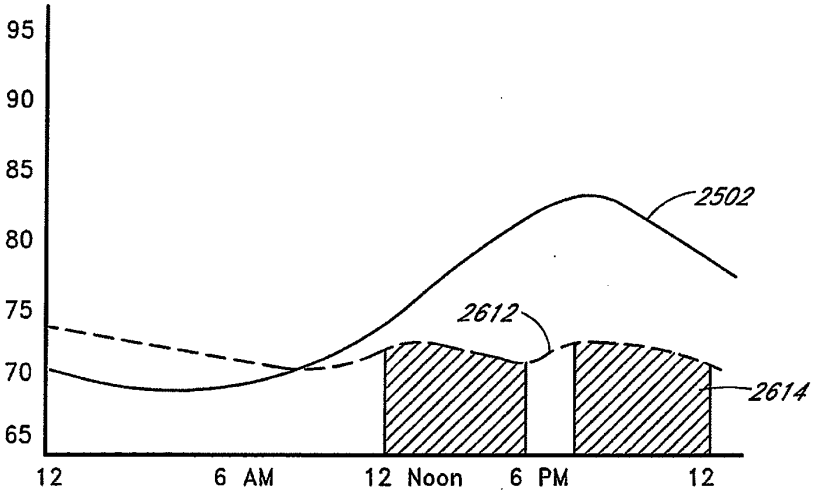


FIG. 26B

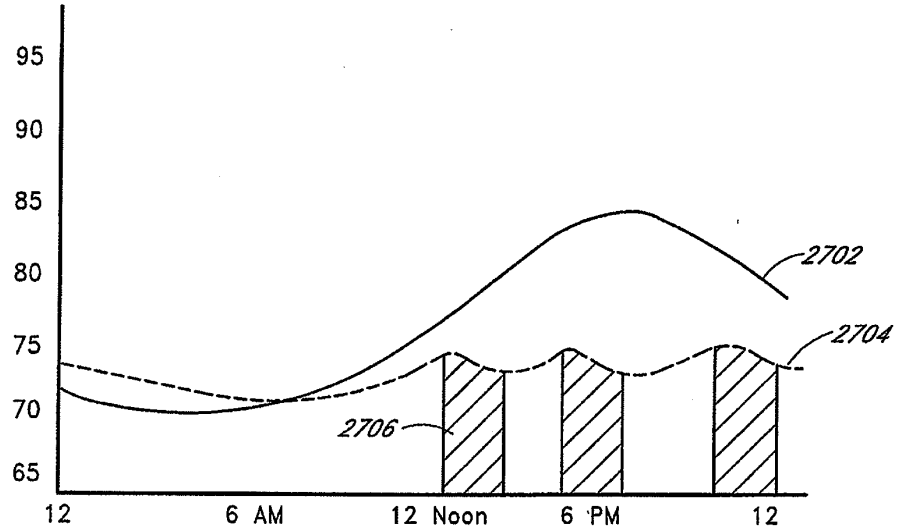


FIG. 27A

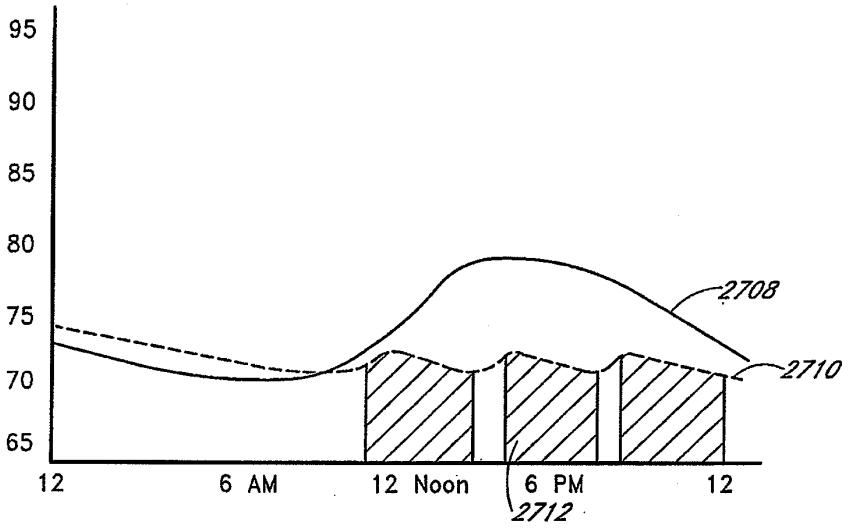


FIG. 27B

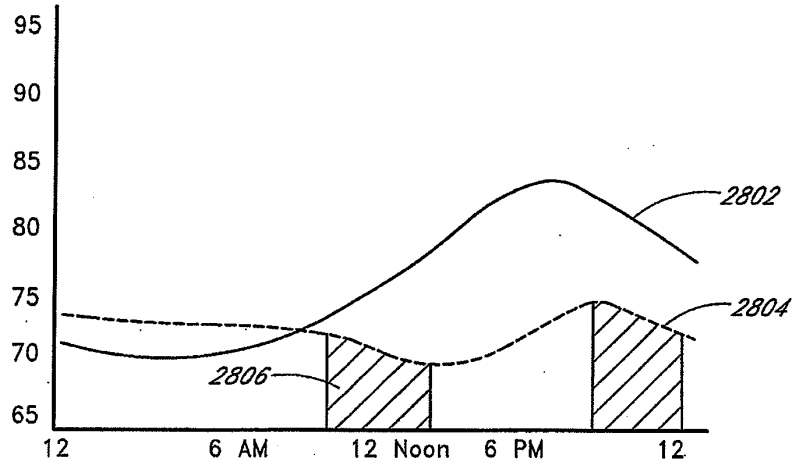


FIG. 28A

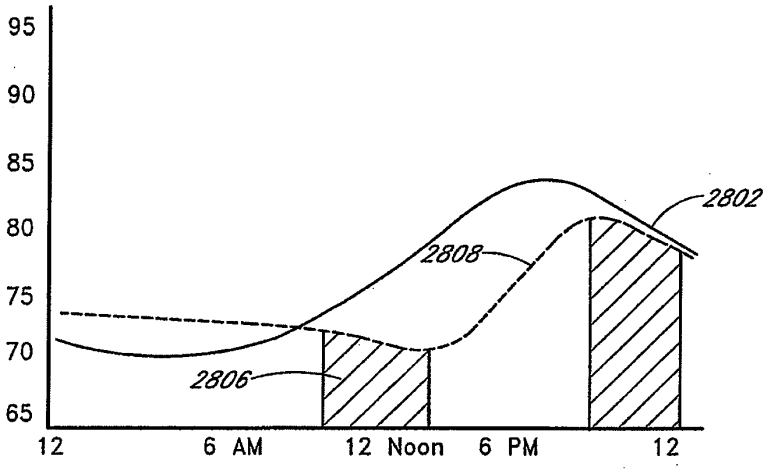


FIG. 28B

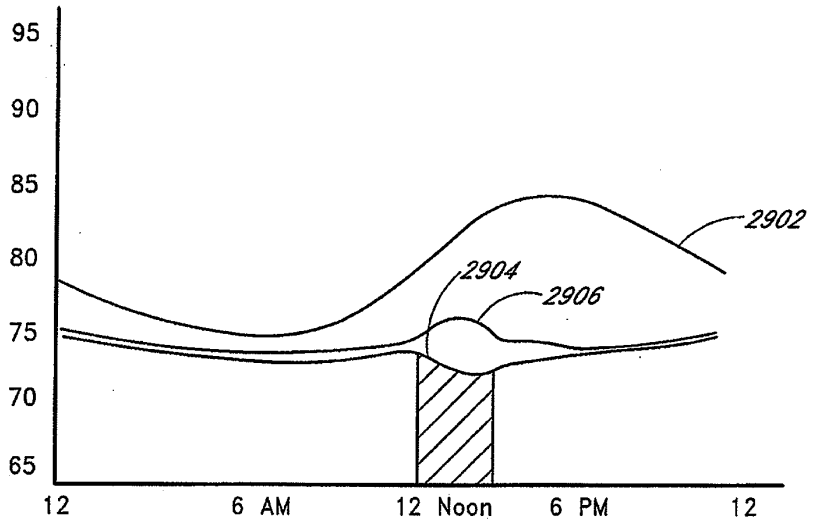


FIG. 29A

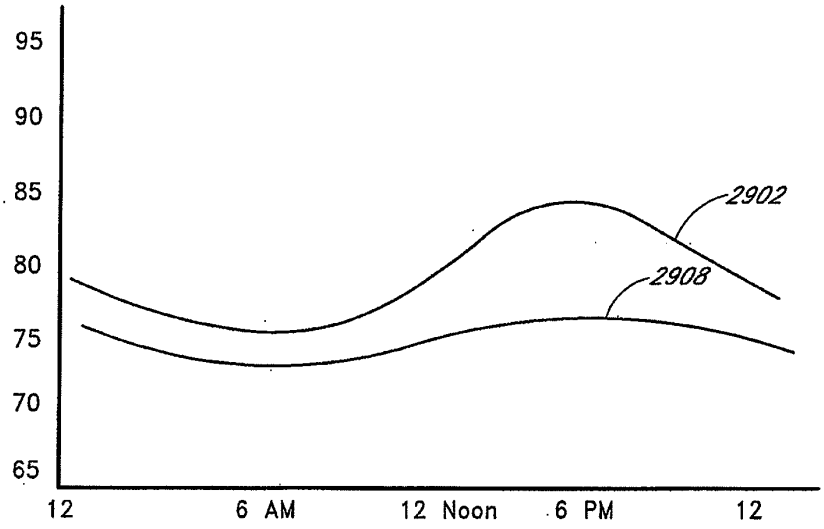


FIG. 29B

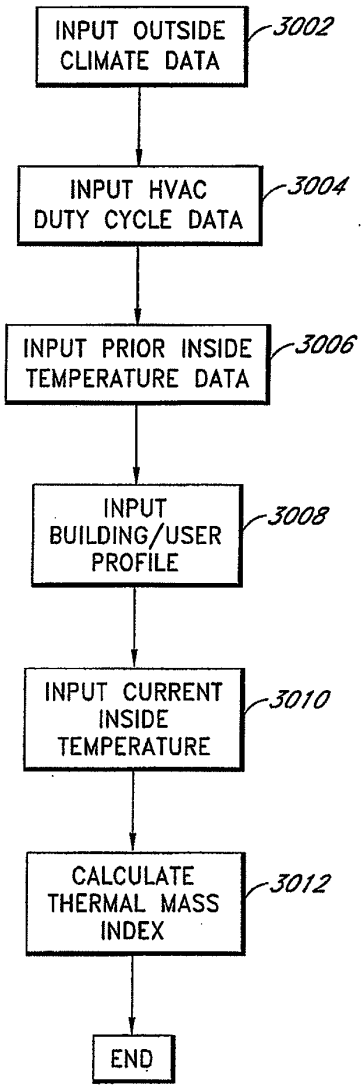

INPUT OUTSIDE CLIMATE DATA
3002
INPUT HVAC DUTY CYCLE DATA
3004
INPUT PRIOR INSIDE TEMPERATURE DATA
3006
INPUT BUILDING/USER PROFILE
3008
INPUT CURRENT INSIDE TEMPERATURE
3010
CALCULATE THERMAL MASS INDEX
3012
END

FIG. 30

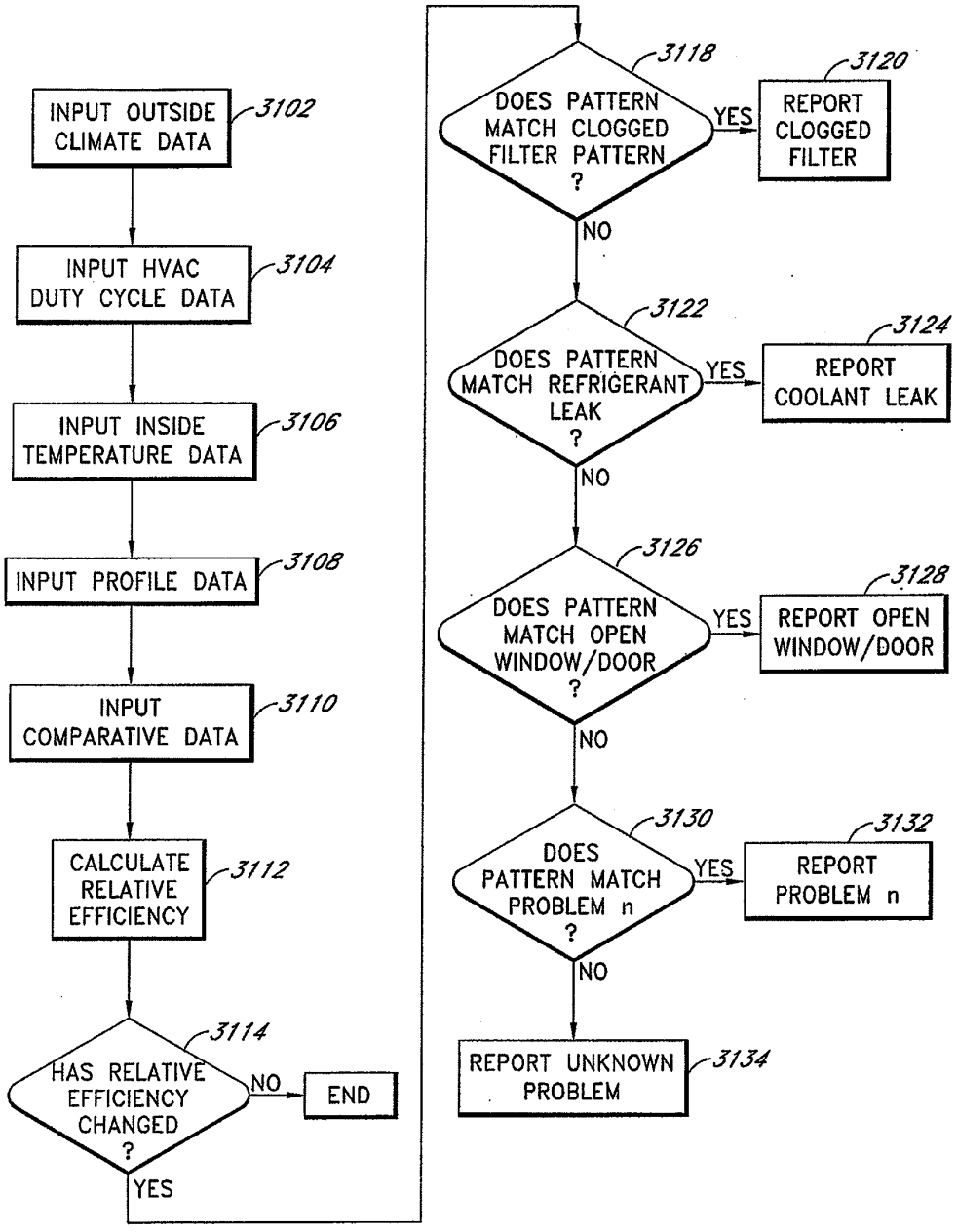

INPUT OUTSIDE CLIMATE DATA
3102
INPUT HVAC DUTY CYCLE DATA
3104
INPUT INSIDE TEMPERATURE DATA
3106
INPUT PROFILE DATA
3108
INPUT COMPARATIVE DATA
3110
CALCULATE RELATIVE EFFICIENCY
3112
HAS RELATIVE EFFICIENCY CHANGED ?
3114
NO
END
YES
DOES PATTERN MATCH CLOGGED FILTER PATTERN ?
3118
YES
REPORT CLOGGED FILTER
3120
NO
DOES PATTERN MATCH REFRIGERANT LEAK ?
3122
YES
REPORT COOLANT LEAK
3124
NO
DOES PATTERN MATCH OPEN WINDOW/DOOR ?
3126
YES
REPORT OPEN WINDOW/DOOR
3128
NO
DOES PATTERN MATCH PROBLEM n ?
3130
YES
REPORT PROBLEM n
3132
NO
REPORT UNKNOWN PROBLEM
3134

FIG. 31

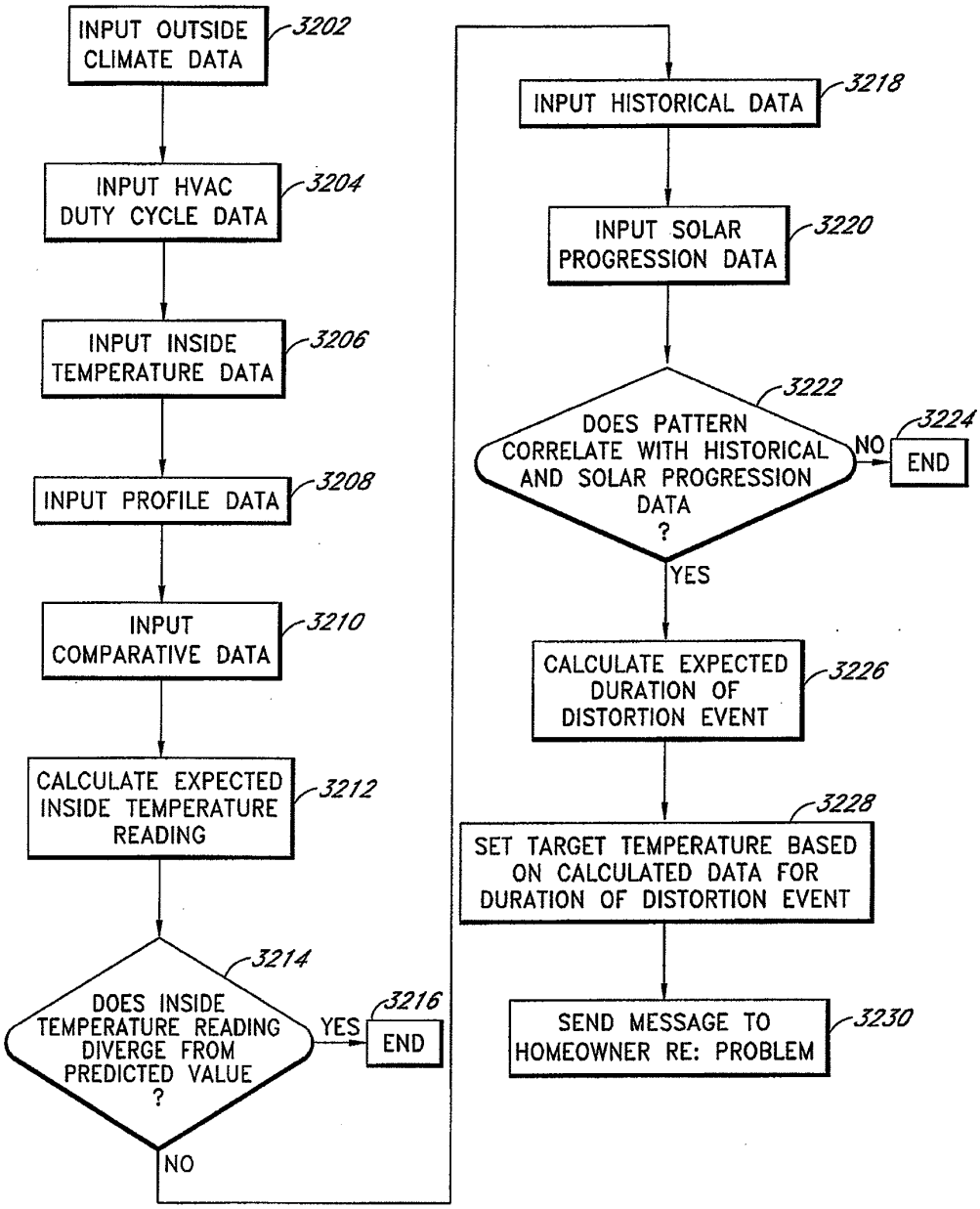

INPUT OUTSIDE CLIMATE DATA
3202
INPUT HVAC DUTY CYCLE DATA
3204
INPUT INSIDE TEMPERATURE DATA
3206
INPUT PROFILE DATA
3208
INPUT COMPARATIVE DATA
3210
CALCULATE EXPECTED INSIDE TEMPERATURE READING
3212
DOES INSIDE TEMPERATURE READING DIVERGE FROM PREDICTED VALUE ?
3214
YES
3216
END
NO
INPUT HISTORICAL DATA
3218
INPUT SOLAR PROGRESSION DATA
3220
DOES PATTERN CORRELATE WITH HISTORICAL AND SOLAR PROGRESSION DATA ?
3222
NO
3224
END
YES
CALCULATE EXPECTED DURATION OF DISTORTION EVENT
3226
SET TARGET TEMPERATURE BASED ON CALCULATED DATA FOR DURATION OF DISTORTION EVENT
3228
SEND MESSAGE TO HOMEOWNER RE: PROBLEM
3230

FIG. 32

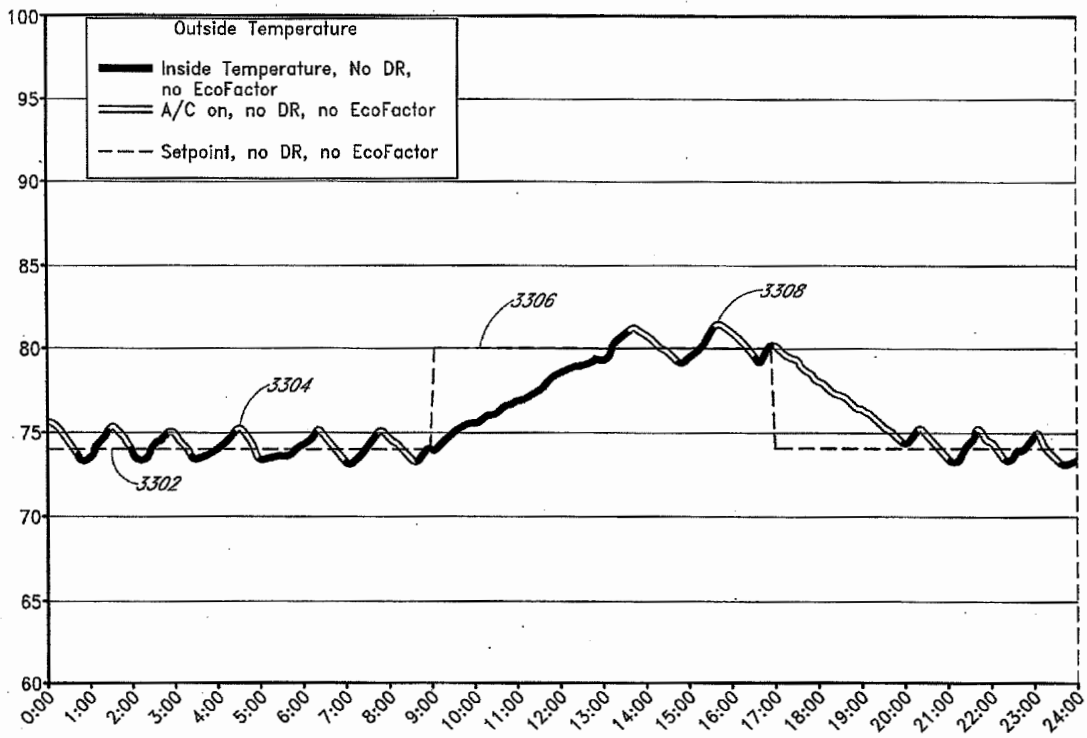

Outside Temperature
Inside Temperature, No DR, no EcoFactor
A/C on, no DR, no EcoFactor
Setpoint, no DR, no EcoFactor
100
95
90
85
80
75
70
65
60
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
3302
3304
3306
3308

FIG. 33

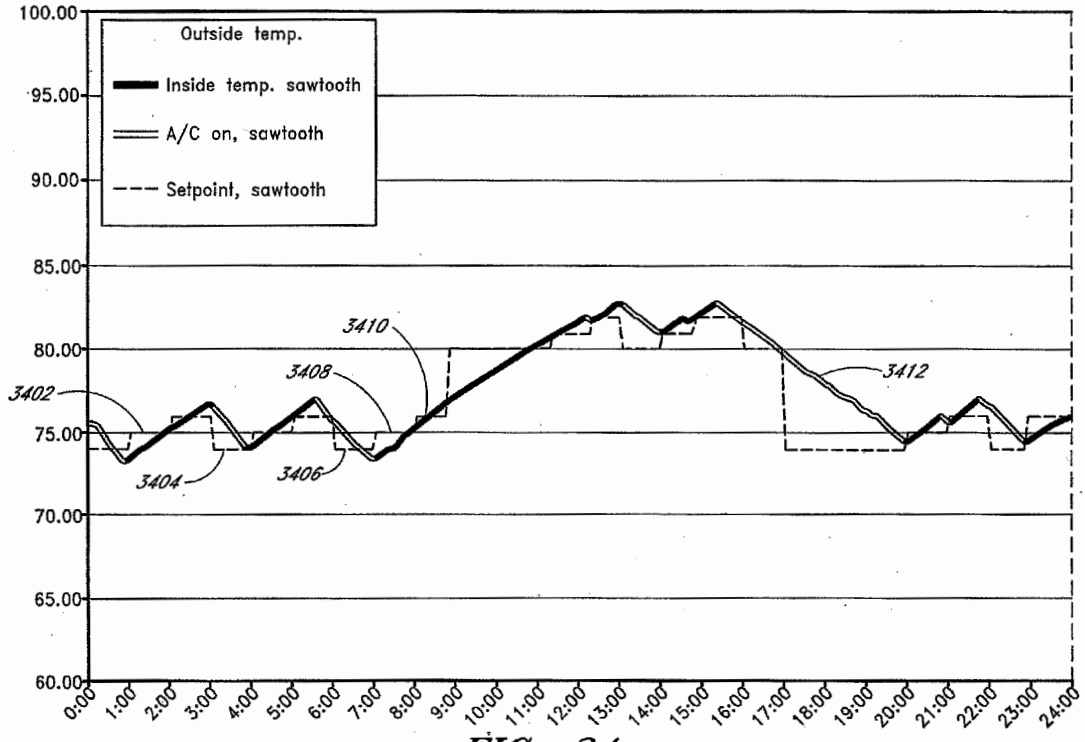

Outside temp.
Inside temp. sawtooth
A/C on, sawtooth
Setpoint, sawtooth
100.00
95.00
90.00
85.00
80.00
75.00
70.00
65.00
60.00
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
3402
3404
3406
3408
3410
3412

FIG. 34

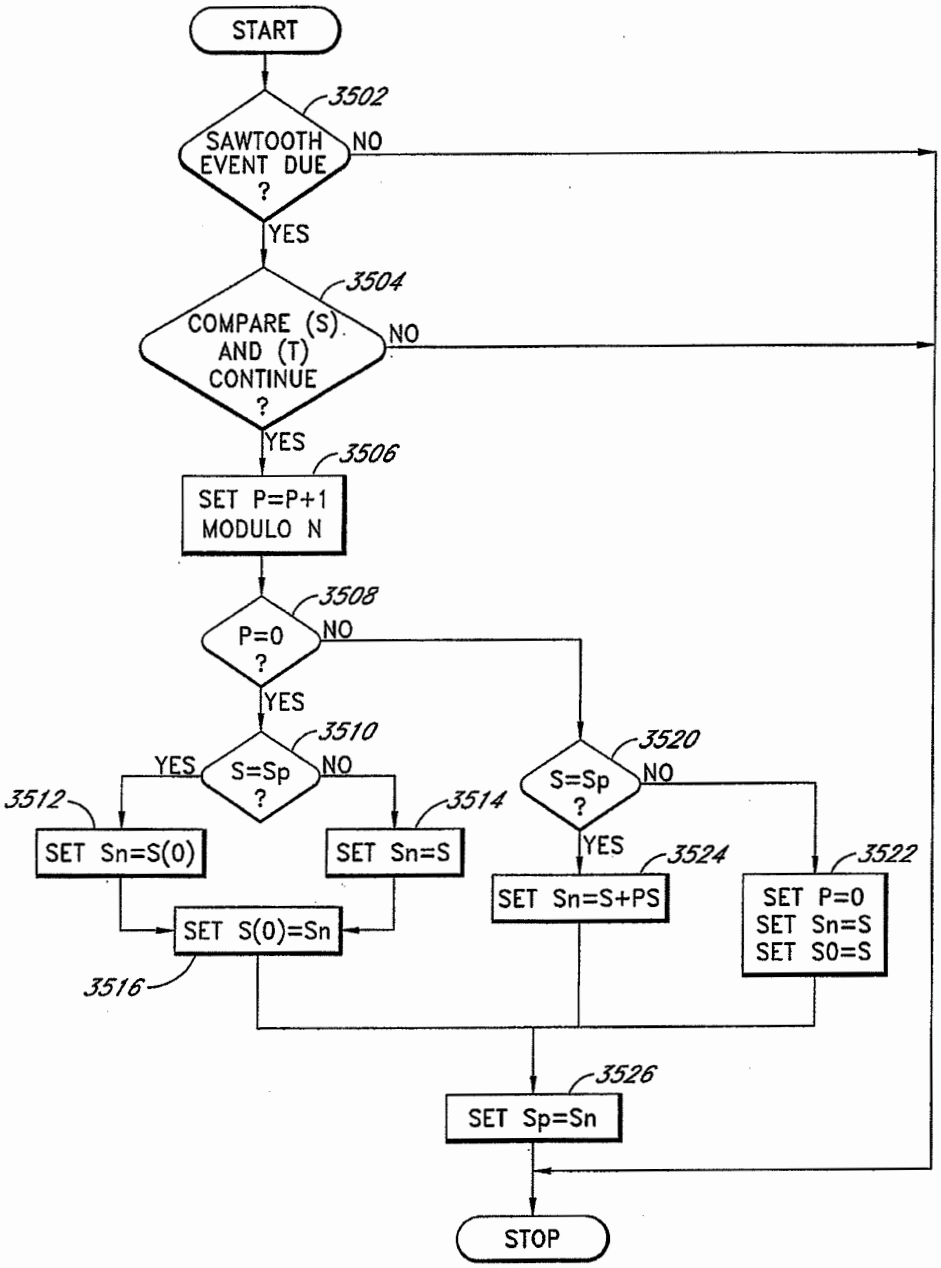

START
3502
SAWTOOTH EVENT DUE ?
NO
YES
3504
COMPARE (S) AND (T) CONTINUE ?
NO
YES
3506
SET P=P+1 MODULO N
3508
P=0 ?
NO
YES
3510
S=Sp ?
YES
NO
3512
SET Sn=S(0)
3514
SET Sn=S
3516
SET S(0)=Sn
3520
S=Sp ?
NO
YES
3524
SET Sn=S+PS
3522
SET P=0
SET Sn=S
SET S0=S
3526
SET Sp=Sn
STOP

FIG. 35

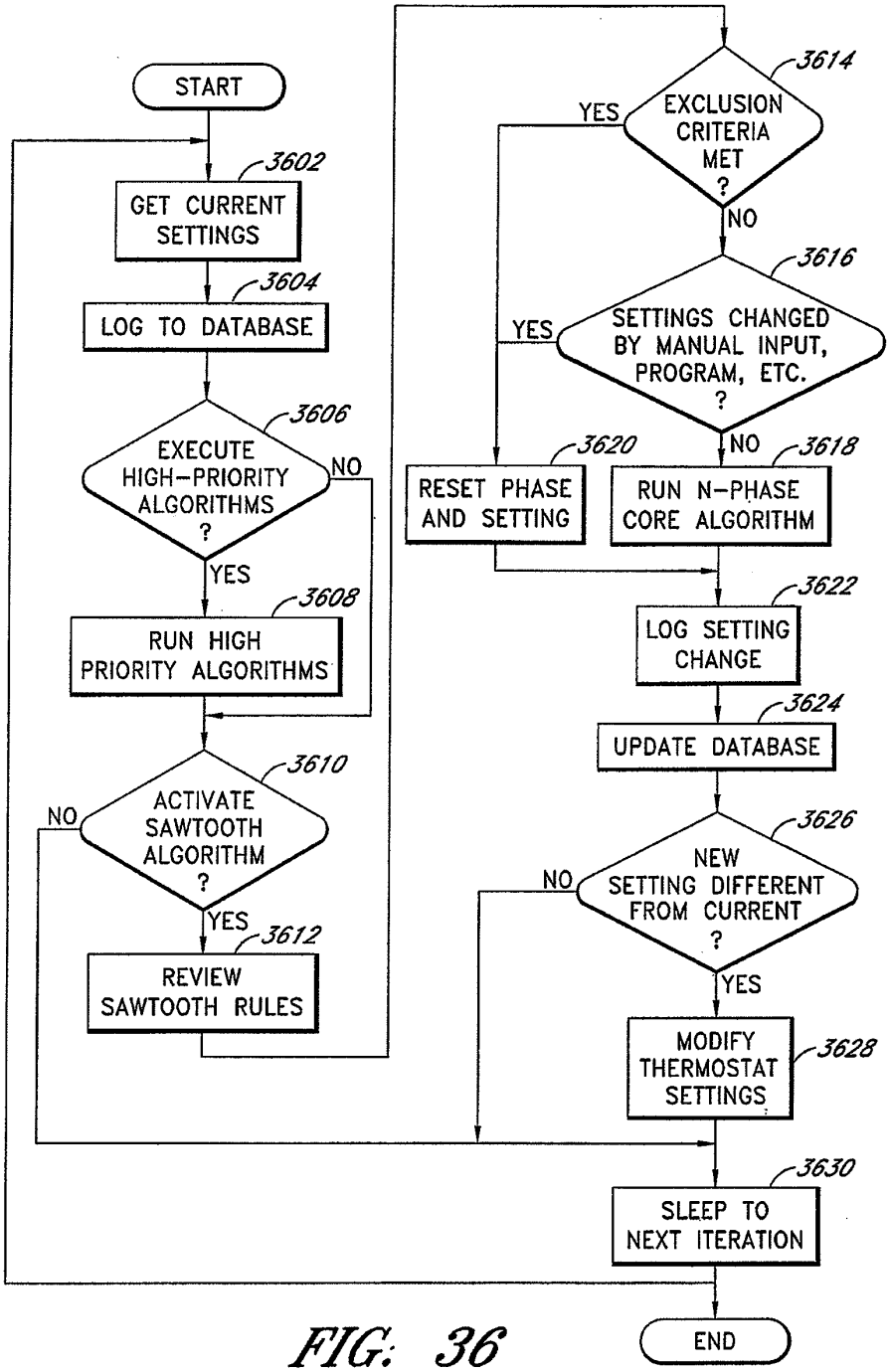

START
3602
GET CURRENT SETTINGS
3604
LOG TO DATABASE
3606
EXECUTE HIGH-PRIORITY ALGORITHMS ?
NO
YES
3608
RUN HIGH PRIORITY ALGORITHMS
3610
ACTIVATE SAWTOOTH ALGORITHM ?
NO
YES
3612
REVIEW SAWTOOTH RULES
3614
EXCLUSION CRITERIA MET ?
YES
NO
3616
SETTINGS CHANGED BY MANUAL INPUT, PROGRAM, ETC. ?
YES
NO
3620
RESET PHASE AND SETTING
3618
RUN N-PHASE CORE ALGORITHM
3622
LOG SETTING CHANGE
3624
UPDATE DATABASE
3626
NEW SETTING DIFFERENT FROM CURRENT ?
NO
YES
3628
MODIFY THERMOSTAT SETTINGS
3630
SLEEP TO NEXT ITERATION
END

FIG. 36

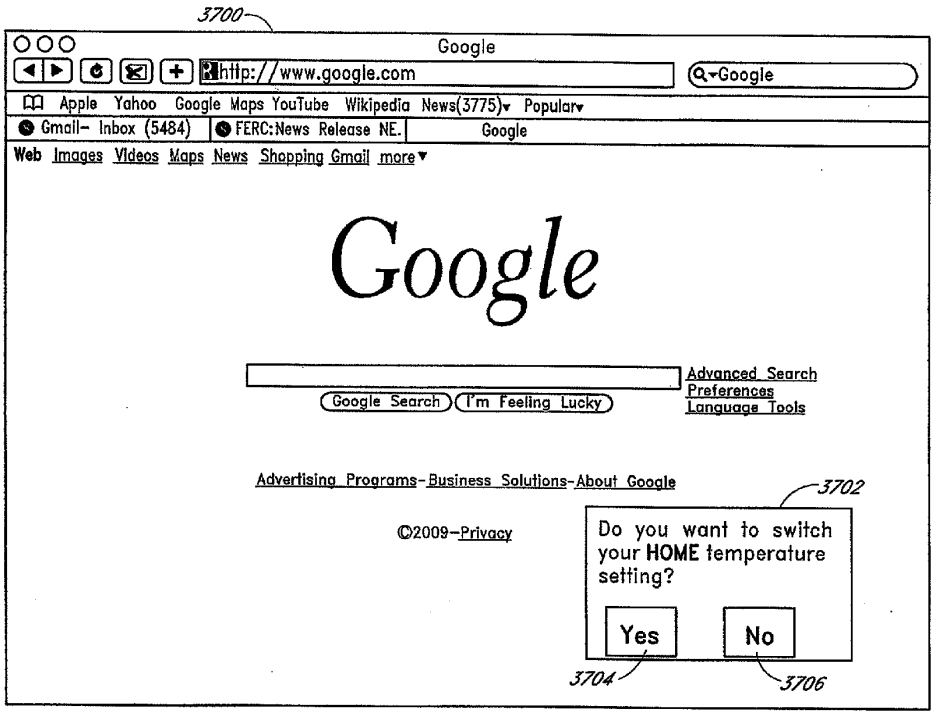

3700
Google
http://www.google.com
Google
Apple Yahoo Google Maps YouTube Wikipedia News(3775)▾ Popular▾
Gmail- Inbox (5484)
FERC:News Release NE.
Google
Web Images Videos Maps News Shopping Gmail more▾
Google
Google Search
I'm Feeling Lucky
Advanced Search
Preferences
Language Tools
Advertising Programs-Business Solutions-About Google
©2009-Privacy
3702
Do you want to switch your HOME temperature setting?
Yes
No
3704
3706

FIG. 37

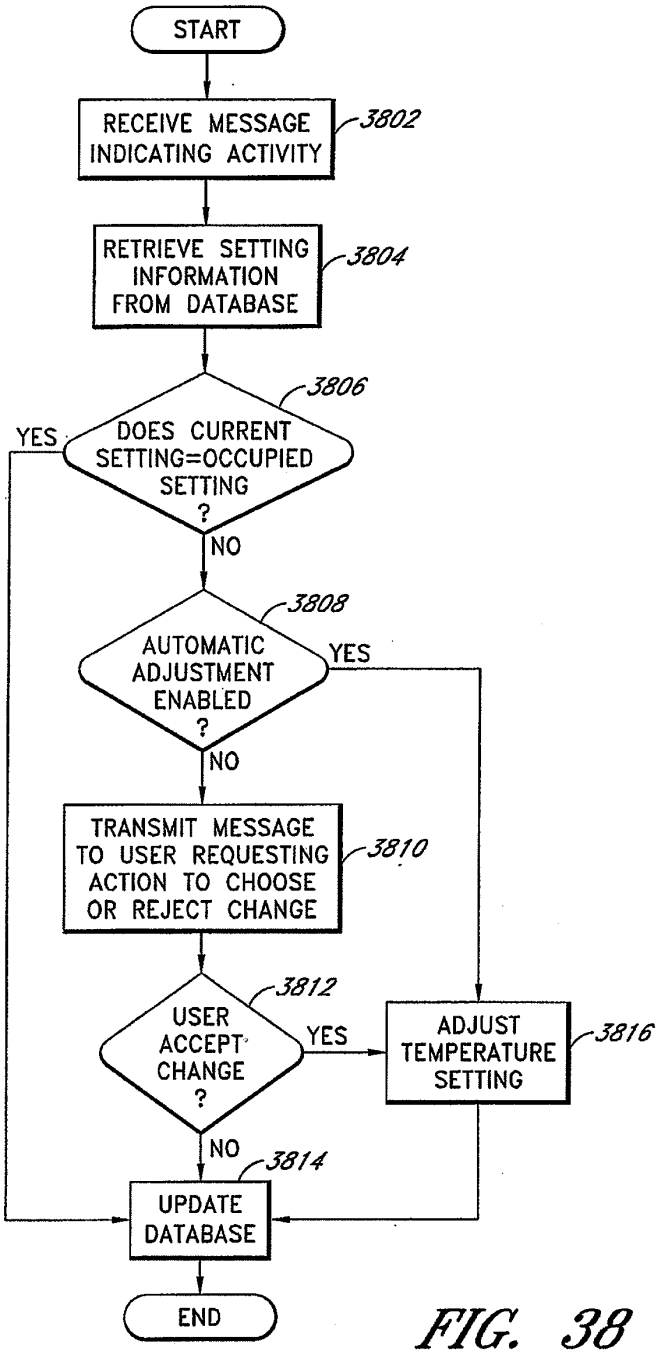

START
RECEIVE MESSAGE INDICATING ACTIVITY
3802
RETRIEVE SETTING INFORMATION FROM DATABASE
3804
3806
DOES CURRENT SETTING=OCCUPIED SETTING ?
YES
NO
3808
AUTOMATIC ADJUSTMENT ENABLED ?
YES
NO
TRANSMIT MESSAGE TO USER REQUESTING ACTION TO CHOOSE OR REJECT CHANGE
3810
3812
USER ACCEPT CHANGE ?
YES
ADJUST TEMPERATURE SETTING
3816
NO
3814
UPDATE DATABASE
END

FIG. 38

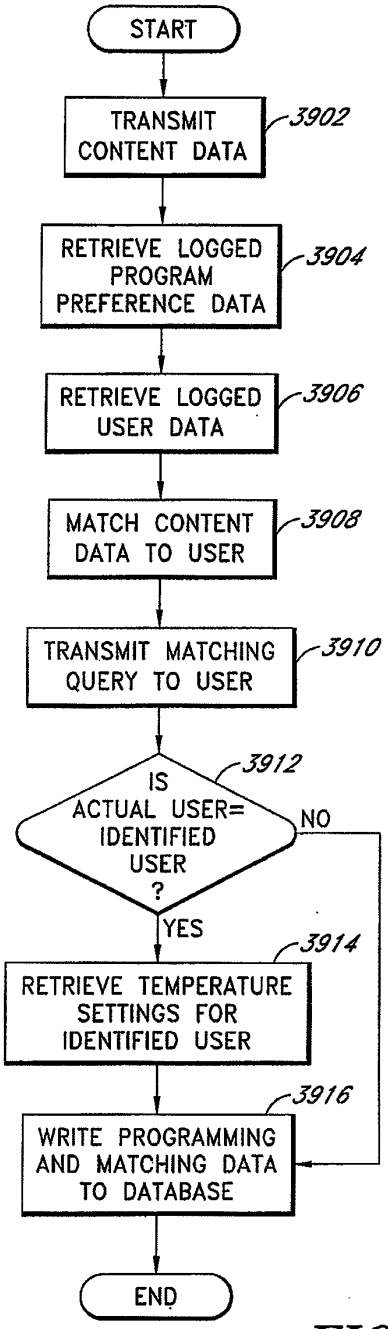

START
TRANSMIT CONTENT DATA
3902
RETRIEVE LOGGED PROGRAM PREFERENCE DATA
3904
RETRIEVE LOGGED USER DATA
3906
MATCH CONTENT DATA TO USER
3908
TRANSMIT MATCHING QUERY TO USER
3910
IS ACTUAL USER= IDENTIFIED USER ?
3912
NO
YES
RETRIEVE TEMPERATURE SETTINGS FOR IDENTIFIED USER
3914
WRITE PROGRAMMING AND MATCHING DATA TO DATABASE
3916
END

FIG. 39

PTO/AIA/01 (06-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

■ United States application or PCT international application number 14/048932 filed on October 8, 2013.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

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 the 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.

LEGAL NAME OF INVENTOR

Inventor: John Douglas Steinberg Date (Optional): 11/5/13

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1 minute 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. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	Unknown
	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	H2176	12/05/2006	Meyer et al.	
	2	12/805705	06/10/2010	Crabtree	
	3	13/470074	08/30/2012	Steinberg	
	4	13/523697	06/14/2012	Hublou et al.	
	5	13/725447	06/06/2013	Steinberg	
	6	13/729401	12/28/2012	Sloop	
	7	13/852577	03/28/2013	Steinberg et al.	
	8	13/858710	09/05/2013	Steinberg et al.	
	9	13/861189	04/11/2013	Steinberg et al.	
	10	14/082,675 (EFACT.007C1)	11/18/2003	Steinberg et al.	
	11	14/263,762	04/28/2014	Steinberg	
	12	14/285,384	05/22/2014	Steinberg et al.	
	13	14/292,377	05/30/2014	Steinberg	
	14	14/491,554	09/19/2014	Steinberg	
	15	14/527,433	10/29/2014	Steinberg et al.	
	16	14/731,221	06/04/2015	Steinberg et al.	
	17	15/616,719	06/07/2017	Steinberg et al.	
	18	D 646,990	10/18/2011	Rhodes	
	19	D 659,560	05/15/2012	Rhodes	
	20	D 673,467	01/01/2013	Lee et al.	
	21	D 705,095 (EFACT.015DA)	05/20/2014	Steinberg et al.	
	22	4,136,732	01/30/1979	Demaray et al.	
	23	4,270,693	06/02/1981	Hayes	
	24	4,341,345	07/27/1982	Hammer et al.	
	25	4,403,644	09/13/1983	Hebert	
	26	4,451,879	05/29/1984	Welch et al.	
	27	4,475,685	10/09/1984	Grimado et al.	
	28	4,655,279	04/07/1987	Harmon	

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	Art Unit	Unknown
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SHEET 2 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	29	4,674,027	06/16/1987	Beckey	
	30	4,675,828	06/23/1987	Winston	
	31	4,702,305	10/27/1987	Beckey et al.	
	32	4,702,413	10/27/1987	Beckey et al.	
	33	4,897,798	01/30/1990	Cler	
	34	5,124,502	06/23/1992	Nelson et al.	
	35	5,244,146	09/14/1993	Jefferson et al.	
	36	5,270,952	12/14/1993	Adams et al.	
	37	5,279,458	01/18/1994	Dewolf et al.	
	38	5,297,838	03/15/1994	Juravich	
	39	5,314,004	05/24/1994	Strand et al.	
	40	5,348,078	09/20/1994	Dushane et al.	
	41	5,454,511	10/03/1995	Van Ostrand et al.	
	42	5,462,225	10/31/1995	Massara et al.	
	43	5,544,036	08/06/1996	Brown et al.	
	44	5,555,927	09/17/1996	Shah	
	45	5,572,438	11/05/1996	Ehlers et al.	
	46	5,682,949	11/04/1997	Ratcliffe et al.	
	47	5,706,190	01/06/1998	Russ et al.	
	48	5,717,609	02/10/1998	Packa et al.	
	49	5,725,148	03/10/1998	Hartman	
	50	5,729,474	03/17/1998	Hildebrand et al.	
	51	5,818,347	10/06/1998	Dolan et al.	
	52	5,839,654	11/24/1998	Weber	
	53	5,924,486	07/20/1999	Ehlers et al.	
	54	5,977,964	11/02/1999	Williams et al.	
	55	6,079,626	06/27/2000	Hartman	
	56	6,115,713	09/05/2000	Pascucci et al.	
	57	6,145,751	11/14/2000	Ahmed	

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SHEET 3 OF 14	Attorney Docket No.	EFACT.012C5

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Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	58	6,178,362	01/23/2001	Woolard et al.	
	59	6,216,956	04/17/2001	Ehlers et al.	
	60	6,223,544	05/01/2001	Seem	
	61	6,260,765	07/17/2001	Natale et al.	
	62	6,241,156	06/05/2001	Kline et al.	
	63	6,351,693	02/26/2002	Monie	
	64	6,400,956	06/02/2002	Richton	
	65	6,400,996	06/04/2002	Hoffberg et al.	
	66	6,437,692	08/20/2002	Petite et al.	
	67	6,449,534	09/10/2002	Stewart	
	68	6,454,177	09/24/2002	Sasao et al.	
	69	6,478,233	11/12/2002	Shah	
	70	6,480,803	11/12/2002	Pierret et al.	
	71	6,483,906	11/19/2002	Lggulden et al.	
	72	6,536,675	03/25/2003	Pesko et al.	
	73	6,542,076	04/01/2003	Joao	
	74	6,549,130	04/15/2003	Joao	
	75	6,574,537	06/02/2003	Kipersztok et al.	
	76	6,580,950	06/17/2003	Johnson	
	77	6,594,825	07/15/2003	Goldschmidtlki et al.	
	78	6,595,430	07/22/2003	Shah	
	79	6,598,056	07/22/2003	Hull et al.	
	80	6,619,555	09/16/2003	Rosen	
	81	6,622,097	09/16/2003	Hunter	
	82	6,622,115	09/16/2003	Brown et al.	
	83	6,622,925	09/23/2003	Carner et al.	
	84	6,622,926	09/23/2003	Sartain et al.	
	85	6,628,997	09/30/2003	Fox et al.	
	86	6,633,823	10/14/2003	Bartone et al.	

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SHEET 4 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	87	6,643,567	11/04/2003	Kolk et al.	
	88	6,644,098	11/11/2003	Cardinale et al.	
	89	6,671,586	12/30/2003	Davis et al.	
	90	6,695,218	02/24/2004	Fleckenstein	
	91	6,700,224	03/02/2004	Biskup, Sr.,	
	92	6,726,113	04/27/2004	Guo	
	93	6,731,992	05/04/2004	Ziegler	
	94	6,734,806	05/11/2004	Cratsley	
	95	6,772,052	08/03/2004	Amundsen	
	96	6,785,592	08/31/2004	Smith	
	97	6,785,630	08/31/2004	Kolk	
	98	6,786,421	09/07/2004	Rosen	
	99	6,789,739	09/14/2004	Rosen	
	100	6,845,918	01/25/2005	Rotondo	
	101	6,853,959	02/08/2005	Ikeda et al.	
	102	6,868,293	03/15/2005	Schurr	
	103	6,868,319	03/15/2005	Kipersztok et al.	
	104	6,882,712	04/19/2005	Iggulden et al.	
	105	6,889,908	05/10/2005	Crippen et al.	
	106	6,891,838	05/10/2005	Petite et al.	
	107	6,912,429	06/28/2005	Bilger	
	108	6,981,383	01/03/2006	Shah et al.	
	109	6,991,029	01/31/2006	Orfield et al.	
	110	7,009,493	03/07/2006	Howard	
	111	7,031,880	04/18/2006	Seem et al.	
	112	7,039,532	05/02/2006	Hunter	
	113	7,061,393	06/13/2006	Buckingham et al.	
	114	7,089,088	08/08/2006	Terry et al.	
	115	7,130,719	10/31/2006	Ehlers et al.	

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	Art Unit	Unknown
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SHEET 5 OF 14	Attorney Docket No.	EFACT.012C5

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	116	7,130,832	10/31/2006	Bannai et al.	
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PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	Unknown
	Filing Date	Herewith
	First Named Inventor	John Douglas Steinberg
	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 6 OF 14	Attorney Docket No.	EFACT.012C5

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Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
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U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
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	234	2011/0290893	12/01/2011	Steinberg	
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	256	2013/0144453	06/06/2013	Subbloie	
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	260	2013/0226502 EFACT.006C2	08/29/2013	Steinberg et al.	
	261	2013/0310989 (EFACT.009C1)	11/21/2013	Steinberg et al.	
	262	2014/0039690 (EFACT.012C1)	02/06/2014	Steinberg	
	263	2014/0058567	02/27/2014	Matsuoka et al.	
	264	2014/0074300	03/13/2014	Shilts et al.	
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	266	2014/0229018 (EFACT.013C3)	08/20/2014	Steinberg	
	267	2014/0316581	10/26/2014	Fadell et al.	
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	269	2015/0043615 (EFACT.004C4)	02/12/2015	Steinberg et al.	
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	276	2016/0061474 (EFACT.010C2)	03/03/2016	Cheung et al.	
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	279	2016/0241538	08/18/2016	Khurana et al.	
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	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
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U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	281	2016/0363337	12/15/2016	Steinberg et al.	
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	283	2017/0234562	08/17/2017	Ribbich et al.	
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Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
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	Art Unit	Unknown
(Multiple sheets used when necessary)	Examiner	Unknown
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FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
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Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
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NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
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	343	Written Opinion and Search Report for PCT/US2011/032537, dated 12/12/11 (our reference EFACT.012WO).	
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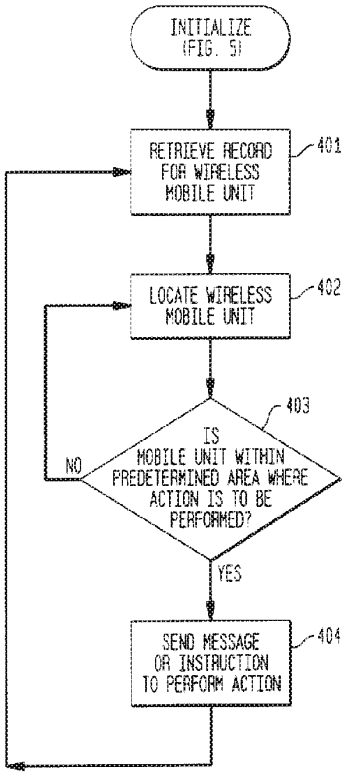
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(54) Method and apparatus for a wireless telecommunications system that provides location-based action services

(57) A wireless telecommunications system uses location or position information to initiate actions on behalf of travelers. As position information of a wireless mobile unit is received, it is compared to stored position information of a remote location, such as a home. As the traveler approaches his home, and gets within a certain distance of home, a signal is then sent to a controller within his home to perform an action or instruct the performance of an action.

FIG. 4A



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Description

Field Of The Invention

[0001] The present invention relates to telecommunications in general, and, more particularly, to a wireless telecommunications system.

Description Of Related Art

[0002] FIG. 1 depicts a schematic diagram of a portion of a known wireless telecommunications system, providing wireless telecommunications service to a number of wireless mobile units (e.g., wireless mobile units 101-1 through 101-3) that are situated within a geographic region. The heart of a typical wireless telecommunications system is a wireless switching center ("WSC") 120. Typically, the WSC 120 is connected to a plurality of base stations (e.g., base stations 103-1 through 103-5) that are dispersed throughout the geographic region serviced by the system and to the local and long-distance telephone and data networks (e.g., local-office 130, local-office 138 and toll-office 140). WSC 120 is responsible for, among other things, establishing and maintaining a call between a first wireless mobile unit and a second wireless mobile unit or, alternatively, between a wireless mobile unit and a wireline mobile unit (e.g., wireless mobile unit 150), which is connected to the system via the local and/or long-distance networks.

[0003] The geographic region serviced by a wireless telecommunications system is partitioned into a number of spatially distinct areas called "cells." As depicted in FIG. 1, each cell is schematically represented by a hexagon. In practice, however, each cell has an irregular shape that depends on the topography of the terrain surrounding the cell. Typically, each cell contains a base station, which comprises the radios and antennas that the base station uses to communicate with wireless mobile units in that cell and also comprises the transmission equipment that the base station uses to communicate with the WSC 120. However, locating wireless mobile units within a cell was often difficult.

[0004] Recently, global position systems (GPS) have been developed to the point where they are very cheap to implement. Thus, such systems may soon be prevalent in wireless mobile units to determine precise location thereof. In addition, in the area of wireless technology, assisted GPS is being developed to improve on normal GPS for position or location detection in wireless mobile units. Further, other known systems already exists (such as known triangulation methods) for precisely locating wireless mobile units. And still others are constantly being developed. Therefore, a need exists to create other uses for the location or position information of wireless mobile units.

[0005] Increasingly complex modern life leaves many people eager for means of simplifying their busy lives. Moreover, there is a tendency to enjoy automating even simple tasks-like automatic opening of garage doors. More and more, such automation is finding its way into homes and offices today. Actions such as turning on lights, ovens, heating/cooling systems, etc. are often done automatically in homes. Familiar systems like these are time based, i.e., based on times of the day. However, as people arrive in their homes at varying times due to irregular work hours, or arrive in their offices at varying times due to irregular home hours, a need exists for automating actions based on something other than time.

Summary of the Invention

[0006] The present invention is directed to a wireless telecommunications system that uses location or position information to initiate actions on behalf of travelers. As position information is received, it is compared to position information of a remote location, such as a home. As the traveler approaches his home, and gets within a certain distance of home a signal is then sent to a controller within his home to perform an action or instruct an action. These actions can include varying temperature within the home, for example.

Brief Description Of The Drawings

[0007] The present invention will become more fully understood from the detailed description given hereafter and the accompanying drawings which are given by way of illustration only, and thus are not limiting of the present invention, wherein like reference numerals represent like elements and wherein,

FIG. 1 is a schematic diagram of a known wireless telecommunications system;

FIG. 2 is a schematic diagram of a wireless telecommunications system including the location-action server of an embodiment of the present invention;

FIG. 3 is a block diagram of the salient components of the location action server of FIG. 2 in conjunction with components of a remote location for performing an action;

FIGS. 4a and 4b are flowcharts illustrating operation at the server and at the remote location;

FIG. 5 is a flowchart depicting the registration steps involved in establishing a location-based action;

FIG. 6 illustrates the controller for controlling/performing exemplary actions; and

FIG. 7 illustrates an example of a location-based ac-

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tions.

Detailed Description

[0008] The illustrative embodiment of the present invention enables the use of both the telecommunications capability and the location-finding capability of a wireless telecommunications system. These capabilities are combined to drive actions in the users home, office, or other specified location. In general, the illustrative embodiment performs two fundamentally distinct steps. In accordance with the first step, the movement of a wireless mobile unit is located and an incoming data stream of the user's location is maintained. In accordance with the second step, the illustrative embodiment sets geographically based criteria, at the direction of the user, by which location-based actions are imposed. When the geographically based criteria are met, the wireless system initiates processes resulting in location-dependent actions.

[0009] FIG. 2 is a schematic diagram of a wireless telecommunication system including the location-action server 221 of a preferred embodiment of the present invention. The system includes a wireless switching center (WSC) 220 connecting the location-action server 221 with base stations 203-1 through 203-4, wherein it is understood that the number of base stations is exemplary only. Such a system is capable of: (1) providing wireless telecommunications service to wireless mobile unit 201, including location-based services based on location of the wireless mobile unit 201; (2) monitoring the movement (changing location) of wireless mobile unit 201 as it remotely travels; and (3) providing location-based actions based on the observed changing locations of wireless mobile unit 201. The location server 221 is responsible for providing all location-based action services for wireless mobile unit 201.

[0010] FIG. 3 is a block diagram of the salient components of location-action server 221. The location-action server 221 includes a location-action controller 301. The location-action controller 301 is connected to each of a location-action service database 302; location determining server 303; input device such as a console of an operator 304; and location action and preferences server 305. Location action and preferences server 305 is the part of the location-action server 221 that maintains a profile for each supported user and "understands" the actions that can be taken on behalf of users, e.g., opening a door, turn power onto a given appliance, etc. The location-action and preferences server translates actions from location-action service database 302 into simple commands that can be transmitted to the item/appliance that will perform the action. Further, the location-action and preferences server 305 "understands" the user's preferences (e.g., preference for turning appliances on when user has approached within 2 miles, and opening door when user has approached within 50 feet, for example). The location-action and preferences server 305 matches user's actions and preferences and maintains the user's specified actions and preferences as a user profile, to be invoked whenever the user calls for location-based action services.

[0011] Location-action controller 301 is, for example, a computer programmed to orchestrate location-based action services. Further, location-action controller 301 controls the operation of the other elements in location-action server center 221.

[0012] Location-action service database 302 is a database or memory that contains, among other things, digitized maps of geographic areas serviced by the location-action server 221 and WSC 220. These are used for comparison with a current location of a wireless mobile unit 201 to determine whether to impose the desired actions. The geographic data and related data may be embodied in a Geographic Information System (GIS), for example. Location-action service database 302 further preferably contains not only the GIS database, but also GIS processing software that enables geographic functions, chiefly determining proximity relationships that enable the functionality described herein as will be explained in more detail hereafter. Some personal preferences may also be established in location-action service database 302, which may create an understanding for the automated processing of concepts such as the home of the user of a wireless mobile unit 201; the user's, office, or other places that correspond to a set geographic area that will be conveniently referred to by such common labels as home/office hereafter.

[0013] Location-action service database 302 further preferably stores a list of actions to be performed in association with a designated wireless mobile unit 201 and the geographic area (distance/proximity thresholds) that will be considered to meet a criteria for initiating control of actions to be performed. These can be customized by the user. For example, actions performed when a user approaches/leaves his/her home/office include physical actions such as adjusting environmental conditions (e.g. temperature) and/or lighting, activating/deactivating a home security system, warming an oven, opening/closing garage doors, etc. (when the wireless mobile unit has satisfied a geographic relationship with the remote location, such as coming within a predetermined distance thereof, for example). Such actions are performed at the direction of a home-based central controller 330, such as a home computer (PC) for example. This central controller 330 performs the action, such as sorting email when a user is within 5 miles of his office for example; or directs another action/action controller 320 to perform the action. Any action which can be controlled by a remote signal (which necessarily includes an action performable by any electronic or electrical device) is contemplated to be within the scope of the present invention. This action/action controller 320 can be a controller of a thermostat, light switch, garage door opener, etc. Thus, a remote control system 310 includes a central controller 330 for actions performed directly

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thereon, such as email sorting for example, and optionally one or more action/action controller(s) 320. The central controller 330 of the remote control system 310 receives signals instructing performance/control of actions from location-action controller 301 through the WSC 220 and phone lines, either wireless or land-lines, connected to central controller 330 in a known manner.

[0014] Note that while central controller 330 may be employed at the location where these services are performed, its' presence is not essential to the methods disclosed herein. The increasing availability of "smart" appliances (e.g. internet enabled and addressable) make central controller 330 less necessary, especially in the future. Thus, it should be understood that remote control system 310 could include merely "smart" appliances themselves, with actions being directly controlled by location-action controller 301.

[0015] Location determining server 303 determines the location of a wireless mobile unit 201 when requested to do so by location-action controller 301 and provides location-action controller 301 with that information when it is obtained. The location of wireless mobile unit 201 can be determined in a number of known ways including global positioning systems (GPS) and assisted GPS used in conjunction with wireless mobile units, and other known techniques such as triangulation, for example. How the location information is obtained is not limitive of the present invention. Location-action controller 301, in conjunction with location-action and preference server 305, determines the identification of wireless mobile units for which location determining server 303 monitors and identifies position/location information.

[0016] Location-action and preference server 305 works in conjunction with location-action controller 301 to determine which wireless mobile units are to be monitored; what are location thresholds at which actions are to be performed; what actions are to be performed when thresholds are exceeded; etc. The functioning of location-action and preference server 305 includes the set-up and authorization of users and may use Wireless Intelligent network authorization procedures such as those used for set-up of other wireless services such as call-waiting, voice-activated dialing, etc. Details of the functioning of such service profiles will be familiar to those of ordinary skill in the art, as will there set-up, maintenance and termination. This can be a service that a wireless mobile unit user signs up for, for example. The functioning of the location-action and preference server 305 further includes performing of threshold tests and invoking services, when appropriate, as will be described further with regard to Figs. 4 and 5 and their accompanying explanations.

[0017] Operator's console 304 enables travelers (users) to call the location action server 221 to request a service or change of wireless mobile unit 201 in preference in a user's wireless service file, for example. Thus, stored actions/thresholds can be modified. Alternatively, the operator's console 304 could be replaced by automated processes, linked to menus in the wireless mobile unit 201 of the user, for example. Some of the functionality described above can be automated by using an understanding of related user preferences, such as the options for different output devices that the user may tie to his/her wireless service file, which may be located elsewhere in the wireless network.

[0018] FIG. 4a is a flowchart of the operation of an illustrative embodiment of the present invention, wherein position/location movement of a wireless mobile unit is tracked as it travels during a trip and wherein that information is then used in near realtime to initiate location-based actions. In doing so, the illustrative embodiment performs two fundamentally distinct, major steps: (1) specifying the desired services by the recording actions to be taken on behalf of the user and the geographic conditions under which those actions will be performed, and (2) the continuous monitoring of the user's location against the geographic criteria (threshold position for comparison) for the action: if the conditions are met the action will be performed; if conditions are not met, position/location monitoring will continue as long as the basis for the service remains.

[0019] Prior to step 401 in FIG. 4a, a user of a wireless mobile unit initially decides to subscribe to a location-based action service. The user must have a specific designatable location in mind (which will generally be a familiar location such as home or office or a friend's home, for example), and a specific action or set of actions to be performed at the designated location (it should be noted that the specific actions could be programmed in a home or office PC as will be described with regard to Fig. 6). These actions may be associated with routine events, such as coming to the office to begin the work day or coming home at the end of the work day. The actions are performed based on the fact that the user is about to be physically present at the designated location, i.e., the actions are performed when a user is within a certain distance of the designated location based upon a location of the wireless mobile unit which is with the user.

[0020] Additionally, prior to step 401 of Fig. 4a, the wireless network ascertains that the user is authorized for location-based action services-a step which implies the user has a wireless mobile unit that can be located routinely with little impact on the network. This will often be the case.

[0021] Initially, the process begins with step 401 of Fig. 4a wherein the process is initialized at the location-action server 221. Information regarding actions to be performed, locations at which actions are to be performed, threshold positions at which actions are to be initiated, etc., are stored at location-action server 221. Thus the user essentially subscribes for the service and defines the parameters. This process will be described in more detail with regard to Fig. 5.

[0022] As previously stated, the steps involved in establishing parameters defining where, when, to whom,

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and what actions are to be performed are described in Fig. 5, further defining step 401 of Fig. 4. Initially, in step 502, the service to be involved is established. A user interface at the wireless mobile unit 201 might include other services, for example. The user invokes the location-based action service by initializing, either through a menu on his/her wireless mobile phone or through a similar mechanism such as that which could be provided over the Internet. Alternatives to invoking over the Internet include speaking to an operator or using an IPA (Intelligent Personal Agent). Those skilled in the art will recognize how to construct these various alternative devices for invoking/starting the service, but the menu interface is described further here.

[0023] Once in the menu for location-based actions, this user interface presents a list of actions and a list of locations, for example. In more advanced versions, nearly free-form inputs could exist, such that any action that could be understood by an intelligent module of the computer controlling the ultimate actions could be included. The list of actions include opening/unlocking a door, turning on equipment, raising or lowering temperature in the designated target location (such as home or office for example), or any other common actions. Actions ultimately performed in the designated target location within the scope of the present application include all actions which can commonly be driven simply by turning on power. For example, in the case where the actions are to be taken in a "smart home" (as will be described in more detail regarding Fig. 6), the home wiring is built such that all electric power outlets can be computer-controlled, and the home computer can be simply "told" to apply power at a given outlet/circuit or group ("macro") of outlet/circuits. The application of power will then open the garage door, turn on specified equipment, etc.

[0024] Besides specifying the action to be performed in Step 502, the user must specify the geographic conditions under which the service will be invoked in step 503. These are further defined in steps 504 and 506. This establishes the location where actions are performed; the "location-basis" under which actions are performed; and when actions are performed.

[0025] First the user specifies the designated site (target location) that is to be the basis of the action in step 504. The site may be chosen from a pre-programmed stored list, including such items as "home," "office," "secondary office," or "mother's house," etc. These sites, while using familiar names, will be translated by the location action controller 301 into street addresses, latitude/longitude, UTM (Universal Transverse Mercator), or a similar location designation scheme that can be dealt with by a Geographic Information System (GIS). This, and all other selected information is stored at location-action server 221, in a location-action service database 302.

[0026] The geographic criteria or relationship(threshold position/location at which actions are triggered) is set in Step 505 as the Site Relation Condition. The most common criteria will be proximity. For example, as a proximity threshold the user sets 5 miles such that when the wireless mobile unit 201 is within 5 miles of the designated target location (e.g., his home), then the determined geographic relationship with the designated target will be satisfied and an action will be triggered (e.g., adjust environmental conditions such as temperature or humidity). It should be noted that services could also include entry onto a particular road, municipality, or any geographic area as a triggering threshold for satisfying a geographic relationship. Conversely, it can include leaving any geographic area or reaching a certain distance away from an area or a specific location. Thus, when a user is leaving and is one mile from home, environmental conditions in the home can be automatically adjusted so as not to waste power. Many possible variations can be invoked, particularly if provisioned via a graphical interface such as that included in common GIS or Desktop Mapping schemes (see for examples, the ARC/Info products from ESRI of Redlands, CA, or MapInfo from MapInfo, Inc, Troy, NY).

[0027] Once the user has specified (1) the action to be taken (e.g. adjusting environmental conditions such as temperature), (2) the location wherein the action should be taken (e.g. "home"), and (3) the criteria or geographic relationship (typically distance within which to invoke the action such as "5 miles" from home, for example), the initialization is nearly complete. However, the system may require other internal settings. The most obvious of these is the tolerance, which can be set in step 506. By tolerance, for example, this refers to the fact that when specifying "perform this action when I am within 1 mile ± 100 meters", the ± part is yet to be specified. Because of its subtlety, this part may be specified by the system rather than by the user, for example. The initialization Step 401 is completed by writing the Full Record of Condition in Step 507, which writes the information in Location Action Service Database 302. In step 508, it then indicates that the Location Action Controller 301 may begin its process of verification/authentication, and proceed to begin controlling the service.

[0028] Once the process has been initialized, the wireless network then monitors the location of the wireless mobile unit 201 of the user at regular intervals. Note the wireless mobile unit 201 may contain the functionality needed to locate itself, and may send results to the location service controller 301 (through a controlling base station and WSC 220); such as through GPS or modified GPS circuitry within the wireless mobile unit 201 itself. Alternatively, the location can be determined in a known manner through triangulation using base station information, etc., either at the location action server 221 or WSC 220. Those familiar with wireless location technology/functioning will recognize that for the services disclosed herein, it does not matter whether location results are calculated in the network or in the wireless mobile unit 201 itself.

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[0029] For example, and as is clear to those skilled in the art, there are various ways in which the illustrative embodiment can ascertain the location of wireless mobile unit 201. For example, wireless mobile unit 201 can include a satellite position system receiver (e.g., a Global Positioning System (GPS) receiver, etc.) so that wireless mobile unit 201 can determine its own latitude and longitude. In such a case, wireless mobile unit 201 provides its location to a controlling base station, WSC 220, and eventually to location action server 221 when requested. An example of such an arrangement is taught in U.S. Patent 5,479,482, entitled "Cellular Terminal For Providing Public Emergency Call Location Information," issued Dec. 26, 1995.

[0030] In accordance with another technique, wireless mobile unit 201 and location determining server 303 may share the task of computing the latitude and longitude of wireless mobile unit 201. In such a case, wireless mobile unit 201 provides an indicium of its location, through a controlling base station and WSC 220, to location determining server 303 of location action server 221 when requested. An example of such an arrangement is described by G. Vannucci and R.E. Richton in pending U.S. Patent applications Serial No. 08/927,432, and 08/927,434.

[0031] In accordance with other techniques, either wireless mobile unit 201 or base stations 203-1 through 203-4 use of terrestrial triangulation techniques, in a well-known fashion, determine the location of wireless mobile unit 201 based on the time-of-arrival or direction-of-arrival of signals transmitted from each other. It will be clear to those skilled in the art how to determine the location of wireless mobile unit 201 for the purposes of the present invention, and that the reporting of the location to location determining server 303 (from the base stations through WSC 220) at regular intervals requires merely adding a timer, for example. It will similarly be clear to those skilled in the art that wireless location determination systems will have a certain inherent accuracy, and that they generally report a confidence or uncertainty level and that that level might need to be considered when invoking any location-based service. Factoring in consideration of the areas of uncertainty will be part of any location-based service but will not be described at length here, as the considerations should be evident. For example, when criteria for invoking services are examined, the uncertainty/confidence must be considered. Depending on the nature of the action/service, different confidence levels might appropriately be invoked. However, because this is a secondary factor in invoking location-based action services, its use would probably be better left to the administrative parts of location-based services rather than set by users in most cases.

[0032] Following initialization of the service as explained in Fig. 5, the process may begin at Step 401 within the location-action server 221. In step 401, a record of the wireless mobile unit 201, the location criteria or geographic relationship (designated target, threshold, etc.) and the action to be taken is established. This information is stored in a record in a location action service database 302, in association with information identifying the wireless mobile unit 201 (such as it's phone number, for example) and in association with information identifying the target location where the actions are to be performed (such as the phone number of a user's office, home, etc.). It should be noted that the record stored in the location-action service database 302 may include all necessary information to carry out the instructing of the action, or may be linked to existing information, such as a known telephone number of the wireless mobile unit 201 and/or known home or office numbers of a user. The aforementioned record and other stored information may be stored in a geographically oriented database, such as are associated with GISs. Location action controller 301 records that such a record exists. At this point in the location-action controller 301 initiates the criteria checking shown in steps 402 and 403.

[0033] The criteria checking steps 402 and 403 are the heart of the system. In step 402, the location of wireless mobile unit 201 is continually determined/received. This is done at periodic intervals, e.g., once per second. Next, in step 403, the retrieved criteria are checked at regular intervals, typically timed to mesh with the timing of step 402. For example, in step 403 it is determined whether or not the location information received in step 402 indicates that the wireless mobile unit has satisfied the geographic relationship with the target location, e.g. is it within a threshold distance (e.g., 5 miles) of the target location (e.g., "home"). These two timed processes are "merged" in a manner to check whether the location of the wireless mobile unit of the user meets the criteria or geographic relationship with the target that has been set.

[0034] It should be noted that the record storage and criteria checking of steps 401-403 need not be limited to a single wireless mobile unit or to a single target location. For example, if a family has two wireless phones, for example, then they may designate that the actions take place when either of the two wireless phones meets the set geographic relationship. This can be set and stored in location-action service database 302. Further, one set of actions can be triggered by either wireless phone meeting a first geographic relationship with a home of the users, for example, and a second set of actions can be stored in association with only one of the wireless phones, for office related actions, for example.

[0035] In addition, for a single wireless mobile unit, multiple geographic relationships can be stored in association therewith, with similar or different actions to be performed. Thus, when a wireless mobile unit of a user satisfies a first set geographic relationship with a first target location (e.g. home), a first set of actions will be triggered at the home. When the same wireless mobile unit satisfies a second set geographic relationship with

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a second target location (e.g. office), a second set of actions will be triggered at the office. Accordingly, upon the wireless mobile unit satisfying either of the set geographic relationships with either of the respective target locations, a controls signal will be sent to the respective target to trigger the respective action(s). Therefore, information identifying one or more various wireless mobile units can be stored in association with information of various target remote locations and in association with various set geographic relationships thereof and actions to be performed.

[0036] Further, it should be noted that the monitoring performed in step 402 can be provided to applications other than those in step 403. Further, step 402 can be performed using criteria established outside of step 401. Also note that there will be service provisioning steps that the providers of services described here will undertake before users can employ any steps in Figure 4a. These provisioning steps would include, for example, initiate billing and check that the end-to-end communications protocols required for subsequent steps of the service disclosed are ready. Authentication/security functions may also be established to further protect users against unauthorized disclosures of data regarding their whereabouts (position/location), which many would want to keep private. Methods to perform such provisioning steps are well-known to those skilled in the art, as these are normal functions of public telephone networks for well-known services such as call waiting, caller-ID, etc.

[0037] If the criteria are met in step 403, a control signal or instruction to perform an action is sent in step 404. This is easily accomplished since the location-action server 221 knows the phone number of the remote location where the action is to be performed. If not, location of the wireless mobile unit 201 is monitored in step 402. As noted previously, the action is carried by the location action server 221 sending a prearranged control signal to the remote central computer 330, which in turn directly causes the action to occur (either at central controller 330 for computer actions such as sorting email, for example, or by controlling a remote action/action controller 320 such as a thermostat controller for adjusting environmental conditions such as temperature). If the criteria are not met, the condition is checked again (periodically).

[0038] In the case where the criteria is met in step 403, the location-action controller 301, having "deduced" that the criteria has been met by comparing the criteria stored in location-action database 302 with the most recent location determination result from the location determining server 303, sends a signal to invoke the action. This may include calling a specific telephone number (e.g., the home or office telephone number for the user). One of ordinary skill in the art familiar with this type of pre-programmed controller will recognize that a variety of signals may be used from this point to establish, validate, and invoke the computer-to-computer communications that enables this step (from location-action server 221 to the remote control system 310). The communications may take place via the Public Switched Telephone Network (PSTN) or any ordinary or extraordinary means.

[0039] The home/office computer (central controller 330) of remote control system 310 that receives the instructions to invoke the action is previously set up to acknowledge the received instruction. Upon receipt of a return acknowledgment, the location-action controller 301 will either cycle to the next service it performs on behalf of the particular user described here, or will stop the processes for that user. An external stop signal, either invoked by the user or a system administrator, can also stop the process at step 403. This external stop signal is typical of administrative steps that are not shown explicitly in the Figures, but whose presence is both required for a practical system and evident the those skilled in the art.

[0040] Fig. 4b is a flowchart illustrating the steps performed at the designated target location, such as at the user's home. Initially, a central controller 330 of remote control system 310 monitors whether or not an instruction to perform an action has been received in step 410. If no instruction has been received, the system merely continues to monitor for receipt of such a signal. However, if the signal has been received from location-action controller 310 of location-action server 221, through the phone lines (either land-line, or wireless) in step 420 it determines which actions are to be performed based on the signal received. Thereafter, in step 430, the central controller the performance of the action by either performing the action itself (if the action is a computer action such as sorting email, for example), or sends a signal to a remote device or controller of a device 320 to perform the action.

[0041] For example, if the action is adjusting temperature, a signal is sent to a thermostat controller, where the signal itself merely controls a thermostat so as to adjust the temperature. It should be noted that the specific parameters of adjusting the temperature or even specific actions to be taken at the remote control system 310 can be programmed therein, such as at the central controller 330 for example. Alternatively, some information could be prestored at location-action service database 302 of location-action server 221, such that a certain signal is sent when a user has departed his home by 1 mile and another signal is sent when a user has arrived within 5 miles of his home, with the actual action to be performed being stored in central controller 330. In such an instance, upon receiving an arrival signal from the location-action server 221, the central controller 330 can perform a first set of actions such as raising the temperature in the house, turning the lights on, opening the garage door, etc. If a second signal is sent from location-action server 221 indicating that a user has departed his home by a predetermined distance for example, then the central controller 330 can be pro-

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grammed to perform a different set of actions, such as locking all doors, closing a garage door, lowering temperature in the house, closing a garage door, etc. It should be clear to those of ordinary skill in the art that all variations and permutations 10/6/99thereof are also within the scope of the present invention.

[0042] Fig. 6 illustrates the central controller 330, in a preferred embodiment thereof. As previously stated, such a central controller 330 can include, for example, a home computer. As such, the home computer will include a display portion 610, a CPU 650 connected to the display portion 610, and further connected to memory 680 and an input device 690. The CPU 650 is further connected via input port 660 to a phone line for receiving information from location-action controller 301 of location-action server 221, for example; and an output port 670 for outputting information to control the carrying out of various actions such as adjusting temperature, opening a garage door, turning on and off lights, etc. As previously stated, the specific actions to be performed can be programmed using CPU 650, memory 680, and input device 690 within the central controller 330 itself; certain groups of actions can be performed therein when a particular arrival or departure signal is received from location-action controller 301 of location-action server 221 for example; or specific instruction signals can be received by CPU 650 from location-action controller 301 of location-action server 221 dictating exactly which actions are to be performed or controlled by central controller 330.

[0043] Fig. 6 further illustrates specific elements displayed on display portion 610 of central controller 330, indicating which actions may be performed. It should be noted that the various actions indicated on display portion 610 of Fig. 6 are merely indicated illustrative purposes only and should not be deemed limiting of the present invention.

[0044] First display areas 620a and 620b may, for example, display a symbol indicating a particular action to be performed. The specific word or phrase corresponding to the symbol may optionally be displayed in area 630a and 630b for example. Further, in a separate display area 640a and 640b, it can be indicated whether or not a particular action is ON or OFF. By such a system, using display portion 610 as a touch screen for example, a user can easily program specific actions to be performed when a signal is received from a location-action controller 301 of a location-action server 221 in conjunction with the present application. Additionally, although not shown in Fig. 6, specific control of various actions can take place at the central controller 330 in a similar manner, such as setting the exact that the temperature the home should reach. These "variable parameters" of an action are probably best programmed at central controller 330.

[0045] Software for controlling various devices, such as a coffee pot, lights, etc. is known from companies such as Active Home™, which currently activate devices in the home based upon a particular time of day for example. Accordingly, similar programming is carried out in connection with the present invention, utilizing location information and external control from a location-action controller 301 of a location-action server 221 in place of the known "time of day" control. Accordingly, in a system wherein a user desires to determine which particular action should take place in his or her home when he is within a particular distance from the home (either arriving or departing), the use of a central controller 330 as shown in Fig. 6 is ideal. As such, a user can turn various factions ON so that when an arrival signal is received from location-action-action controller 301 of location-action server 221, several actions are performed. Alternatively, the user can cancel some actions if, for example, the user does not desire to turn the coffee pot ON each time he arrives; or can vary the parameters of certain actions (adjusting the temperature by 5 degrees instead of 3 degrees for example).

[0046] Fig. 6 also depicts an arrival macro and a departure macro. As such, a user can string a plurality of tasks together in a macro so that, for example, each time he leaves his house and exceeds the predetermined threshold, such as 1 mile for example, three tasks will be performed (i.e., the lights will be turned OFF, the temperature will be lowered, and the garage door will be shut). Similarly, an arrival macro can be determined and prestored such that when a user is within 5 miles of his home, for example, two tasks will be performed (such as raising the temperature by 5 degrees and turning the lights ON, for example). As such, the actions are more easily controlled by the user.

[0047] Figs. 7a and 7b illustrate one particular example of the system of the present application. Fig. 7a indicating the steps performed at the location-action server 221; and Fig. 7b indicating the steps performed at the remote control system 310.

[0048] In step 710, a record for a wireless mobile unit 201 is retrieved and the location of the wireless mobile unit 201 is monitored. Thereafter, in step 720, actions to be performed are determined, such as adjusting temperature for example, and a threshold distance (as a set geographic relationship) along with the target location, is also determined (namely 5 miles from the home for example). Alternatively, instead of determining exactly which actions are to be performed, a threshold need merely be determined such that if the threshold is met, a signal will be sent from location-action controller to central controller 330 indicating that an action is to be performed; with the action itself being determined at the central controller 330 based upon receipt of an arrival or departure signal for example (such as in a departure/arrival macro).

[0049] Thereafter, in step 730, it is determined whether or not the wireless mobile unit 201 meets the threshold, namely is the wireless mobile unit 201 within 5 miles of the user's home, for example. If not, the system returns to step 710 and the location or position of the wire-

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less mobile unit 201 is continually monitored. If so, the system moves to step 740 wherein a signal is sent to the central controller 330 of the user's home. This is done, for example, since the location-action controller 301 knows the home number of the user, stored in association with the telephone number of the wireless mobile unit 201. Thus, a signal can be sent to the user's home via the existing phone lines.

[0050] Fig. 7b illustrates the actions performed at the user's home, for example. Namely, the central controller 330 monitors the phone lines for a control signal from the location-action controller 301 in step 750. In step 760, a signal is received. Thereafter, in step 770, it determines which actions are to be performed, either from the received signal itself or from actions preprogrammed in the computer such as actions which are part of a stored departure macro or an arrival macro, as previously explained with regard to Fig. 6 for example. Thereafter, the action of adjusting the temperature (for example) is performed by the central controller 330 either controlling the temperature (action) itself, or sending a signal to an action controller 320, such as a thermostat controller, for adjusting the temperature. For temperature adjustment, and for other specific actions, exactly how much to adjust the temperature can be specifically stored, for example at the computer or central controller 330 of the user so as to be easily adjustable to the user. When a signal to adjust the temperature is received from the location-action controller 301, the computer can then determine how much to adjust the temperature and output a signal for appropriate control thereof.

[0051] The invention being thus described, it will be obvious that the same may be varied in many ways.

[0052] For example, the structure of location-action service data base 302 is not limiting and need only store, in some fashion, the required information. How information is stored is not limitive of the present invention. Further, the location of the various components of the location-action server 221 is not limitive of the present invention. The components can be in a single unit as shown in Fig. 3, or can be located apart from location-action controller 301. Only operative connection between the components is important. The location-action server 221 of Fig. 3 is merely a description of a preferred structure.

Claims

1. An apparatus comprising:

   a controller, adapted to receive information indicating position of a wireless communications device;

   a memory, adapted to store information identifying the wireless communication device and position information of a remote location stored in association with the information identifying the wireless communication device, the controller being adapted to output a control signal to the remote location instructing initiation of an action at the remote location upon received information indicating that the position of the wireless communication device has satisfied a geographic relationship with the remote location.

2. The apparatus of claim 1, wherein the geographic relationship is satisfied when the position of the wireless communication device is within a designated distance of the remote location.

3. The apparatus of claim 1, wherein the controller is adapted to compare position information of the wireless communication device to stored position information of the remote location and is adapted to determine when the wireless communication device has satisfied the geographic relationship.

4. The apparatus of claim 1, wherein the wireless communication device is a wireless phone.

5. The, apparatus of claim 1, wherein the position information indicating position of the wireless communication device is received from a global positioning system (GPS) within the wireless communication device.

6. The apparatus of claim 1, wherein the position information indicating position of the wireless communication device is received from an assisted global positioning system (assisted GPS).

7. The apparatus of claim 1, wherein the action initiated at the remote location includes operating a door.

8. The apparatus of claim 1, wherein the action initiated at the remote location includes adjusting environmental conditions at the remote location.

9. The apparatus of claim 1, wherein the action initiated at the remote location includes sorting email.

10. The apparatus of claim 1, wherein the memory stores position information of a plurality of remote locations in association with the information identifying a wireless communication device.

11. The apparatus of claim 10, wherein the controller is adapted to output a control signal to one of the plurality of remote locations upon receiving information indicating that the position of the wireless communication device is within a designated distance of the one of the plurality of the remote locations.

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12. The apparatus of claim 1, wherein the memory stores information identifying a plurality of wireless communication devices in association with position information of the remote location.

13. The apparatus of claim 12, wherein the controller is adapted to output a control signal to the remote location upon receiving a signal indicating that the position of one of the plurality of wireless communication devices is within a designated distance of the remote location.

14. The apparatus of claim 11, wherein the memory stores information identifying a plurality of wireless communication devices in association with position information of at least one of the plurality of remote locations.

15. The apparatus of claim 14, wherein the controller is adapted to output a control signal to one of the remote locations upon receiving a signal indicating that the position of an associated one of the plurality of wireless communication devices is within a designated distance of the one of the remote locations.

16. The apparatus of claim 1, wherein a telephone number identifies the remote location, and the controller is adapted to output the control signal using the telephone number of the remote location.

17. The apparatus of claim 16, wherein the controller is adapted to output the control signal to the remote location through telephone lines.

18. The apparatus of claim 16, wherein the controller is adapted to output the control signal to the remote location through wireless communication.

19. The apparatus of claim 1, wherein the stored information identifying the wireless communication device includes a telephone number.

20. The apparatus of claim 1, wherein the control signal adapted to be output to the remote location identifies the action to be initiated.

21. The apparatus of claim 1, wherein the control signal adapted to be output to the remote location does not identify the action to be initiated, the action being variable at the remote location.

22. An apparatus comprising:

a memory, adapted to store information identifying a wireless communication device and position information of a remote location stored in association with the information identifying the wireless communication device; and

a controller, adapted to output a control signal to the remote location instructing initiation of an action at the remote location upon determining that a position of the wireless communication device has satisfied a geographic relationship with the remote location.

23. The apparatus of claim 22, wherein the position of the wireless communication device is determined at the controller through triangulation.

24. The apparatus of claim 22, wherein the geographic relationship is satisfied when the position of the wireless communication device is within a designated distance of the remote location.

25. A system, comprising:

a first controller, adapted to receive information indicating position of a wireless communication device;

a memory adapted to store information identifying the wireless communication device and position information of a remote location stored in association with the information identifying the wireless communication device; and

a second controller, located at the remote location, adapted to initiate an action at the remote location upon receiving a control signal from the first controller, the first controller adapted to send the control signal to the second controller upon receiving a signal indicating that the position of the wireless communication device has satisfied a geographical relationship with the remote location.

26. The system of claim 25, wherein the geographic relationship is satisfied when the position of the wireless communication device is within a designated distance of the remote location.

27. The system of claim 25, wherein the second controller, upon receiving the control signal from, the first controller, is adapted to initiate the action by outputting a signal to a device at the remote location.

28. The system of claim 27, wherein the second controller is adapted to output the signal to open/close a door at the remote location.

29. The system of claim 27, wherein the second controller is adapted to output the signal to adjust environmental conditions at the remote location.

30. The system of claim 25, wherein the second con-

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troller, upon receiving the control signal from the first controller, is adapted to initiate the action by performing a programmed task.

31. The system of claim 30, wherein the programmed task is adjustable at the second controller.

32. The system of claim 30, wherein a parameter of the programmed task is adjustable at the second controller.

33. The system of claim 30, wherein the programmed task includes sorting email.

34. The system of claim 25, wherein the first controller is adapted to compare position information of the wireless communication device to stored position information of remote location and is adapted to determine when the wireless communication device has satisfied the geographic relationship based upon the comparison.

35. The system of claim 25, wherein the wireless communication device is a wireless phone.

36. The system of claim 25, wherein the position information indicating position of the wireless communication device is received from a global positioning system (GPS) within the wireless communication device.

37. The system of claim 25, wherein the position information indicating position of the wireless communication device is received from an assisted global positioning system (assisted GPS).

38. The system of claim 25, wherein the memory stores position information of a plurality of remote locations in association with the information identifying a wireless communication device.

39. The system of claim 38, wherein the first controller is adapted to output a control signal to one of the plurality of remote locations upon receiving information indicating that the position of the wireless communication device is within a designated distance of the one of the plurality of the remote locations.

40. The system of claim 25, wherein the memory stores information identifying a plurality of wireless communication devices in association with position information of the remote location.

41. The system of claim 40, wherein the first controller is adapted to output a signal to the remote location upon receiving a signal indicating that the position of one of the plurality of wireless communication devices is within a designated distance of the remote location.

42. The system of claim 39, wherein the memory stores information identifying a plurality of wireless communication devices in association with position information of at least one of the plurality of remote locations.

43. The system of claim 42, wherein the first controller is adapted to output a control signal to one of the remote locations upon receiving a signal indicating that the position of an associated one of the plurality of wireless communication devices is within a designated distance of the one of the remote locations.

44. The system of claim 25, wherein a telephone number identifies the remote location, and the controller is adapted to output the control signal using the telephone number of the remote location.

45. The system of claim 44, wherein the first controller is adapted to output the control signal to the second controller at the remote location through telephone lines.

46. The system of claim 44, wherein the first controller is adapted to output the control signal to the second controller at the remote location through wireless communication.

47. The system of claim 25, wherein the stored information identifying the wireless communication device includes a telephone number.

48. A method, comprising:

storing position information of a remote location in association with information identifying a wireless communication device;

receiving information indicating a position of the wireless device; and

outputting a control signal to the remote location instructing initiation of an action upon the received information indicating that the position of the wireless communication has satisfied a geographic relationship with the remote location.

49. The method of claim 48, wherein the geographic relationship is satisfied when the wireless communication device is within a designated distance of the remote location.

50. The method of claim 48, further comprising:

comparing the received position information of the wireless communication device to the stored

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position information of the remote location and outputting the control signal based upon the comparison.

51. The method of claim 48, wherein the information indicating position is received from a wireless phone.

52. The method of claim 48, wherein the action initiated at the remote location includes operating a door.

53. The method of claim 48, wherein the action initiated at the remote location includes adjusting environmental conditions at the remote location.

54. The method of claim 48, wherein the action initiated at the remote location includes sorting email.

55. The method of claim 48, wherein storing includes storing position information of a plurality of remote locations in association with information identifying a wireless communication device.

56. The method of claim 55, wherein outputting includes outputting a control signal to one of the plurality of remote locations upon receiving information indicating that the position of the wireless communication device is within a designated distance of the one of the plurality of the remote locations.

57. The method of claim 48, wherein the information identifying a wireless communication device includes a telephone number.

58. The method of claim 48, wherein a telephone number of the remote location is stored in association with the position information and information identifying the wireless communication device.

59. The method of claim 58, wherein the control signal is output to the remote location through telephone lines.

60. The method of claim 58, wherein the control signal is output to the remote location through wireless communication.

61. The method of claim 48, further comprising:

initiating the action at the remote location upon receiving the output control signal.

62. The method of claim 48, further comprising:

outputting a signal to a controller to operate a door at the remote location upon receiving the output control signal.

63. The method of claim 48, further comprising:

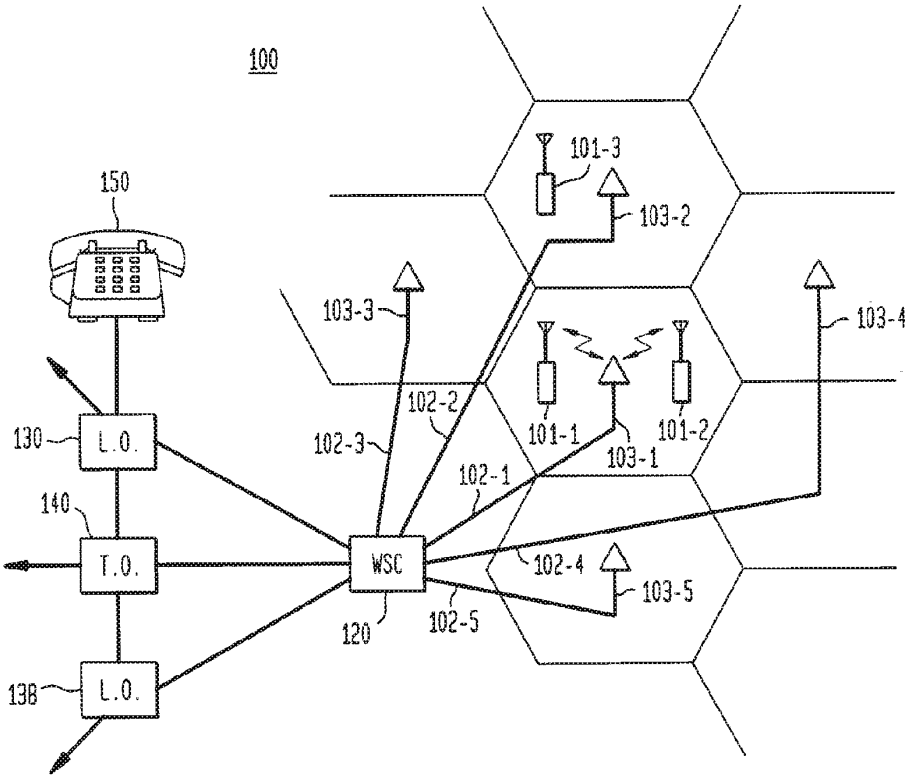
outputting a signal to a control device to adjust environmental conditions at the remote location upon receiving the output control signal.

64. The method of claim 48, further comprising:

sorting email at the remote location upon receiving the output control signal.

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FIG. 1
(PRIOR ART)



Ex. 1004.0326

FIG. 2

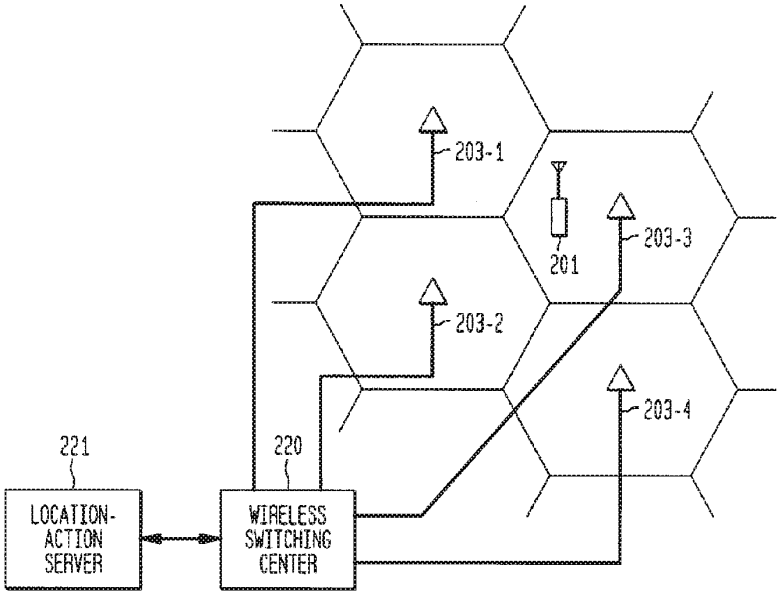
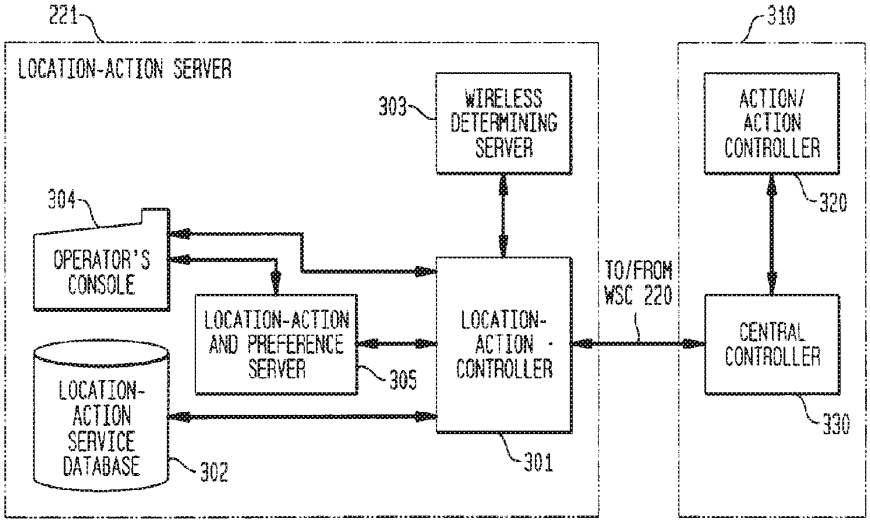


FIG. 3



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FIG. 4A

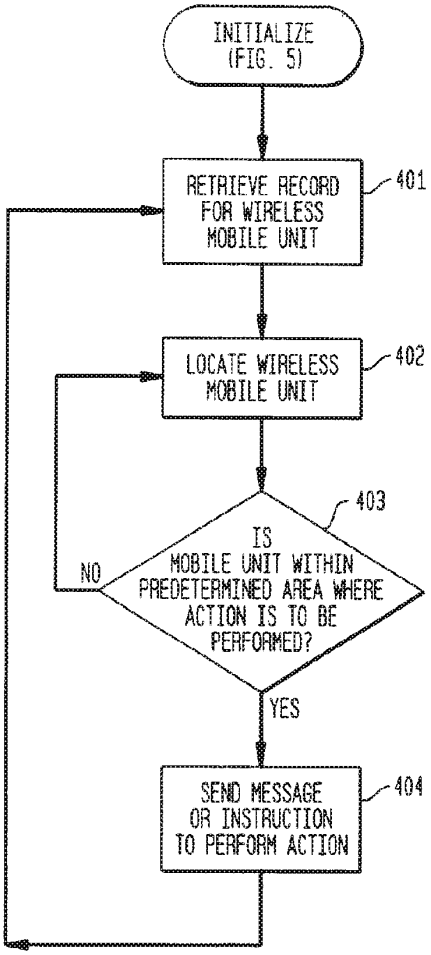
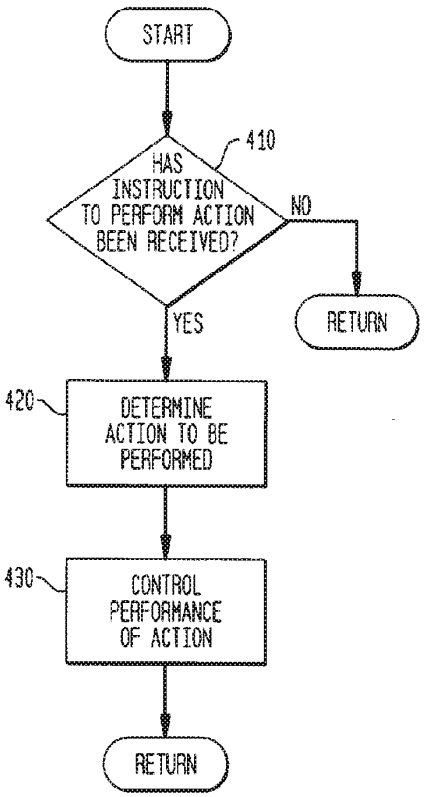
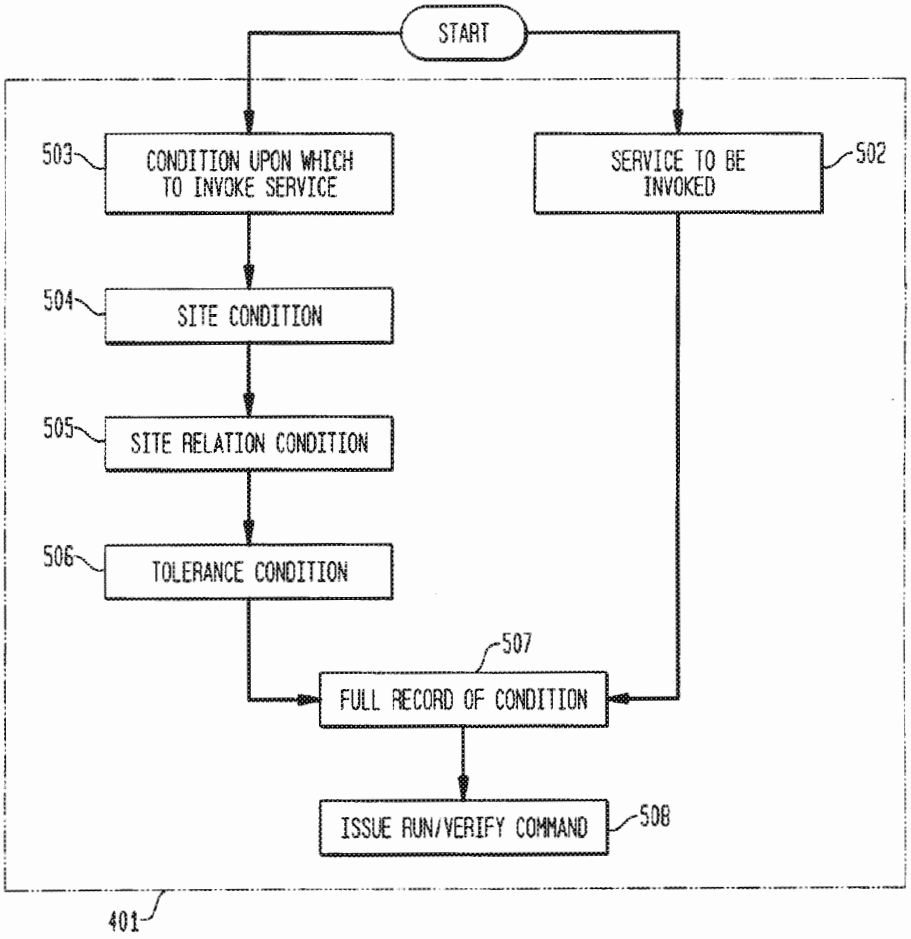


FIG. 4B



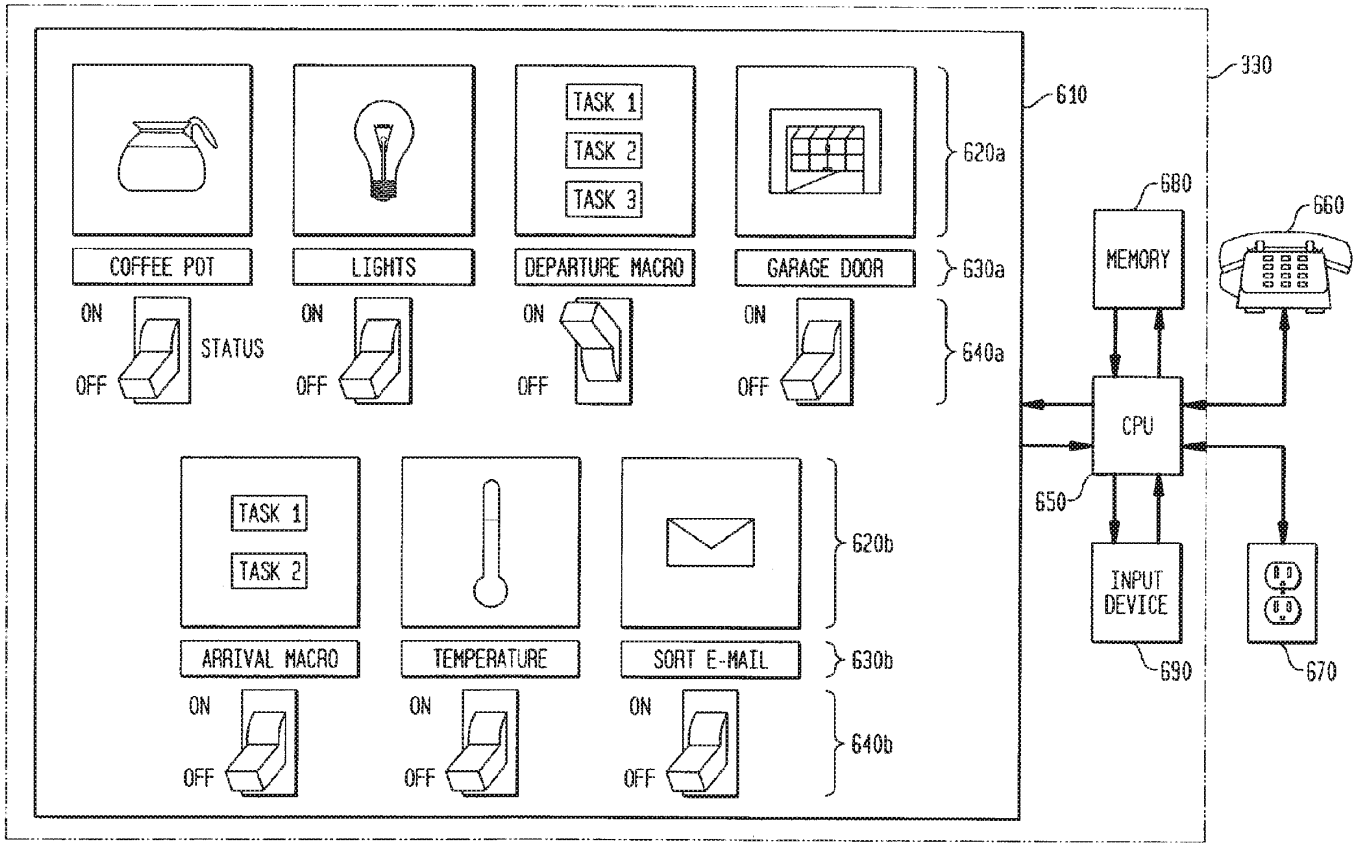
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FIG. 5



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FIG. 6



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Ex. 1004.0330

FIG. 7A

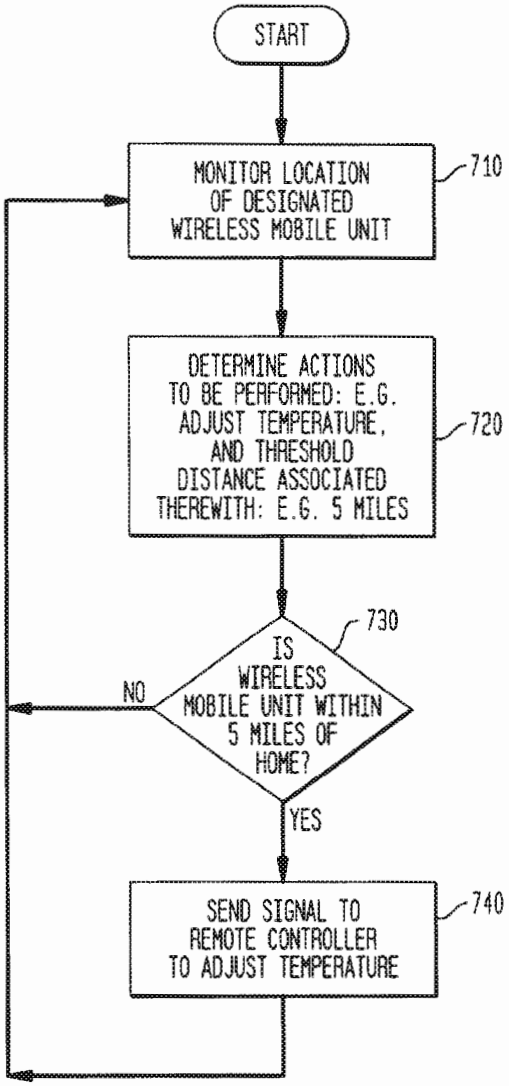
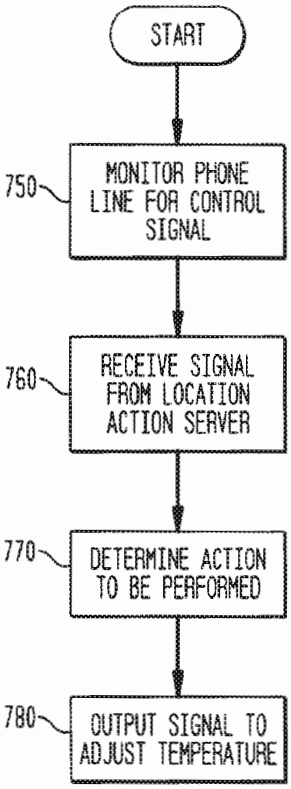


FIG. 7B



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(54) Method for controlling a heating, ventilation, and air conditioning (HVAC) system

(57) A method controls a heating, ventilation, and air conditioning (HVAC) system by determining a travel time from a mobile site to a fixed site, and determining a conditioning time for a HVAC system at the fixed site. The HVAC is maintained in an ON state if the travel time is less than the conditioning time, and otherwise maintaining the HVAC in an OFF state, and wherein the conditioning time is determined using a building thermal model.

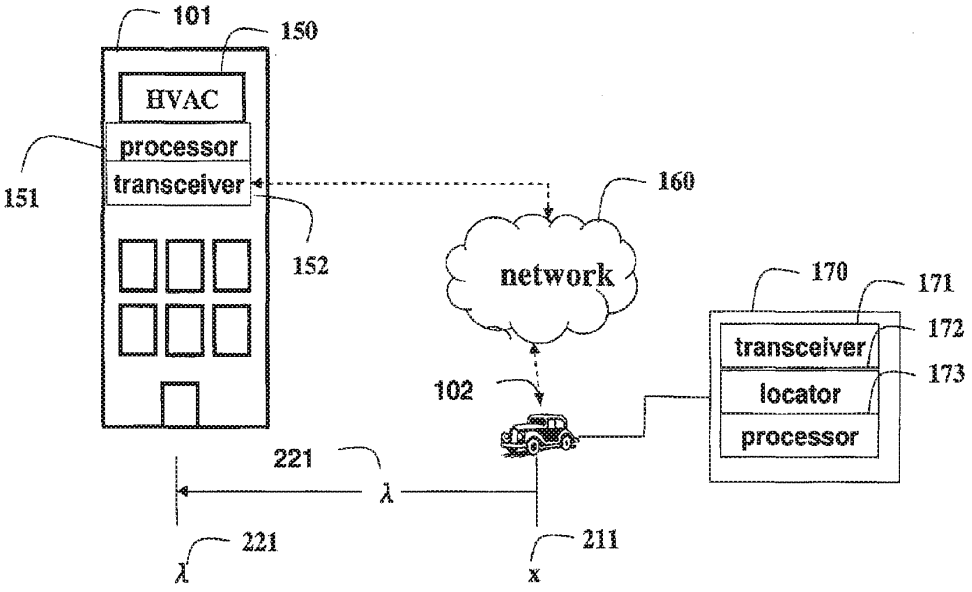


Figure 1

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Description

Field of the Invention

[0001] The invention relates generally to the field of heating, ventilation, and air conditioning (HVAC) systems, and more particularly to energy saving programmable HVAC systems.

Background of the Invention

[0002] Heating, ventilation, and air conditioning (HVAC) systems consume a large amount of energy. Commonly, heating and cooling operations for an environment are controlled automatically with one or more thermostats. A thermostat can be located centrally, or thermostats can be distributed. Typically, the operation of the HVAC system is according to preset temperature limits.

[0003] Because many environments may be unoccupied at times, this wastes energy. Occupancy can be determined with motion detectors. However, the time required to heat or cool the environment to the desirable temperature takes considerable time, perhaps longer than the time that the environment is occupied.

[0004] An operation schedule can be used. However, this is impractical when the occupancy period is irregular, or the schedule changes frequently. Schedules also do not accommodate holidays, vacations, travel, unplanned absence, and other changes to the occupancy routine. Thus, the schedule is only a best guess of occupancy.

[0005] One system augments manual and programmable home thermostats by using just-in-time heating and cooling based on travel-to-home distance obtained from location-aware mobile phones, Gupta et al., "Adding GPS-Control to Traditional Thermostats: An Exploration of Potential Energy Savings and Design Challenges," Book Pervasive Computing, Volume 5538/2009, pp. 95-114, May 2009. The system starts heating or cooling an inhabitable space only when the time necessary for the space's occupant to reach that space becomes lower than the time it would take to bring the space to a comfortable temperature.

[0006] That system used a GPS-enabled device such as a telephone to determine a user's current location, and a publicly available mapping system (MapQuest) to compute the time to reach the space to be conditioned from the user's current location.

[0007] In order to compute the time necessary to bring the space to a comfortable temperature, that system uses empirical data stored in heating/cooling look-up tables. For a given combination of indoor and outdoor temperature, the table stores the time it would take to heat or cool the space to a comfortable temperature. Each table is specific to the heating/cooling system type installed at the particular location. That system lacks generalization, because the tables must be individually constructed for each residence from measurements. Furthermore, the observed data from a limited time period typically would not include all possible combinations of indoor and outdoor temperatures that might be encountered in the future.

[0008] Another disadvantage of that system is the need to constantly re-compute and compare the travel time and conditioning time. Since the GPS-enabled mobile device is typically powered by a battery, constant communication between the device and the conditioned space would quickly drain the mobile device's battery, and is also likely to result in costly data communications traffic.

Summary of the Invention

[0009] A method controls a heating, ventilation, air conditioning (HVAC) system by determining a travel time from a mobile site to a fixed site, and determining a conditioning time for a HVAC system at the fixed site based on pre-computed building thermal models.

[0010] The HVAC is maintained in an ON state if the travel time is less than the conditioning time, and otherwise maintaining the HVAC in an OFF state, and wherein the conditioning time is determined using a building thermal model.

[0011] The mobile device carried by the spaces occupant and the building HVAC system installed at the conditioned space communicate according to a protocol that results in minimal data traffic.

Brief Description of the Drawings

[0012]

Figure 1 is a schematic of a system for controlling a HVAC system according to embodiments of the invention;

Figure 2A is a flow diagram for controlling a HVAC system according to embodiments of the invention;

Figure 2B is a state transition diagram for controlling the HVAC system according to embodiments of the invention;

Figure 3 is a table of conditional logic used by embodiments of the invention; and

Figures 4A-4B are graphs of environmental conditions as a function of travel time.

Detailed Description of the Preferred Embodiment

[0013] The embodiments of our invention provide a method for operating a heating, ventilation, and air conditioning (HVAC) system. The method uses a travel time for a person to reach the environment being controlled, and the conditioning time of the HVAC system.

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[0014] Figure 1 shows a fixed site (a workplace) 101, and a mobile site 102 at a location x 211, e.g., the mobile site is traveling to the fixed site. The mobile site includes a person destined for the fixed site. The mobile site can be a car, public transportation, a bicycle, or a person carrying a mobile communications device 170. The device 170 includes a mobile transceiver 171, a mobile locator 172, and a mobile processor 173.

[0015] The fixed site 101 includes a HVAC system 150, which is connected to a fixed processor 151 and a fixed transceiver 152 similar to the mobile transceiver 171. In a simplest form, the HVAC system includes a boiler, and perhaps air circulation means.

[0016] The fixed site and the mobile site can communicate with each other via a network 160, e.g., the internet, using the transceivers 152 and 171.

[0017] The travel time λ221 for the mobile site to arrive at the fixed site 101 can be estimated from the locations x 211 of the mobile site 102. The locations can be sensed using the locator 172, e.g. a global positioning system (GPS), or a mobile communication device, e.g., mobile telephone in the vehicle, and the location of the mobile site is provided by a mobile telephone service provider. The locator can also be a BlueTooth device communicating with a fixed-location BlueTooth beacon. The travel time can also consider traffic and weather conditions between the mobile and fixed sites, as available via the network.

[0018] As shown in Fig. 2A, the fixed site estimates 230 the conditioning time Θ231 from environmental conditions 229 and a building thermal model 228. The environmental conditions can include the external temperature and direct sunlight illumination at the fixed site. It is assumed these are constant or slowly varying, and if not, they can be adjusted for diurnal and annual variations, and according to weather forecasts, also readily available via the network.

[0019] The building thermal model 228 represents the thermal response of the building to the environmental conditions (e.g., external temperature, sunlight) and the operation of the HVAC system 150 that actively moves heat in or out of the building. A popular type of building thermal model is a grey-box model, where the building is modeled as a thermal circuit. The building thermal model can include factors such as thermal gain and transmission through windows, convection and conduction, shading and insulation. The building thermal model tracks the state of the building continuously and for any amount of heat supplied by the HVAC system 150, and can predict the future evolution of the internal temperature of the building. In order to compute the conditioning time Θ231, the building thermal model is used to determine the future evolution of the internal temperature for the case when the HVAC system 150 is operated at full power. The time necessary for the internal temperature to reach a comfortable threshold, e.g. 70F, is determined to be the conditioning time Θ231.

[0020] A difference 240 between the travel time 221 and the conditioning time 231 is then used to determine how the operation 250 of the HVAC system 150 is maintained.

[0021] As shown in Figure 2B, the HVAC is maintained in an OFF state 261 until the conditioning time constraint 262 is satisfied. Then, the HVAC is maintained in an ON state 263until the conditioning time constraint 264 is satisfied. Namely, the HVAC is maintained in an ON state if the travel time is less than the conditioning time, and otherwise the HVAC is maintained in an OFF state. The travel time 221 is based on probabilistic information obtained from previous traveling patterns, considering the mode of travel, the time of day, the date and the day of the week. The travel time can also be based on schedules of public transportation. The travel time can be determined at either the fixed or mobile location. The travel time can be periodically transmitted, or either the fixed or the mobile site can initiate the communication of the travel time explicitly.

[0022] Figure 2A shows our method. The location x 211 of the mobile site is periodically sensed 210. The locations can be used to estimate 220 the travel time λ221 to the fixed site. A threshold time ε239 can be used to avoid rapid transitions between the ON and OFF states, which decreases efficiency.

[0023] Figure 3 shows the logic used by an embodiment of our invention to schedule communication between the fixed and mobile sites. In this embodiment, there is no regularly scheduled communication, either the fixed or mobile site can initiate a communication. Figure 3 shows the currently maintained states 301 of the HVAC system, the sites 302, and the constraints 303 based on the travel time λ, the conditioning time Θ and the threshold time ε.

[0024] Whenever there is a communication between the sites, the mobile site communicates the travel time λ221 to the fixed site, and the fixed site communicates the conditioning time Θ 231, and the currently maintained state 301 of the HVAC system to the mobile site. The fixed site stores λ and the mobile site stores Θ. For each current state 301 of the HVAC, a communication is initiated by the site 302, when the constraint 303 becomes true for the corresponding state of the HVAC system.

[0025] As shown respectively in Figures 4A and 4B, it should be noted that when the HVAC system is ON, the system can operate in various modes. For example, if the travel is relatively large, then the HVAC can condition the environment slowly over a long period. That is the output of the HVAC system 'ramps-up' slowly. This minimizes energy consumption. If the travel time changes, the conditioning time can change accordingly. If the travel time is short, the HVAC might need to operate at maximum capacity to reach the desired internal environment condition. That is, the conditioning time is approximately proportional to the travel time.

Thus, in one embodiment, the travel time from the mobile site to the fixed site is determined, and an operation of the HVAC system is set according to the travel time.

Ex. 1004.0334

[0026] In another embodiment, multiple instances of the method can collaborate to minimize communications by the mobile site. For example, the person associated with the mobile site can be at the fixed workplace site and a fixed residence. In this case, the travel time and condition time can be determined for each sites, depending on whether the person is going to work, or coming home.

[0027] The HVAC system can be for an environment that can be occupied by multiple individuals. In this case, the travel time, conditioning time, and conditional logic are determined for each individual, and the HVAC is maintained in the ON state when any one condition indicates that this should be the case, and in the OFF state when all conditions indicate that this should not be the case.

[0028] In the case wherein N individuals share the same environment, but have different preferences for the environmental condition , the fixed site can calculate a separate Θ for each occupant (Θ_1, Θ_2, Θ_3 ... Θ_N), and each mobile site can communicate a separate λ, i.e., (λ_1, λ_2, λ_3, ..., λ_N). Furthermore, the HVAC system can use a separate threshold time ε for each occupant (ε_1, ε_2, ε_3 ... ε_N). The HVAC transitions to the ON state when any of the conditioning times (Θ_1, Θ_2, Θ_3 ... Θ_N) is greater than its corresponding travel time (λ_1, λ_2, λ_3, ..., λ_N). The HVAC transitions to the OFF state when Θ_N plus a threshold time ε_N is less than the travel time λ_N for all corresponding Ns.

[0029] It should be noted that the method can also be used for other equipment, e.g., lighting, in which case Θ=0, boilers, coffee makers, and water coolers. For desktop computers, the conditioning time is the time required to activate the computer, and Θ is a constant.

[0030] Thus, in the general case, the system is any equipment in or for an environment that needs to be maintained in an ON state when individuals are in the environment, and in an OFF state when the environment is unoccupied. The system is most effective at saving energy when the conditioning time is significantly greater than zero, so that the system can assure the comfort of occupants by starting to condition the space significantly before the occupants arrive, but at the same time is less than the travel time of the occupants for long periods, so that it can safely conserve energy during such periods.

[0031] Although the invention has been described by way of examples of preferred embodiments, it is to be understood that various other adaptations and modifications may be made within the spirit and scope of the invention. Therefore, it is the object of the appended claims to cover all such variations and modifications as come within the true spirit and scope of the invention.

Claims

1. A method for controlling a heating, ventilation, and air conditioning (HVAC) system, comprising the steps:

   determining a travel time from a mobile site to a fixed site;
   determining a conditioning time for a HVAC system at the fixed site; and
   maintaining the HVAC in an ON state if the travel time is less than the conditioning time, and otherwise maintaining the HVAC in an OFF state, wherein the conditioning time is determined using a building thermal model, and wherein the steps are performed in a processor.

2. The method of claim 1, wherein the conditioning time includes a threshold time.

3. The method of claim 1, wherein the mobile site includes a mobile transceiver and a mobile locator; and wherein the fixed site includes a fixed transceiver; and wherein the processor includes a fixed processor at the fixed site and a mobile processor at the mobile site.

4. The method of claim 1, wherein the fixed site and the mobile site communicate via a network.

5. The method of claim 3, wherein the mobile locator is a global positioning system.

6. The method of claim 3, wherein the mobile locator is a BlueTooth device communicating with a fixed-location BlueTooth beacon.

7. The method of claim 3, wherein the mobile locator is a mobile telephone, and a location of the mobile site is provided by a mobile telephone service provider.

8. The method of claim 1, wherein the travel time is determined from locations of the mobile site.

9. The method of claim 1, wherein the travel time depends on traffic and weather conditions.

10. The method of claim 1, wherein the travel time is based on probabilistic information obtained from previous traveling patterns, and considers a mode of travel, time of day, date, and day of week.

11. The method of claim 1, wherein the travel time is determined based on schedules of public transportation.

12. The method of claim 1, wherein the travel time is

Ex. 1004.0335

determined at either the fixed site or the mobile site.

13. The method of claim 1, wherein the travel time is transmitted to the fixed site periodically.

14. The method of claim 1, wherein the travel time is transmitted at a request by either the fixed site or the mobile site.

15. The method of claim 1, wherein the conditioning time is constant.

16. The method of claim 1, wherein the conditioning time is adjusted for diurnal and annual variations, and according to weather forecasts.

17. The method of claim 1, wherein the conditioning time is adjusted for internal environmental conditions at the fixed site.

18. The method of claim 1, wherein the conditioning time maximizes performance of the HVAC system.

19. The method of claim 1, wherein the mobile site and the fixed site communicate the travel time and the conditioning time only if any of the following constraints is true:

HVAC is OFF, site is fixed, and $\Theta > \lambda$;
HVAC is OFF, site is mobile, and $\lambda < \Theta$;
HVAC is ON, site is fixed, and $\Theta < \lambda - \varepsilon$;
HVAC is ON, site is mobile, and $\lambda > \Theta + \varepsilon$;

where λ is the travel time, Θ is the conditioning time, and ε is a threshold time.

20. The method of claim 1, where the conditioning time is approximately proportional to the travel time.

21. The method of claim 1, wherein there are N multiple mobile sites that each communicate travel times λ to the fixed site and the HVAC system turns ON when any of the travel times λ_N is less than the conditioning timeΘ and turns OFF when all of the travel times λ_N are greater than the conditioning time Θ plus a threshold time ε.

22. The method of claim 21, in which the fixed site estimates a separate conditioning time Θ_N for each of N multiple mobile sites.

23. The method of claim 1, wherein the conditioning time is slowly varying.

24. The method of claim 1, wherein the model considers thermal gain and transmission through windows, convection and conduction, shading and insulation.

25. The method of claim 24, wherein the conditioning time satisfies a thermal property constraint.

26. A method for controlling a heating, ventilation, air conditioning (HVAC) system, comprising the steps:

determining a travel time from a mobile site to a fixed site including a HVAC system; and
setting an operation of the HVAC system according to the travel time.

Ex. 1004.0336

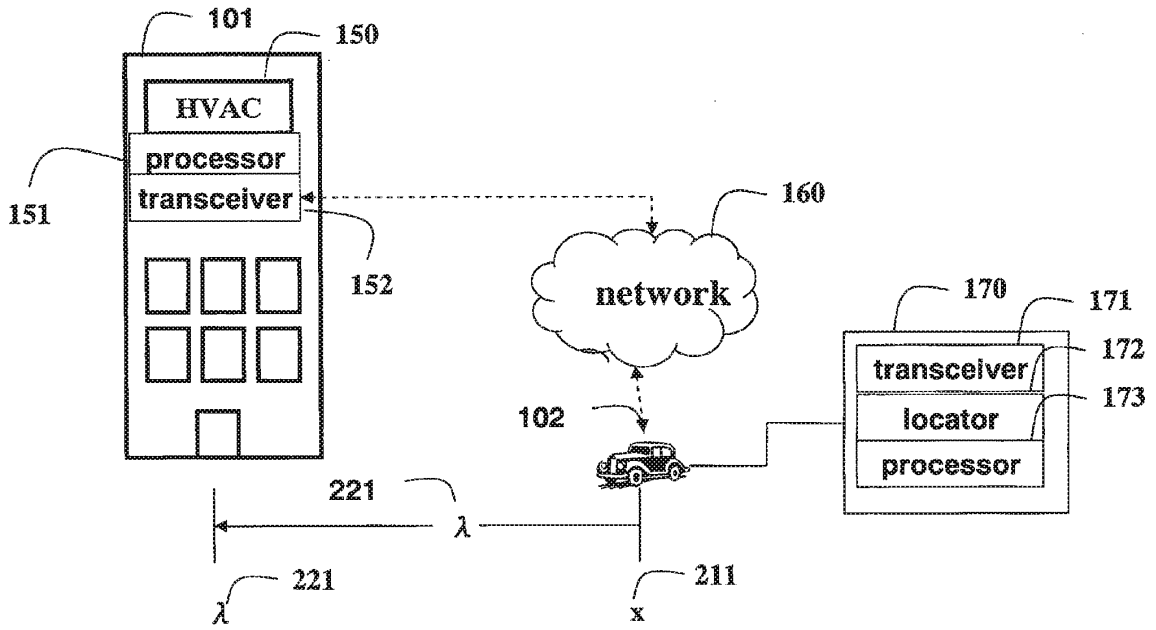

101
150
HVAC
processor
transceiver
151
152
160
network
170
171
transceiver
172
173
locator
processor
102
221
λ
221
λ
211
x

Figure 1

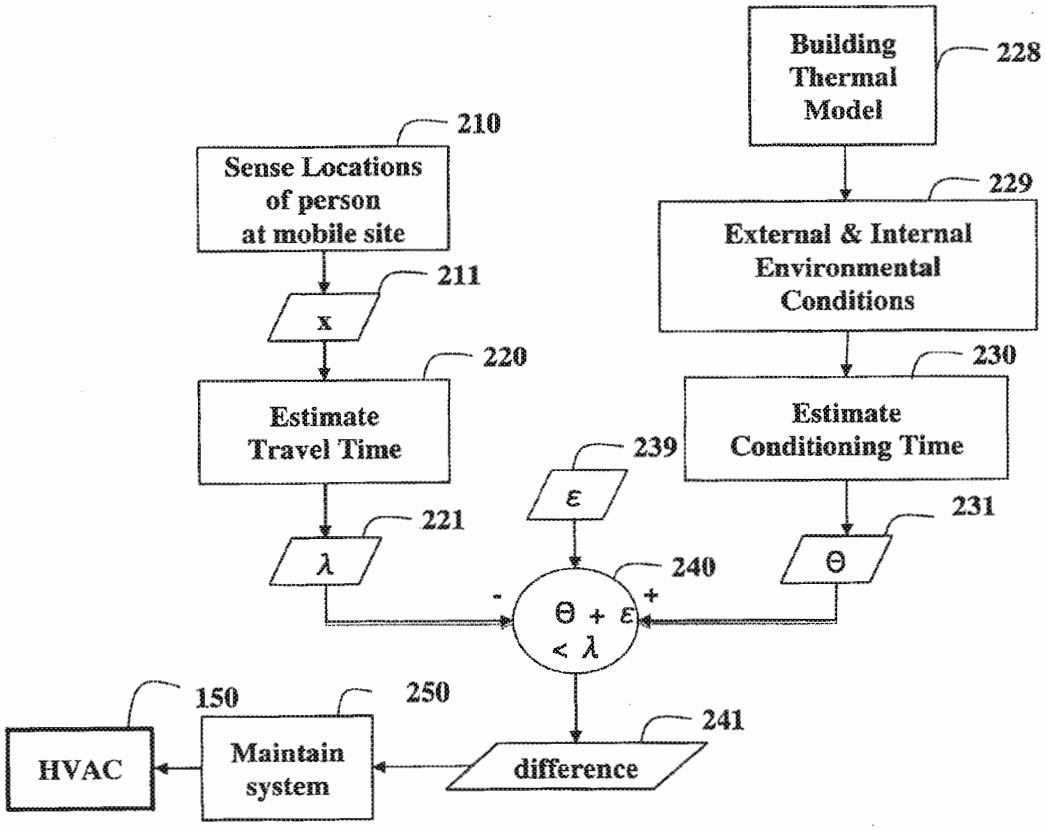


Figure 2A

EP 2 372 263 A2

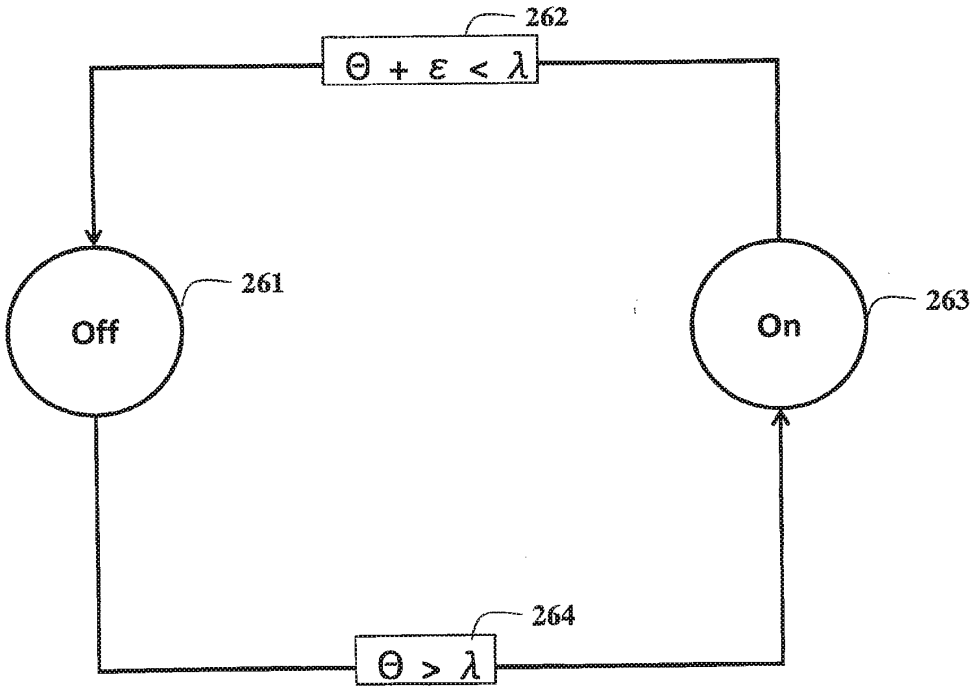


Figure 2B

Logic for Transmissions		
HVAC State	**Site**	**Constraint**
OFF	fixed	$\Theta > \lambda$
OFF	mobile	$\lambda < \Theta$
ON	fixed	$\Theta < \lambda - \varepsilon$
ON	mobile	$\lambda > \Theta + \varepsilon$
301	302	303

Figure 3

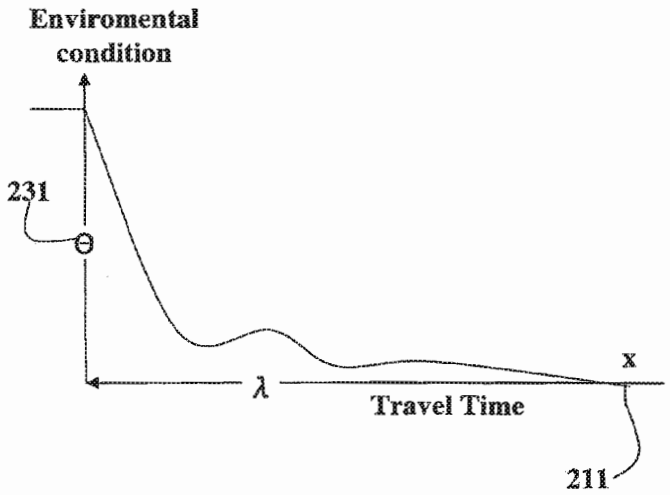


Figure 4A

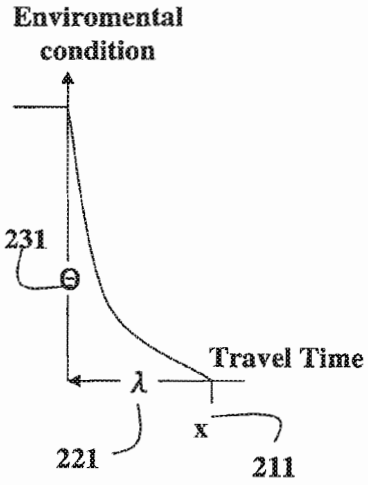


Figure 4B

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- **GUPTA et al.** Adding GPS-Control to Traditional Thermostats: An Exploration of Potential Energy Savings and Design Challenges. *Book Pervasive Computing*, May 2009, 95-114 **[0005]**

Ex. 1004.0342

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(52) UK CL (Edition X):
G3N NGBA1 N262 N402B N404

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GB 2212949 A **EP 0883050 A1**
WO 2002/090914 A1 **US 5197666 A**

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UK CL (Edition W) **G3N**
INT CL[7] **F24F, G05B, G05D, G06F**
Other: **ONLINE: WPI, EPODOC, JAPIO.**

(54) Abstract Title: **Household energy management system**

(57) A household energy management system uses measurements of the household electricity supply 4 to identify and to determine the energy consumption of individual household appliances. From these measurements, models can be built of the behaviour of the occupants of the house, the thermal properties of the house and the efficiency of the appliances. Using the models, the household appliances - in particular heating and cooling appliances - can be controlled to optimize energy efficiency; and maintenance programmes for the appliances and for the house itself can be recommended to the householder or arranged with a service company.

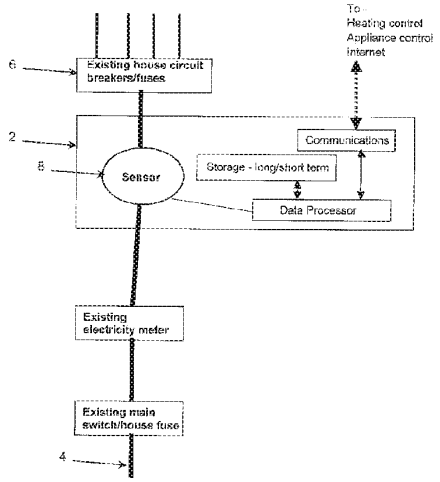


Figure 1

GB 2 408 592 A

Original Printed on Recycled Paper

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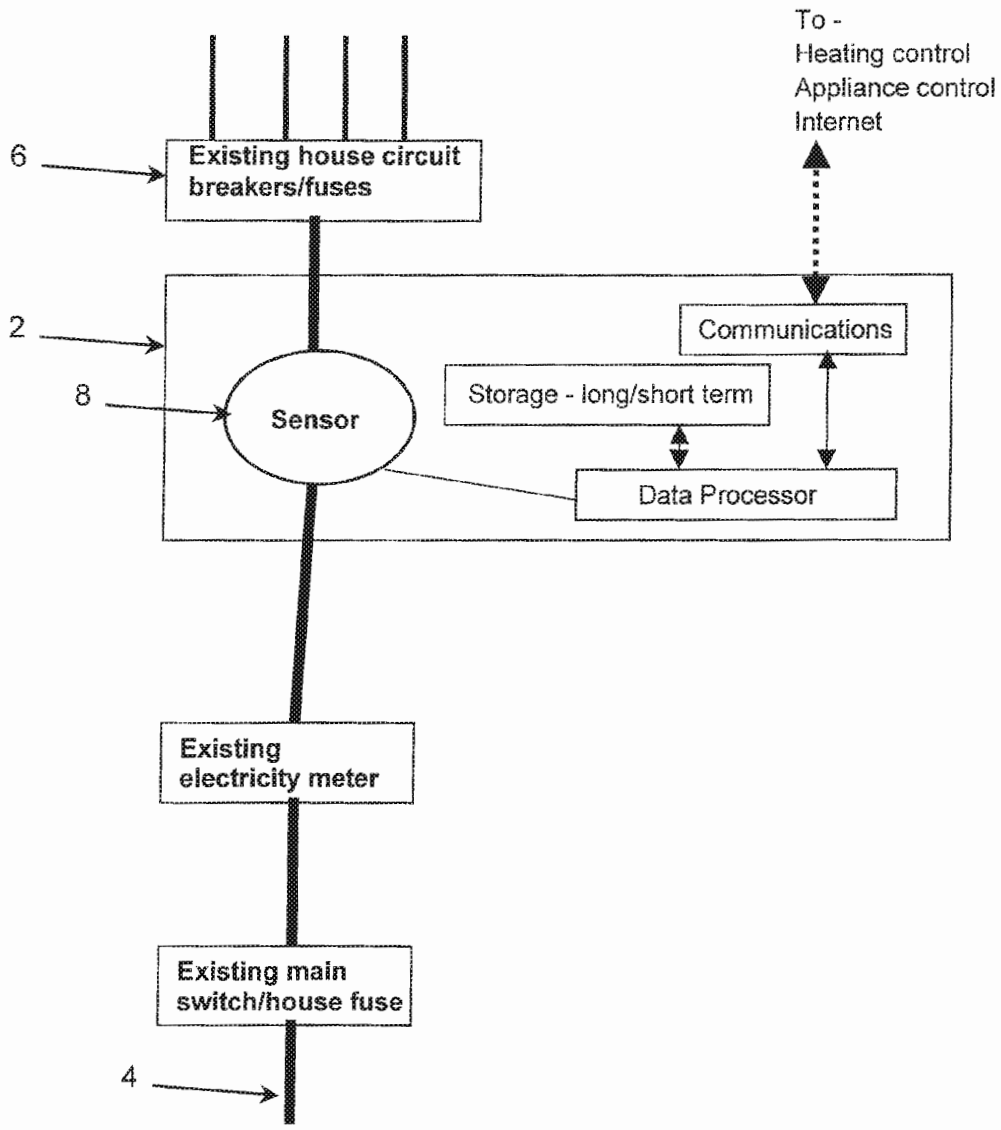

To -
Heating control
Appliance control
Internet
6
Existing house circuit breakers/fuses
2
8
Sensor
Communications
Storage - long/short term
Data Processor
Existing electricity meter
Existing main switch/house fuse
4

Figure 1

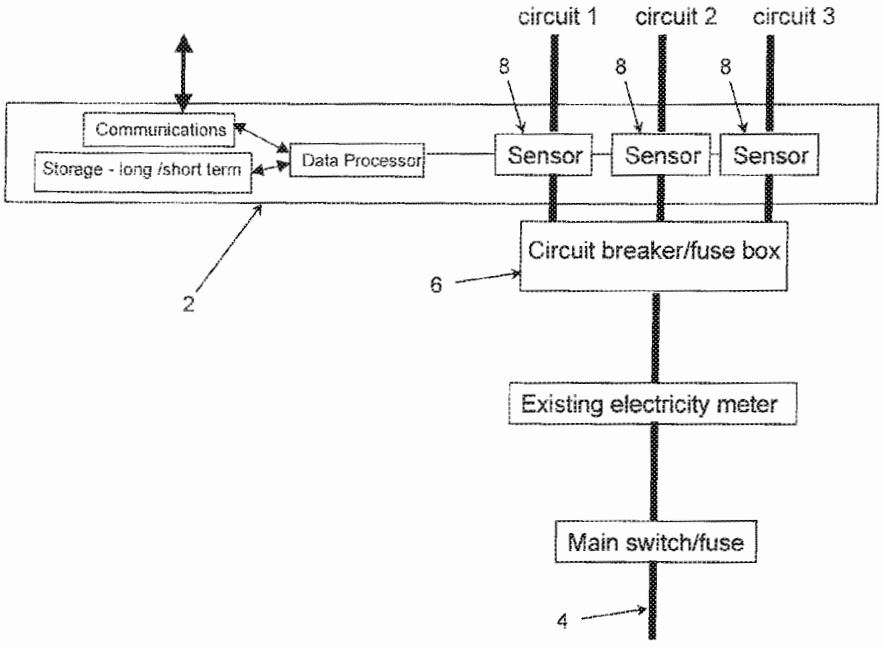

circuit 1
circuit 2
circuit 3
8
8
8
Communications
Storage - long /short term
Data Processor
Sensor
Sensor
Sensor
2
6
Circuit breaker/fuse box
Existing electricity meter
Main switch/fuse
4

Figure 2

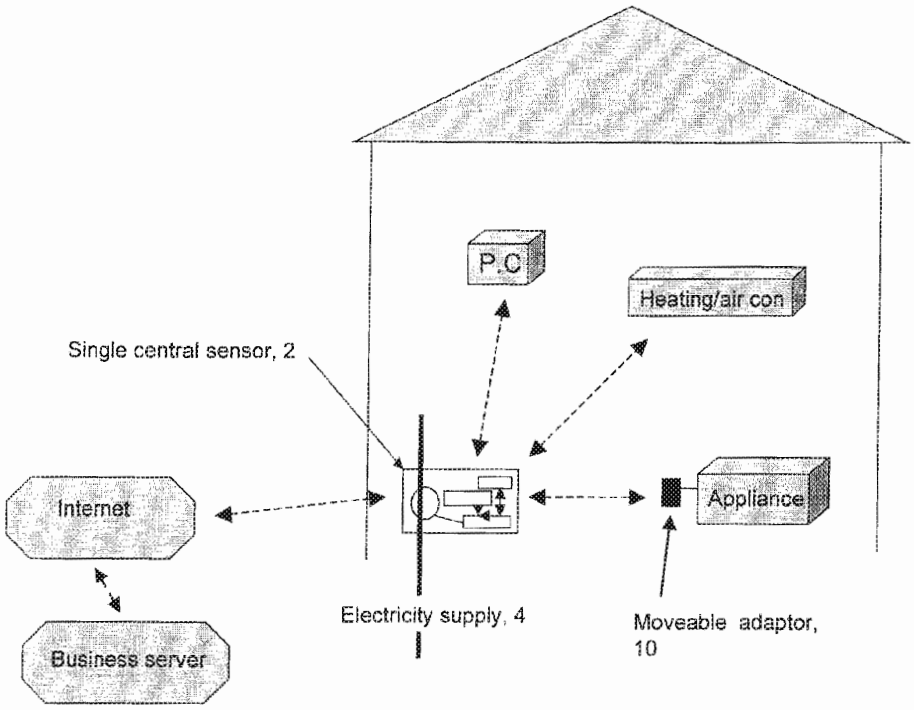

P.C
Heating/air con
Single central sensor, 2
Internet
Appliance
Business server
Electricity supply, 4
Moveable adaptor, 10

Figure 3

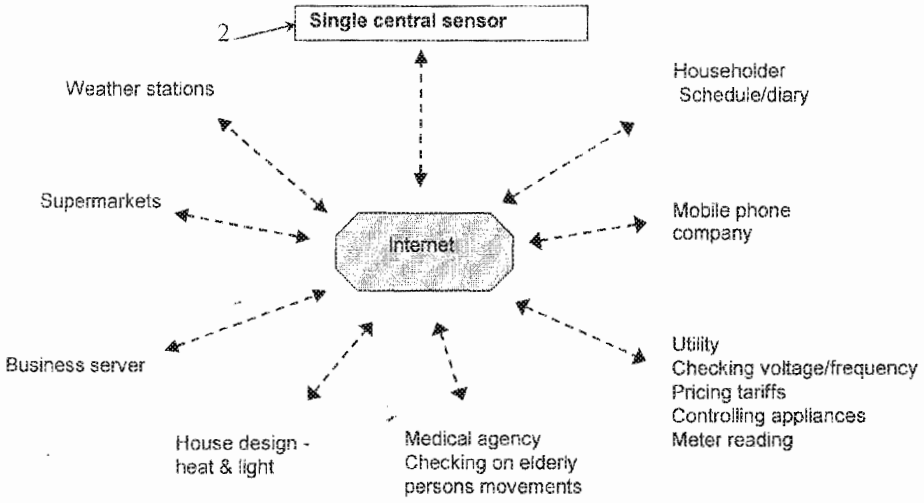

2
Single central sensor
Weather stations
Householder
Schedule/diary
Supermarkets
Internet
Mobile phone
company
Business server
Utility
Checking voltage/frequency
Pricing tariffs
Controlling appliances
Meter reading
House design -
heat & light
Medical agency
Checking on elderly
persons movements

Figure 4

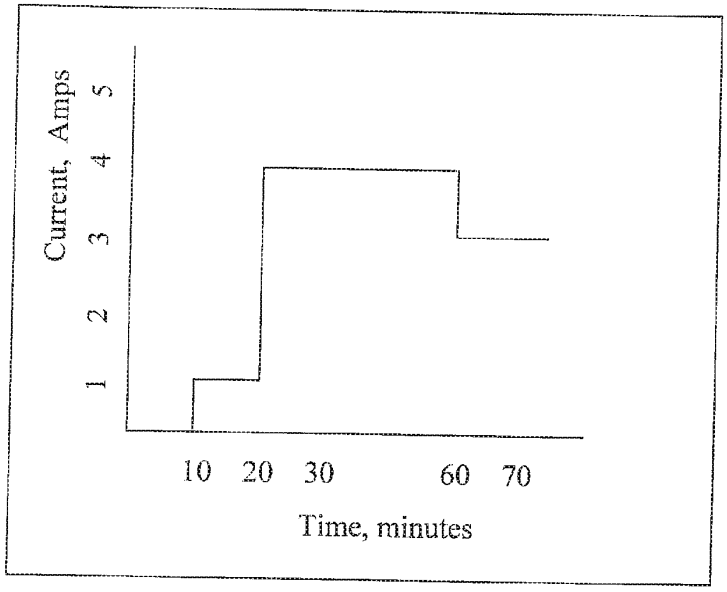


Figure 5

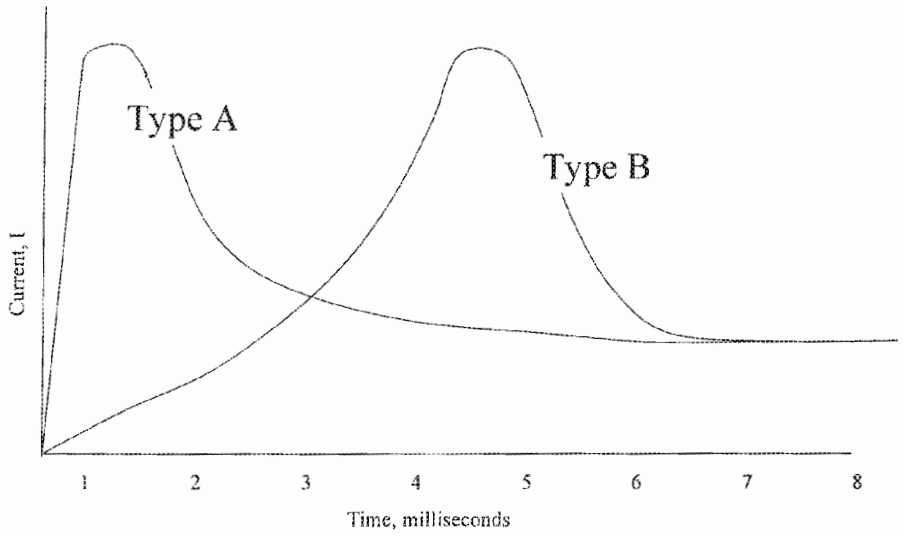


Figure 6

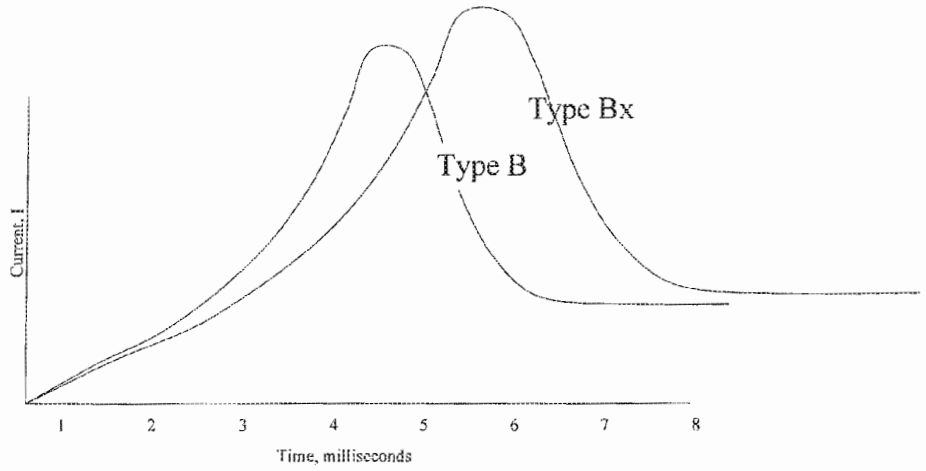


Figure 7

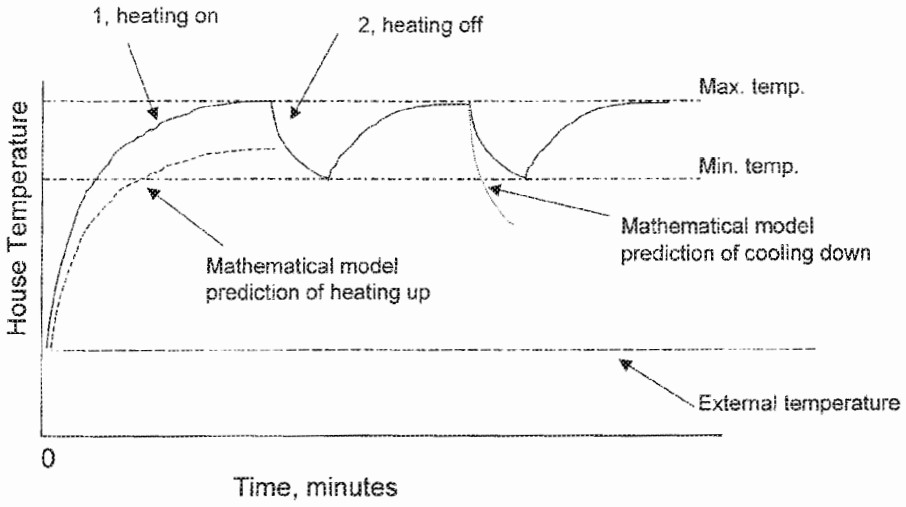

1, heating on
2, heating off
Max. temp.
Min. temp.
House Temperature
Mathematical model prediction of cooling down
Mathematical model prediction of heating up
External temperature
0
Time, minutes

Figure 8

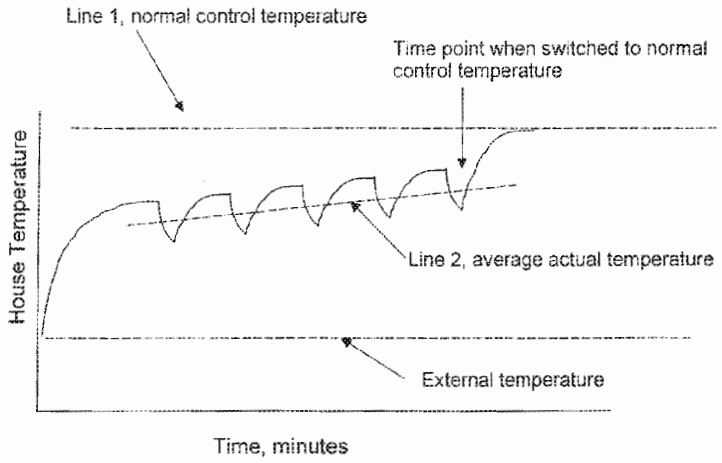

Line 1, normal control temperature
Time point when switched to normal control temperature
House Temperature
Line 2, average actual temperature
External temperature
Time, minutes

Figure 9

TITLE

Household energy management system

DESCRIPTION

Technical field

The invention relates to the field of household energy management and in particular to ways in which the behaviour of the occupants of a house, the thermal properties of the house and the operation of household appliances can be measured and modelled, in order to control the household appliances in a certain way or to recommend courses of action to the users of the system such that energy use by the household is made more efficient.

Throughout this specification, the words "house" and "household" are used for convenience but those words are not to be interpreted as limiting the scope of the invention to the context of separate, domestic dwellings. Among other things, the word "house" is intended to include within its scope an apartment, an office, a hotel room or a part of any of the aforesaid.

Background of the invention

There have been a number of patents in this field in recent years, which describe new hardware solutions to achieving a computer/Internet-controlled house and provide improved control of the energy consumption in the household.

In general the prior art in the computer-controlled house control uses several electricity sensors (one per appliance/wall socket) to monitor the electrical activities in a house. This large number of additional devices is complicated and costly. By basing the system on a single sensor it would be more suitable for retrofitting to existing houses with existing appliances.

US patent 5572438 by Ehlers describes a house system, which uses a first and a second microcomputer to monitor and control the energy in the household. The patent mainly describes the hardware required to deliver the improvements – microcomputer, current

sensors, appliance control and communication links to the outside world. The system requires a current sensor on each appliance. The hardware requirements for this system seem excessive and expensive to retrofit into an existing household.

US patent application 2003/0050737 by Osann describes another arrangement of hardware, which suggests changing all or several of the electrical wall sockets within the house. It includes suggestions of including video cameras, intercom, and motion detector and temperature sensor in each of these replacement wall outlets. This appears an excessive use of technology with an extensive requirement for hardware and installation work by skilled electricians. Many of these features will not be valued by householders who are happy to not have video cameras in the house. The main financial saving to the householder is through improved temperature control and the additional systems seem excessive. However, the patent application does describe (in claims 81 and 82) a method whereby all of the house electrical current changes can be monitored from a single location in or near the circuit breakers. This seems a much simpler and cheaper approach, which will suit retrofitting of existing houses. However, this idea can be used more effectively with further analytical/mathematical tools run on a computer and with additional moveable adaptors to which it can communicate, as described herein.

An electronic control system for a house is currently on sale from Honeywell Controls under the registered trade mark Hometronic. The system is described on their web site at *http://content.honeywell.com/uk/press/hometronic_dayinthelife.htm*. The Hometronic system uses a single central controller to determine on and off times for appliances and heating appliances around the house. It can connect to the Internet and be controlled via the web from anywhere in the world. However, it relies on one control device being attached to one appliance to provide on/off control and this makes it an expensive system to retrofit.

US patent 5115967 describes a mathematical method of predicting the transient thermal behaviour of a house climate control system (heating/cooling system).

It is already known to use infrared sensors to determine occupancy in the house and to use this information to control house energy systems. An example of this is given in US patent 6324008.

US patent application 2002/0095269 discloses an appliance monitoring system, in which a subsystem incorporated in each appliance monitors parameters such as the number of cycles and the energy consumption of the appliance. In the event that the appliance needs attention, the system alerts the user or a service centre.

Microchip Technology Inc is a supplier of microchips. They have posted an article entitled "Microchip watt-hour Meter using PIC16C923 and CS5460" on their web site at *http://www.microchip.com/1010/suppdoc/appnote/all/an220/index.htm* on how to use one of their chips to make a watt hour meter. The power measurement integrated circuit CS5460 from Cirrus Logic/Crystal Power Measurement is used with the microcontroller PIC16C923 to make a power meter. The CS5460 measures the instantaneous voltage and current four thousand times a second and uses these measurements to compute instantaneous power, V_{RMS}, I_{RMS} and accumulated energy. Once the accumulated energy has increased by 10 Watt.seconds a pulse is generated at the output pin (EOUT pin) for counting by another device to form a consumption meter. The article explains how to use this device to record total power consumption.

Summary of the invention

In a first aspect, the invention provides a household energy management system comprising at least one sensing means, which measures energy use by occupants of the house; a modelling means, which uses the energy measurements from the sensing means to build a model of the behaviour of the occupants; and a control means, which controls the operation of one or more household appliances in the house on the basis of the model.

The modelling means may build a predictive model of the pattern of behaviour of the occupants over time, in which case the predictive model may be continually refined in response to new measurements by the sensing means.

A model of the predicted behaviour of the occupants of a house allows more efficient use of the appliances in the house. For example, the predictive model may predict the times when the house will be occupied in order for the control means to control the operation of one or more household appliances, such as heating or cooling appliances, on the basis of the predicted times when the house will be occupied.

Additionally, or alternatively, the modelling means may build a temporary model of the current behaviour of the occupants.

A model of the current behaviour of the occupants of a house also allows more efficient use of the appliances in the house. For example, the temporary model may allow the control means to control the operation of heating or cooling appliances to achieve a desired temperature according to the current level of activity of the occupants.

The model of the behaviour of the occupants may include a determination of whether the house is occupied. To assist in this, the modelling means may have an interface with an intruder alarm system in the house and may receive signals indicative of the location of the occupants derived from, for example, a mobile phone network or a global positioning system. In a further enhancement, the modelling means can use the location signals to predict when the occupants may return to the house.

One application of the behaviour modelling means is to trigger an alert when an unexpected pattern of behaviour is detected. For example it may warn when an elderly person becomes immobile or when activity is detected in the house while the occupants are away.

Preferably, the sensing means measures electrical activity within the house. The sensing means may comprise a moveable sensor for location between an electricity supply outlet and an individual electrical appliance to measure the energy use by that appliance; or a fixed sensor on the household electricity supply to measure the respective energy uses of

a plurality of electrical appliances connected to the supply. The optimum combination is one fixed sensor and a few moveable sensors, as described below.

In a second aspect, the invention provides a household energy management system, comprising one or more temperature sensors for measuring the temperature inside the house; a source of information about the temperature outside the house; a modelling means, which uses the inside and outside temperature measurements to derive a transient thermal model of the house, which can predict changes in the inside temperature on the basis of the information about the outside temperature; means for comparing the derived transient thermal model with a reference transient thermal model; and means for warning a user of the system when the derived model differs from the reference model by more than a predetermined limit.

The temperature sensor inside the house may be a thermostat or other temperature control device forming part of the household heating system; and it need not send temperature readings continuously to the household energy management system but may, for example, only inform the energy management system when the inside temperature has reached a value at which heating or cooling appliances are switched on or off.

The transient thermal model may additionally make use of information about the wind speed and/or humidity outside the house. As the source of the information about the outside temperature and/or wind speed and/or humidity, the system may comprise one or more sensors outside the house or it may comprise means for receiving broadcast weather information. The weather information may be broadcast as part of a radio or television signal or via a cable or telephone link or, preferably, over the Internet.

If the reference transient thermal model is a standard model for the type of house in which the system is installed, then the warning means can warn the user that the thermal properties of the house are poor relative to similar houses.

If the derived transient thermal model is periodically updated, then the reference transient thermal model may be a derived transient thermal model for the same house from an earlier period, whereby the warning means can warn the user that the thermal properties of the house are deteriorating.

The modelling means may also be responsive to the operation of heating or cooling appliances in the house, whereby the warning means can warn the user of poor or deteriorating performance of the appliances and may automatically summon an engineer to repair the appliances. For example, the system can identify the optimum time for boiler maintenance by comparing the boiler's heating ability with its specification or with its past performance.

A further use of the transient thermal model is to provide a basis for a control means to control the operation of heating or cooling appliances in order to achieve a desired temperature in the house at a given time, using the minimum amount of energy or, if the cost of energy varies during the day, the cheapest amount of energy. Thus the system can determine when the house heating or cooling needs to come on to meet the desired temperature at the given time, rather than always turning on the heating at a fixed, programmed time.

The control means can also be used to switch the heating or cooling appliances periodically on and off at intervals determined in accordance with the transient thermal model to maintain the temperature in the house within a desired range, without the use of a thermostat.

In a third aspect, the invention provides a household energy management system, comprising at least one sensor on the household electricity supply for measuring the instantaneous total power delivered by the electricity supply; means for identifying electrical appliances connected to the supply on the basis of their respective start-up characteristics when the appliances are switched on; means for comparing the sensed start-up characteristics with reference characteristics; and means for warning a user of the

system when the sensed characteristics differ from the reference characteristics by more than a predetermined limit.

The comparison means may further compare operating characteristics and/or shut down characteristics of the appliances with corresponding reference characteristics.

The system may further comprise means for recording the total time of operation and/or the number of cycles of operation of each appliance, which can be compared against a database of lifetime expectancy and reliability for different appliances. The database may be a local database, internal to the system, or a shared database, accessed via an external network. In the case of a shared database, means are preferably provided for updating the shared database with measured lifetime and reliability data for appliances connected to the system.

The system may further comprise modelling means receiving signals from the comparison means and from the database in order to recommend to the user of the system a program of maintenance or replacement of the appliance.

A household energy management system in accordance with the invention, which monitors the energy consumption of household appliances, can also act as an electricity meter and may indicate the electricity consumption reading to the householder or transmit the reading directly to the electricity provider. If the system is networked to the electricity provider, then the provider can inform the system of changing electricity prices. The system may simply inform the user of these prices or it may be programmed to control household appliances so as to minimize the energy costs to the householder. For example, it may be more cost-effective to increase the background temperature of the house by operating electrical heating appliances at a time of day when electricity is relatively cheap in order to reduce the amount of heating required when demand is at its peak. Alternatively, the electricity provider may be given direct control of the electrical heating appliances.

Similarly, if the system is networked to a gas supplier, then the supplier can inform the system of changing gas prices. The system may simply inform the user of these prices or it may be programmed to control household gas appliances, such as a gas-fired central heating boiler, so as to minimize the energy costs to the householder. Alternatively, the energy management system or the gas supplier itself may be given direct control of the gas supply via an electrically-operated gas valve.

Methods of operating a household energy management system in accordance with the first, second and third aspects of the invention are also provided.

The modelling functions associated with any of the aspects of the invention may be carried out locally, by computing means provided as part of the system within the house; or remotely, by external computing means accessed via a telecommunications network.

The system allows for standard appliances to be used. Intelligent appliances containing communications and minicomputers can be included but are not essential for this invention. The invention concentrates on using electrical sensors external to existing appliances and linking this to powerful analytical mathematical modelling.

The overall system benefits include:

- Reduced energy consumption.
- Improved householder comfort.
- Improved maintenance and utilisation of expensive capital appliances in the house.
- Reduced cost to the householder through improved energy tariffs.
- Recommending energy saving measures to the householder based on actual measurements of the householder's behaviour, the thermal efficiency of the house and the operational efficiency of household appliances.

The drawings

Figure 1 shows a first way of installing a single central sensor in accordance with the invention into a household electricity supply.

Figure 2 shows a second way of installing a single central sensor in accordance with the invention into a household electricity supply.

Figure 3 shows the communication links between the single central sensor and the other parts of the system according to the invention.

Figure 4 shows various Internet services to which the system according to the invention may link.

Figure 5 illustrates how the current in a household electricity supply may vary with time.

Figure 6 illustrates the current start-up characteristics of two household appliances

Figure 7 illustrates how the start-up characteristic of an appliance may change over time

Figure 8 shows how a transient thermal model in accordance with the invention may be revised.

Figure 9 shows how a transient thermal model in accordance with the invention may be used to control temperature with no feedback.

Description of preferred embodiments

A typical system

Consider a system, which uses a single central sensor to monitor the flow of electricity into the house. It records/analyses the data in great detail – not only on a minute by minute basis but also the instant an appliance is turned on it analyses the starting current in detail over milliseconds. In this way it determines which appliance has been turned on and how long it has been on for and at what time of day it has been used. It builds mathematical models of:

- All appliances used in the house and their pattern of use
- The house's transient thermal behaviour under heating and cooling conditions

The system is intended not just to monitor the electrical system or the gas heating system but to link the monitoring of gas and electricity together to allow a whole system understanding to be achieved and provide better optimisation of the total energy use within the house. For example, sudden changes in electrical activity can indicate that the

householder has returned home early from work and elicit a heating response within the controller to increase the house temperature.

These sensors include not only a single central sensor at the point of entry of electricity to the house but also adaptors, which plug into standard wall sockets. The adaptors allow the collection of detailed information and control the appliances they are connected to.

The analysis is performed on computers either local to the house or on the Internet. Communications between the various system items use standard known communication systems i.e. phone, radio, Internet or communication by power cable.

The single central sensor (Figures 1 and 2)

The single central sensor 2 shown in Figure 1 is connected between the electric power cable to the house 4 and the house circuit breakers/distribution board 6, or in other words at the electrical point of entry to the house. The sensor 8 is used to monitor multiple devices. In more advanced versions, greater resolution may be possible by locating a sensor on each ring main out of the electricity meter, as shown in Figure 2.

The single central sensor 2 monitors the electrical power feeding into the house (e.g. current, voltage and power factor), stores appropriate data and analyses the data to determine what is happening with the house's appliances and with the occupants. The single central sensor 2 contains electronic computing capability including storage (long and short term), processing power, battery back up (not shown) and communications capability with the wider network and local devices.

Communications (Figures 3 and 4)

Existing communication methods will be used with the system to allow communication between all parts of the system including Internet servers, databases of information, the single central sensor 2, the moveable adaptors 10, the householder's personal computer and the householder's mobile phone etc, as shown in Figure 3. These existing communication methods include the well-known methods of linking by telephone, radio,

cable and communications by power cable. The system designer will simply use the most appropriate available technology to achieve the communication required. Figure 4 illustrates in more detail the type of information that may be sent to and from the system over the Internet, as well as the sources and recipients of that information.

Stored data

The data acquired will be stored on a database. This will include data of appliance characteristics, times appliances are on and off and derived data. It can be stored either within the house in some form of small computer, perhaps as part of the single central sensor 2, or on a more powerful server on the Internet-based network of computers.

Monitoring appliance use (Figures 5 and 6)

The system can determine the starting and stopping of appliances used in the house by monitoring the magnitude of current step changes. Consider the example shown in Figure 5. At time 10 minutes an electric light of current 1 Amp is turned on. Ten minutes later a heater of 3 Amp rating is turned on and at time 60 minutes the electric light is turned off. At this point in time the system knows that the light has been on for 50 minutes and knows its power and can therefore calculate the energy consumed by the light (kW.h). At the end of the day the system is able to summarise how much energy each of the house's appliances has used during the day. This can be provided as a summary to the householder such as on a web page or email.

The actual type of appliance started can be determined by analysing the start-up characteristics. As shown in Figure 6, some appliances have quicker response characteristics than others. Type A and Type B have similar final operating currents but they differ in start-up characteristic. Type A has a quick peak in current, suggesting that it is a resistive load like a light bulb, which has a low resistance when cold but this resistance increases once it is hot and consequently the current falls. Type B takes longer to reach its peak current, perhaps indicating that it is a motor with a magnetic reluctance rather than a resistance and a starting inertia quite different to the type A appliance. The system can recognise the appliances by comparing them to a pre-programmed store of

characteristics, which are loaded on the single central sensor 2. These signature characteristics will be pre-programmed into the single central sensor 2 before installation in the house, so it can recognise what is being turned on and off. Alternatively the system can learn the signatures during use.

It will be possible to teach the system to recognise a new appliance if it is not immediately recognised from the data bank of known appliances. For example, if the householder starts using an old valve-driven radio which is not previously known, the single central sensor system may identify that an 'unknown appliance' has been used and email the householder asking what the appliance is. By replying, the householder will teach the system to recognise the valve radio for next time. This new characteristic can be used by the householder's system and also sent electronically to the other single central sensors on the Internet network for use in other houses.

Clearly a householder will use some appliances of identical power rating and very similar start up characteristic such as similar light bulbs. The single central sensor has two ways to address this issue. It can determine the difference by noticing small differences in start-up characteristic which arise from small changes in reluctance and resistance due to cable length differences or it can make a best approximation to what is happening in the house. Any approximation will lead to some uncertainty and error, however few appliances are exactly identical and so the error will be small. Alternatively moveable adaptors 10 can be used between the appliance and the fixed wall outlet. These are explained in more detail below.

New versions of control software can be sent to the single central sensor 2 through the network communications.

Initiating the system

On first installing the system it may be best if the householder runs through an initiation sequence whereby each appliance is turned on and off in a predefined sequence. For example, the householder might be asked to follow the following initiation sequence:

- Turn all household appliances off
- Turn all appliances in Bedroom 1 on
- Turn all appliances off
- Bedroom 2 all on
- Turn all appliances off
- Bedroom 3 all on
- Turn all appliances off
- Kitchen all on
- Turn all appliances off
- Living room all on
- Etc

This method allows the system to learn in which room each appliance is kept. For example the 30W radio might be in Bedroom 1. This helps communications between householder and computer if the location of appliances is known. An initiation sequence like this is already described in US Patent application 2003/0050737.

The householder will be able to access data records of appliance use and so will be able to inform the system of the whereabouts of any appliances that the system cannot directly deduce. So for example if the householder can see that the system did not correctly identify that a TV had been moved from the lounge to bedroom 1 the householder will be able to update this over the Internet interface (standard HTML web pages with radio buttons etc).

Alternative way to teach the system to recognise appliances

An alternative way to teach the system to recognise appliances is to include at least one moveable adaptor 10 as part of the system. This is an adaptor which fits between the appliance power plug and the fixed wall outlet.

It may contains electronics that allow it to measure the current flowing into the appliance, in much the same way as the single central sensor 2 and communicate this to the single central sensor.

Alternatively, the moveable adaptor 10 may just include a transponder, which sends a simple signal to the single central sensor 2 informing it that current is flowing. In this way the single central sensor 2 can associate any transponder signals from the adaptor 10 with the instantaneous changes in household current already detected by the single central sensor 2.

The moveable plug adaptor 10 will help with identification of identical appliances. For example, if two appliances are turned on at the same instant in time it may become difficult to determine what has happened. In general this can probably be ignored, as it is unlikely that appliances will turn on over the same millisecond and any errors introduced in this way will be a small part of the total electrical consumption.

However it may be prudent to use an adaptor 10 with high consumption appliances so that more detailed data can be provided to the system. If, for example, a washing machine were fitted with one of these then the adaptor 10 would signal when current flows through it and the single central sensor 2 would know the difference between this appliance and other general appliances being turned on in the house.

The adaptor 10 could also be used to turn on and off the appliance, whereby the system could manage the appliance to run at night when electricity is cheaper.

A further advantage of the moveable adaptor 10 is that it can be moved to a different wall outlet. For example, if the system recognised and learned the behaviour of a refrigerator at the first outlet it could email the householder and request the householder to move the adaptor to a new outlet. The message might read: *'At 18:06 this evening an appliance was turned on of 60 watts and the system can not determine what it is. Please move Mobile Adaptor 3 from current location on refrigerator to the outlet socket using this*

appliance and allow the system to learn the characteristics of this appliance. Thank you-- Click here if you do not want another email reminder of this event.'

Eventually the householder may settle on having a few of these mobile adaptors 10 in the house, some of which are permanently connected to important appliances and are used to monitor and control these appliances directly. The remainder of these moveable units 10 may be moved around the house at the discretion of the householder and in sympathy with requests from the networked control system.

Another advantage of using a moveable adaptor 10 is that it could recognise which appliances use significant electricity even when turned off or in standby mode. It is common for household appliances to use built in transformers, which use considerable energy heating the transformer even when the appliance is effectively turned off. The adaptor will inform the central monitor of power at all times and the system can then recognise that the appliance is consuming whilst in standby mode and send an email to the householder recommending that the appliance be disconnected from the mains when not in use.

Whenever the householder buys a new appliance he would be best advised to connect it with an adaptor 10 for the first few days of operation so that the system can learn the start and stop characteristics of the appliance. This allows the system to evaluate the consumption rate of the appliance and email recommendations to the householder such as above.

The adaptor 10 could be fitted with additional devices to provide location information to the system. For example it could emit a radio signal which is used to triangulate its physical position in space. In this way the central detector could determine the physical location of appliances such as upstairs, 3 metres north, 1 metre east. In this way a detailed map of both the appliances and the location of a householder using an appliance can be pinpointed. This all helps to populate a detailed appliance database and improve communication between the system and householder.

By having a mobile adaptor 10 and rotating it between electrical sockets, the system can use fewer special adaptors than the prior art systems which have permanently fixed adaptors.

Behaviour pattern analysis

Analysing the stored data can provide information on the householder's patterns of behaviour. It will be possible to observe patterns of behaviour over a weekly basis. For example, the system can notice that every Tuesday the television is switched on at the same time of day and notice on Fridays that the householder gets home 2 hours later than on other workdays. Having detected these patterns of behaviour, the system can alter the control of appliances to provide improved comfort and cost to the householder. This is particularly useful in optimising high energy-consuming appliances such as heating and air conditioning. So on the days that the householder is expected home late the system can defer heating the house to its full temperature until just before the householder is expected. Other applications would be to cook or defrost food in anticipation of the householder's arrival, to complete a washing machine cycle at a time when the householder is likely to be available to remove the washing or to record automatically a television programme that the householder regularly watches. The householder would have to agree to this level of autonomous control and would interface with the computer via the communications network either through a web page or through an interface panel within the house.

Instantaneous behaviour analysis

In addition to building a model of the historical behaviour of the occupants of the house, the system can detect the instantaneous behaviour at any one instant and this can be used to modify the energy control parameters.

Appliances are generally turned on when an occupant of the house presses a switch. The system can use this to determine what activity is taking place within the house. At any

one instant in time the behaviour model can probably deduce how many occupants are in the house, where they are and a rough idea of what they are doing. This could be used to

- control the temperature of the room the occupants are in. Other rooms could be heated to a lower temperature (if individual room temperature control is available).
- recognize a sudden change of behaviour such as an unexpected reduction in activity of an elderly or infirm person. The change in behaviour pattern can be used to email a warning to a nearby relative.

The single central sensor system can alter the control temperature of the house if the householder is obviously active or has gone out. The activity level of the householder can be inferred from the appliances detected within the house. For example, if the householder is using the vacuum cleaner the system might decide to reduce the control temperature within the house until the cleaning has stopped. A reduction in temperature can both reduce the energy consumed by the house and also make the environment more comfortable for the householder whilst they are exercising with the vacuum cleaner. On the other hand, if the system knows that only one person lives in the house and has noticed that the TV is switched on, it may be reasonable to deduce that the householder is static and a slight increase in house temperature would be more comfortable. If two people are in the house then a gated logic decision is required in the control functions to ensure the warmest state is chosen (e.g. the temperature is warmed for a static person even if other one is using the vacuum cleaner)

Alternatively, if the burglar alarm is set, then the system can deduce that all occupants of the house are out and lower the house temperature. A special transponder could be included in the burglar alarm to communicate directly with the single central sensor to inform it that the alarm is set and all occupants are out of the house.

The position and movement of the householder can be noted from the householder's mobile phone and the location detected by the phone network. If the wider system includes access to the mobile phone network then the distance of the householder from their home can be determined and if the householder is far away then the house

temperature can be lowered. For example if the transient model says the house can be heated up to full temperature within 30 minutes and the householder is known to be more than 30 minutes away then the heating system can be turned off completely.

Location information could also be provided based on other monitored activities of the householder. For example, if the householder is using a computer at his/her workplace, then that computer or an Internet service provider could relay the householder's location to the household energy management system. The system could also be networked with other locating systems, such as a congestion charging system that would monitor the location of the householder's car.

In summary, the household temperature can be linked to the activity of the householder and his actual location rather than being linked to a time clock as with current house heating systems.

Meter reading

The system builds up and records detailed energy consumption data and by integrating this over time it can record the total energy (kW.h) used and so become an energy meter. This allows billing information to be sent to the customer and the utility directly over the communications network, as shown in Figure 4.

Not only can the system determine the total energy consumption over the day or week, but it also knows what time of day these units of electricity are used. This enables it to be used by a utility selling electricity to offer the customer variable tariffs during the day or during the week or month. So a customer could chose a tariff arrangement, which gives low price electricity most of the time but very expensive electricity at peak times of demand. This option is already available industrially but is too expensive to meter for small scale domestic users. A customer choosing such a tariff arrangement would save money by getting a better rate for general consumption and as long as consumption is minimised during peak hours would save overall. (It should be noted that in the U.K.'s electricity market, peak hourly electricity prices during the year can reach 100 times

average electricity price and so it would be important for the householder to know when to cut back.)

This variable tariff system could become quite sophisticated offering different rates over the course of one day and different rates from day to day. The customer could be kept informed of these tariffs over the Internet interface available through the total networked system or through daily emailed updates of any rate changes.

The system can identify when the householder operates high consumption appliances and may benefit by altering the time of operating these appliances – e.g. turning the washing machine on at a night when electricity is cheaper.

Interaction with energy utility

The system described can be integrated to communicate directly with the supplier of energy. For example a feature can be included, which allows the electricity supplier to turn appliances on and off to smooth the peak demand which occurs on the grid network. The householder would benefit through a price reduction under such an arrangement.

It is also possible to allow the gas supplier to control the gas heating of a house. For example, on the coldest winter days the gas supplier knows that demand is going to peak at its highest level of the year and may not have the capacity to pass enough gas down the pipelines to meet demand. With the proposed system it is possible for the networked houses to have heating turned on a few hours early such that the house is pre-warmed before peak demand time. Although this is likely to increase the total gas consumption it will reduce the peak demand later in the day and has this operational benefit to the gas supplier who can avoid building additional gas transmission pipelines and pumping equipment. The customer can be encouraged to buy into this scheme through improved annual prices.

Monitoring electrical quality

The single central sensor 2 located at the point of electrical entry to the house can be used to monitor the quality of electricity supplied to the building. In this way it can monitor not only total loss of power during power cuts and its duration but also alterations in frequency, brief spikes of power, dips in voltage. This information can be useful to the householder in monitoring the quality of electricity supplied. If the electricity does not meet requirements, the householder has the opportunity of demanding compensation or improvements from the supplier with the evidence provided by the single central sensor 2. Communication could again be achieved through the Internet, such as web page access or email.

Appliance health monitoring (Figure 7)

The system can be used to compare the start-up characteristics of each appliance on a day-by-day basis. In this way the system can monitor the health of the householder's appliances and warn of problems. For example, an electric motor in a washing machine may have a start-up characteristic when new of Type B, as shown in Figure 7. However, the characteristic of the motor will change as the motor ages and the bearings stiffen and the brushes wear. Towards the end of normal life, the brushes may arc and the motor will take longer and/or require more current to reach speed. This can be monitored by the single central sensor 2. The analysis software can detect these changed characteristics (such as a move to characteristic Type B_X) and compare them to known acceptable behaviour. If the appliance falls outside predetermined limits then an alarm (e.g. an email/text message) can be sent to either the householder or a maintenance technician who can arrive and fix the motor before it fails. Early warning like this provides the householder with preventative maintenance, which reduces the inconvenience and cost of unexpected failures.

The single central sensor could monitor for arcing across the brushes of a motor and to include this function it would monitor for electrical noise during continuous operation, and not just the motor start-up characteristics.

The system will be able to carry out optimisation calculations and recommend to the householder whether an appliance is worth repairing or is best replaced. For example, it may calculate that the washing machine, which is about to fail, has a high probability of further failures (based on a database of typical failure rates). It may find that the cost of two repairs in succession combined with say improved energy consumption of the latest appliance would mean that the householder would be best to replace the appliance rather than repair it. An appropriate message can be sent to the customer with or without an option to buy a replacement appliance through the system. This sort of calculation could be quite detailed including interest rates, probability of failure rates and details on spare parts costs, a database of known appliances and their life expectancies. It offers an online optimisation cost calculation, which is not currently feasible to a householder.

A further appliance health monitoring method is available through counting the number of cycles and hours of operation an appliance has completed. In this way any appliance can be monitored for life consumed and an estimate made of remaining life based on a database of typical expected lifetimes for appliances such as fridges, freezers, cookers or heating boilers. This database could even include model specific data for improved accuracy.

Over time the networked system would learn by itself and build its own life expectancy databases from its own data. This database would be useful as a way of evaluating the value of different appliances and recommending longer-lived appliances for householders to buy.

Transient thermal model

A transient thermal model of the house can be generated and validated by the system. It can be used to:

- Determine when the heating should be turned on and off and so optimise the use of the heat consumed.
- Carry out health monitoring of the heating/insulation systems and recommend maintenance actions.

- Compare the house to other houses or standard models of average houses

A transient thermal model of the house heating is a mathematical model of the house heating characteristics including terms for the steady state heat loss and also terms for its transient thermal performance. For example, a heavy, brick built house will take longer to heat up and cool down than a lightweight, wooden/fibreboard construction and terms in the mathematical model are included for mass, thickness and specific heat of materials etc.

Terms in the thermal model would include:

- Heat transfer coefficient inside house.
- Heat transfer coefficient outside house – terms including effect of wind, rain, humidity etc.
- Temperature inside.
- Temperature outside.
- Materials of construction including thickness, thermal insulation qualities, mass, specific heat.
- Wind resistance of apertures such as doors and windows.

These parameters can be estimated at first from the householder informing the system of the age of house and its type of construction. From then on the model will measure the actual response of the house to varying thermal conditions and adapt the mathematical model until a good fit is obtained between actual response and mathematically modelled response. This is illustrated in Figure 8.

At time 0 the heating is turned on and the actual temperature rises (as shown by Line 1) until it reaches the control temperature at its peak and the heating is turned off. From here the temperature falls according to Line 2 until the minimum temperature is recorded and the heating is started up again. By sensing the electrical operation of heating controls such as a thermostat or gas valve, the single central sensor 2 will detect the time points when the maximum and minimum temperatures are reached and it can compare the actual

times to the mathematically predicted response. Differences in these two will demand the software changes the coefficient terms in the model until the best fit with all known data is achieved. For the first few days the system may be inaccurate, but later once a larger database of known heating and cooling times is known the mathematical model will become increasingly accurate.

The system can use network data to improve validity. For example it can be informed of local weather from existing Internet weather databases which have weather information from nearby weather stations.

Improved heating control

In traditional systems the householder uses a time controller to define when the heating (or air conditioning) should turn on and off. With the use of the transient thermal model, the householder can now define when the house is to reach the controlled temperature schedule rather than when to start heating. This allows the single central sensor system to calculate the optimum time to turn on. For example, say the householder returns home at 17:30 in the evening and wants the house at the desired temperature at 17:30. The system can use the transient model to calculate the time it will take to reach the desired temperature: on a cold windy day this might be 1 hour and on a mild day it might be 30 minutes. In this way the heating system is turned on for the minimum time and the house consumes the minimum heat energy.

Control to a lower temperature than the thermostat set temperature (Figure 9)

The transient thermal model can be used to provide a crude control system without referring to the house thermocouple temperature sensor. This would allow the system to control to a reduced temperature (Line 2) without alteration to the existing thermostat fitted to an existing house heating system, which is set at a higher temperature (Line 1). Figure 9 shows how this would happen. The transient model would be used to determine how fast the house heats up and cools down and the heating appliance (such as a gas boiler) would be turned on and off in response to the mathematical prediction of internal temperature in order to maintain the temperature close to a desired average. This does not

require a house thermocouple for feedback, which means it would have a tendency to drift in temperature, as seen in the slope of Line 2 in Figure 9. This is unacceptable in the long term but may serve for short periods when temperatures below the house thermostat set point are required.

Thermal efficiency monitoring

The validated thermal transient model can be used to compare the house to national house norms. In this way the thermal characteristics of the house can be compared to acceptance limits and weaknesses in the house thermal characteristics can be identified and remedied. For example the system may notice that the house cools down unusually quickly on windy days and yet has a normal cooling characteristic under still air conditions. This will indicate that the house is susceptible to wind and is therefore draughty. An email could be sent to the householder or maintenance contractor to investigate and remedy the situation.

Each of the terms in the thermal transient model can be compared in this manner and the house can be evaluated including the specific heat properties of building materials. Energy saving measures that are recommended in this way are thus based on actual measurements of the house characteristics, rather than generic recommendations which are given to all householders.

Heating health monitoring

The transient thermal model can be used to determine the operational health of the heating system within the house. As explained previously, the system will continuously adjust coefficients within the transient thermal model to ensure it aligns with the true house thermal response. Over months of operation, these coefficients will drift as the thermal characteristics of the house worsen with age. This will be most noticeable with a heating boiler as it becomes fouled through use – the house will begin to take longer to heat up. This gradual drift in characteristics can be used to monitor the degradation of the heating boiler and when a predetermined limit is met then maintenance action can be recommended to the householder or service provider. This active monitoring of boiler

health will provide the householder with more optimal expenditure on maintenance, rather than just maintaining the boiler annually when it may still be in good condition.

It may be thought that a simpler health monitoring system would be to just monitor the time it takes for the house heating to reach temperature, without the use of the transient thermal model. However such a simple system makes no allowance for the changes in weather conditions that occur. By using the transient thermal model as the basis, changes in weather are automatically accounted for within the model leaving just deterioration in boiler efficiency as the remaining explanation for deteriorating performance.

On a system where the single central sensor 2 has difficulty detecting changes such as the electrically powered gas valve opening on the gas boiler, a special house thermostat that communicates with the single central sensor 2 can be used. This thermostat acts as a normal house thermostat – switching open and closed as the temperature rises and falls through set limits. However, it communicates this to the single central sensor 2 so that the system can still determine when temperature limits are reached and the transient thermal model can still be aligned with the real thermal response.

Managing the system

The system described is capable of making decisions for the householder on a minute by minute basis. Initially it will do this in a pre-programmed way – making assumptions about house temperature and timings that are best estimates. However, the system needs a method of improving, learning and adapting to the particular householder's preferences. The householder can do this by informing the system as to whether the result is acceptable. For example, if the householder finds the temperature one day to be too cool in the morning, the householder could open a web page interface window on the system's Internet interface and click appropriate pages to instruct the system that the wrong response was achieved. The more this is done the more the system will adapt to the actual preferences of the user.

CLAIMS

1. A household energy management system, comprising:

at least one sensing means, which measures energy use by occupants of the house;

a modelling means, which uses the energy measurements from the sensing means to build a model of the behaviour of the occupants; and

a control means, which controls the operation of one or more household appliances in the house on the basis of the model.

2. A household energy management system according to claim 1, wherein the modelling means builds a predictive model of the pattern of behaviour of the occupants over time.

3. A household energy management system according to claim 2, wherein the modelling means continually refines the model in response to new measurements by the sensing means.

4. A household energy management system according to claim 2 or claim 3, wherein the predictive model predicts the times when the house will be occupied and the control means controls the operation of one or more household appliances on the basis of the predicted times when the house will be occupied.

5. A household energy management system according to claim 4, wherein the control means controls the operation of heating or cooling appliances to achieve a desired temperature when the model predicts that the house will be occupied.

6. A household energy management system according to claim 5, wherein the control means controls the operation of the heating or cooling appliances in such a way as to minimize the amount of energy used to achieve the desired temperature.

7. A household energy management system according to any preceding claim, wherein the modelling means builds a temporary model of the current behaviour of the occupants.

8. A household energy management system according to claim 7, wherein the control means controls the operation of heating or cooling appliances to achieve a desired temperature according to the current level of activity of the occupants.

9. A household energy management system according to any preceding claim, wherein the model of the behaviour of the occupants includes a determination of whether the house is occupied.

10. A household energy management system according to claim 9, wherein the modelling means has an interface with an intruder alarm system in the house and uses signals received from the intruder alarm in its determination of whether the house is occupied.

11. A household energy management system according to claim 9 or claim 10, wherein the system receives signals indicating the location of the occupants when they are not in the house and wherein the modelling means uses the location signals in its determination of whether the house is occupied.

12. A household energy management system according to claim 11, wherein the modelling means further uses the location signals to predict when the occupants might return to the house.

13. A household energy management system according to claim 11 or claim 12, wherein the locations of the occupants are determined by a mobile telephone network or by a global positioning system.

14. A household energy management system according to any preceding claim, further comprising alerting means, which trigger an alert when an unexpected pattern of behaviour by the occupants of the house is detected.

15. A household energy management system according to any preceding claim, wherein the sensing means measures electrical activity within the house.

16. A household energy management system according to claim 15, wherein at least one sensing means comprises a moveable sensor for location between an electricity supply outlet and an individual electrical appliance to measure the energy use by that appliance.

17. A household energy management system according to claim 15 or claim 16, wherein at least one sensing means comprises a fixed sensor on the household electricity supply to measure the respective energy uses of a plurality of electrical appliances connected to the supply, the sensor comprising means for measuring the instantaneous total power delivered by the electricity supply and means for identifying the appliances on the basis of their respective start-up characteristics when the appliances are switched on.

18. A household energy management system, comprising:

one or more temperature sensors for measuring the temperature inside the house;

a source of information about the temperature outside the house;

a modelling means, which uses the inside and outside temperature measurements to derive a transient thermal model of the house, which can predict changes in the inside temperature on the basis of the information about the outside temperature;

means for comparing the derived transient thermal model with a reference transient thermal model; and

means for warning a user of the system when the derived model differs from the reference model by more than a predetermined limit.

19. A household energy management system according to claim 18, further comprising a source of information about the wind speed and/or humidity outside the house, which is used by the modelling means to derive the transient thermal model of the house.

20. A household energy management system according to claim 18 or claim 19, further comprising one or more sensors outside the house, which are the source of the information about the outside temperature and/or wind speed and/or humidity.

21. A household energy management system according to any of claims 18 to 20, further comprising means for receiving broadcast weather information, which is the source of the information about the outside temperature and/or wind speed and/or humidity.

22. A household energy management system according to any of claims 18 to 21, wherein the reference transient thermal model is a standard model for the type of house in which the system is installed.

23. A household energy management system according to claim 22, wherein the warning means warns the user that the thermal properties of the house are poor.

24. A household energy management system according to any of claims 18 to 21, wherein the derived transient thermal model is periodically updated; and wherein the reference transient thermal model is a derived transient thermal model from an earlier period.

25. A household energy management system according to claim 24, wherein the warning means warns the user that the thermal properties of the house have deteriorated.

26. A household energy management system according to claim 24 or claim 25, further comprising means for informing the modelling means when heating or cooling appliances in the house are operated, whereby the modelling means models the thermal

response of the house to operation of the appliances and whereby the warning means warns the user of poor efficiency or deteriorating efficiency of the appliances.

27. A household energy management system according to claim 26, wherein the warning means further comprises signalling means for summoning an engineer to repair the inefficient appliances.

28. A household energy management system according to claim 26 or claim 27, wherein the means for informing the modelling means when heating or cooling appliances in the house are operated includes sensing means for measuring electrical activity within the house.

29. A household energy management system according to claim 28, wherein at least one sensing means comprises a fixed sensor on the household electricity supply to measure the respective energy uses of electrical appliances connected to the supply, the sensor comprising means for measuring the instantaneous total power delivered by the electricity supply and means for identifying the appliances on the basis of their respective start-up characteristics when the appliances are switched on.

30. A household energy management system according to any of claims 18 to 29, further comprising a control means, which controls the operation of heating or cooling appliances based on the predictions of the transient thermal model, in order to achieve a desired temperature in the house at a given time using the minimum amount of energy.

31. A household energy management system according to claim 30, wherein the control means switches the heating or cooling appliances periodically on and off at intervals determined in accordance with the transient thermal model to maintain the temperature in the house within a desired range, without the use of a thermostat.

32. A household energy management system, comprising:

at least one sensor on the household electricity supply for measuring the instantaneous total power delivered by the electricity supply;

means for identifying electrical appliances connected to the supply on the basis of their respective start-up characteristics when the appliances are switched on;

means for comparing the sensed start-up characteristics with reference characteristics; and

means for warning a user of the system when the sensed characteristics differ from the reference characteristics by more than a predetermined limit.

33. A household energy management system according to claim 32, wherein the comparison means further compares operating characteristics and/or shut down characteristics of the appliances with corresponding reference characteristics.

34. A household energy management system according to claim 32 or claim 33, further comprising means for recording the total time of operation and/or the number of cycles of operation of each appliance.

35. A household energy management system according to claim 34, including means for accessing a database of lifetime expectancy and reliability for different appliances, against which the logged data can be compared.

36. A household energy management system according to claim 35, wherein the means for accessing the database provide access to a database on an external network; and wherein the means for accessing the database also allow the database to be updated with measured lifetime and reliability data for appliances connected to the system.

37. A household energy management system according to claim 35 or claim 36, further comprising modelling means receiving signals from the comparison means and from the database in order to recommend to the user of the system a program of maintenance or replacement of the appliance.

38. A household energy management system according to any of claims 32 to 37, further comprising means for recording the quality of the electricity supply.

39. An energy management network, comprising:

storage means for storing a database of lifetime expectancy and reliability for different household appliances;

a plurality of household energy management systems in accordance with any of claim 35 to 38; and

a network to which the storage means and the energy management systems are connected to enable communication of data between the database and the energy management systems.

40. A method of operating a household energy management system, comprising the steps of:

measuring energy use by occupants of the house;

using the energy measurements to build a model of the behaviour of the occupants; and

controlling the operation of one or more household appliances on the basis of the model.

41. A method of operating a household energy management system, comprising the steps of:

measuring the temperature inside the house;

receiving information about the temperature outside the house; and

using the inside and outside temperature measurements to derive a transient thermal model of the house, which can predict changes in the inside temperature on the basis of the information about the outside temperature;

comparing the derived transient thermal model with a reference transient thermal model; and

warning a user of the system when the derived model differs from the reference model by more than a predetermined limit.

42. A method of operating a household energy management system, comprising the steps of:

measuring the instantaneous total power delivered by the household electricity supply;

identifying electrical appliances connected to the supply on the basis of their respective start-up characteristics when the appliances are switched on;

comparing the sensed start-up characteristics with reference characteristics; and

warning a user of the system when the sensed characteristics differ from the reference characteristics by more than a predetermined limit.

Amendments to the claims have been filed as follows

CLAIMS

1. A household energy management system, comprising:

at least one sensing means, which measures energy use by occupants of the house;

a modelling means, which uses the energy measurements from the sensing means to build a model of the behaviour of the occupants; and

a control means, which controls the operation of one or more household appliances in the house on the basis of the model.

2. A household energy management system according to claim 1, wherein the modelling means builds a predictive model of the pattern of behaviour of the occupants over time.

3. A household energy management system according to claim 2, wherein the modelling means continually refines the model in response to new measurements by the sensing means.

4. A household energy management system according to claim 2 or claim 3, wherein the predictive model predicts the times when the house will be occupied and the control means controls the operation of one or more household appliances on the basis of the predicted times when the house will be occupied.

5. A household energy management system according to claim 4, wherein the control means controls the operation of heating or cooling appliances to achieve a desired temperature when the model predicts that the house will be occupied.

6. A household energy management system according to claim 5, wherein the control means controls the operation of the heating or cooling appliances in such a way as to minimize the amount of energy used to achieve the desired temperature.

7. A household energy management system according to any preceding claim, wherein the modelling means builds a temporary model of the current behaviour of the occupants.

8. A household energy management system according to claim 7, wherein the control means controls the operation of heating or cooling appliances to achieve a desired temperature according to a current level of activity of the occupants as modelled in the temporary model of the current behaviour of the occupants.

9. A household energy management system according to any preceding claim, wherein the model of the behaviour of the occupants includes a determination of whether the house is occupied.

10. A household energy management system according to claim 9, wherein the modelling means has an interface with an intruder alarm system in the house and uses signals received from the intruder alarm in its determination of whether the house is occupied.

11. A household energy management system according to claim 9 or claim 10, wherein the system receives signals indicating the location of the occupants when they are not in the house and wherein the modelling means uses the location signals in its determination of whether the house is occupied.

12. A household energy management system according to claim 11, wherein the modelling means further uses the location signals to predict when the occupants might return to the house.

13. A household energy management system according to claim 11 or claim 12, wherein the locations of the occupants are determined by a mobile telephone network or by a global positioning system.

14. A household energy management system according to any preceding claim, wherein the sensing means measures electrical activity within the house.

15. A household energy management system according to claim 14, wherein at least one sensing means comprises a moveable sensor for location between an electricity supply outlet and an individual electrical appliance to measure the energy use by that appliance.

16. A household energy management system according to claim 14 or claim 15, wherein at least one sensing means comprises a fixed sensor on the household electricity supply to measure the respective energy uses of a plurality of electrical appliances connected to the supply, the sensor comprising means for measuring the instantaneous total power delivered by the electricity supply and means for identifying the appliances on the basis of their respective start-up characteristics when the appliances are switched on.

17. A method of operating a household energy management system, comprising the steps of:

measuring energy use by occupants of the house;

using the energy measurements to build a model of the behaviour of the occupants; and

controlling the operation of one or more household appliances on the basis of the model.

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Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1, 14, 18	GB 2212949 A	(STONECREST LIMITED) Whole Document.
X	1, 14, 18	WO 2002/090914 A1	(EMERSON RETAIL SERVICES INC) Whole Document.
A		EP 0883050 A1	(ELECTRICITE DE FRANCE) See WPI abstract. AN - 1999 - 011837 [02]
A		US 5197666	(WEDEKIND) Whole Document.

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X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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(54) **Title:** DISTANCE REGULATED ENERGY CONSUMING DEVICES

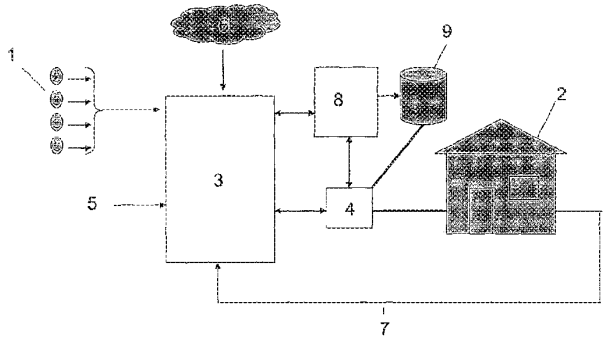


Fig. 1

(57) **Abstract:** This invention relates to a unique occupancy-based electronic control of energy consuming devices, such as household devices like, but not limited to, thermostats, HVAC systems, radiators in general, or any device consuming energy even though no users of the device are present. The control and/or regulation is based on the distance and velocity of the inhabitants relative to the household. An additional feature is a peak load management system ensuring to store energy in energy reservoirs prior to load peaks on the electricity distribution network, using this energy during the load peaks.

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DISTANCE REGULATED ENERGY CONSUMING DEVICES

Background of the invention

Many residential homes in e.g. the USA only have one thermostat controlling the whole house. The thermostat is often located next to the main entrance, making installations very standardized and easy to handle. Furthermore, a large share of these households are only equipped with a simple heating/cooling electro-mechanical thermostat without any possibility of programming. In the few households having a programmable thermostat, this is highly dependant on the owner being able to program it correctly. The world wide waste of such energy resources gives a huge potential for energy savings.

Further, the consumption of electricity is not evenly distributed over the year, not even over the day. About two to four times a day, normally in the morning and in the evening, the consumption of electricity is very high, causing load peaks on the electricity distribution network. Sometimes the peaks are so big that black-outs occur.

This invention relates to the reduction of the consumption energy when it is not needed.

Summary of the invention

This invention relates to a unique occupancy-based electronic control of energy consuming devices, such as household devices like HVAC systems, or any other devices consuming energy even when no inhabitants or persons are using or even being close to the devices.

The basic feature of this invention is to adjust the energy consuming devices according to residents/users locations, where the locations are provided by their cell phone/mobile phone or any other portable device being trackable or traceable in geographic location and in time (either via GPS or triangulating), in the following being referred to as their position identification device or devices..

One preferred, but non-limiting, example of the invention relates to the control of a thermostat controlling the cooling and heating of a household by a HVAC system. The idea of the invention, therefore, is to facilitate energy savings by allowing the HVAC systems to drift off when the comfort temperature is not required, as the house is not occupied.

The underlying principle being that the household thermostat will be so intelligent that the energy saving will happen automatically without the household members actually having to do something for it and without compromising on the comfort.

The idea for the occupancy-based electronic thermostat example is that:

1. If no persons are at home, the thermostat will automatically alter the set-point away from the specified comfort temperature.

2. The occupancy detection is built-in and will be linked to the household members' position identification device.

3. By linking to the individual position identification device ,it will be possible to off-set the comfort temperature in accordance with the household members' distance to the home (being at work, in school, on holiday etc.); ensuring that the comfort temperature will be re-established before their return by tracking the distance.

4. Additionally, the system will also be able to receive information about the current weather, making automatic night set-back etc., possible via the phone system.

The concept naturally bears the potential to be expanded to include other applications – e.g. terminating stand-by functions while the household is not occupied.

In an optional, and additional, more advanced embodiment of the present invention, the energy control system maps the individual resident's in a given single household based on their patterns of movement, where the maps vary in a number of dimensions or parameters, such as the residents distance from household, travelling speed, the time of day, the week and the month.

The energy control system, preferably adaptively, learns the resident's typical behaviours and patterns of movement by their position identification device, and uses these to predict a given behaviour of a resident, what the continuation of this behaviour will be, and when the resident will be expected to arrive at the household.

The energy control system preferably uses a dynamic model with deviation control to form the map of the single resident's patterns of movement, based on date obtained automatically from the individual resident's position identification devices. This method gives the energy control system the possibility to fully automatically optimize the overall efficiency of the energy usage in the household.

The energy control system enables convenient and fully automatic energy saving in any household by allowing the climate comfort zone (temperature, humidity, amount of circulated air, incoming sunlight) drift away from a pre-defined zone of the resident's, when the household is not

occupied. Furthermore, the energy control system will switch off all non-essential energy users e.g. TV, PC, DVD, entertainment centre, electric tooth brush and etc. when no one is around to use them. At the same time, the energy control system pays attention to possible return of any resident to ensure that the climate comfort zone is restored before arrival and ensure that the electric equipment is ready to use again. The essence being that the energy saving is convenient and does not cause any lack of comfort for the residents.

Additional to the resident's location, travelling speed and the time and date, the energy control system may combine the ambient environmental conditions, the resident's location information and the indoor environmental conditions to adjust the indoor temperature and also adjust other environmental parameters, like humidity, amount of circulated and/or re-circulated air to control the indoor air pollution.

The energy control system can be installed in houses, apartments, small offices/commercial buildings, or any other place where an improved energy reduction may be obtained by tracking the users of the place, compared to for example an energy consumption pre-programmed in time.

The energy control system can be split up into independent units or incorporated into one single, combined unit.

In an additional or alternative embodiment of the present invention, the system comprises peak load management.

Since peaks in the local, regional and national energy consumption are predictable through historic data, the energy control system ensures lowering of the temperature of the household before the peaks occur, perhaps by some offset point temperature predeterminded or optionally being calculated based on parameters such as the time for raising the

temperature back to the initial value and the distance and e.g. velocity of the inhabitants relative to the household, and the external conditions such as internal and external humidity, external temperature and weather conditions, cloudiness etc.

In this embodiment the system may comprise means for storing energy in any manner as known in the art such as batteries, such means shall in the following in general be referred to as energy reservoirs. The system then comprises a storage management system able to ensure that energy is stored in the energy reservoirs prior to the peak load, and then used during the peak load period, thereby reducing the load on the power grid. This will reduce the load peaks, and give a more evenly spread electricity consumption. Further, it will reduce the amount of standby power plant needed by the energy companies; it will reduce the end user's electricity bill by reducing the need for electricity in peak periods, where electricity is very expensive.

For short and unpredictable peaks, the storage management system can be allowed to overrule the energy control system temporarily turning of non-essential energy using devices, but also more essential energy using devices such as fridge, freezer, oven, electric heaters to respond to the peak.

Figures:

Fig. 1: Schematic view of the controller according to the invention

Detailed description

Fig. 1 describes the basic idea of the invention, where four users (1) of one or a plural of energy consuming devices (4), the users (4) also referred to as residents (1) of a house (2), are at positions which are

distant from the house (2). 'House' is to be understood as any place where energy consuming devices (4) may be present. Each resident has a position identification device, such as a cell phone with GPS. The positions of the residents (1) are identified by tracking or tracing their position identification devices, e.g. by means of GPS positioned therein, or by simple triangulation to identify the position of the position identification devices relative to the antennas, as done by the telephone companies as a standard.

In the following the control of indoor temperature is used as an example, but any energy consuming device, and any combination of any number of energy consuming devices, also applies to the invention.

The device or devices (4) to be controlled or regulated may therefore be a HVAC system, but could alternatively or additionally be for example a TV, radio etc.

The indoor temperature is registered by a sensor. The energy control system comprises a controller (3) connected to all the residents (1) position identification devices enabling the controller (3) to alter the temperature, when the house is not occupied.

The controller (3) is simple to use and install, and may preferably be battery powered. A built-in radio frequency transmitter sends information to e.g. the radiator or floor heating thermostats all over the house (2).

Knowing the position of the residents (1) at any given time also makes it possible to predict residents (1) travelling speeds, and comparing the last known positions to the present locations, enabling the controller (3) to adjust not only the temperature of the house, but also the time in which the offset is increased or decreased.

The distance from the house to the nearest resident is used to determine the offset of the controller (3) ensuring that the indoor temperature is always at the desired level, when the house is occupied.

The use of individual controllers (3) makes it possible to keep different temperatures in the house (2) and still benefit from the energy savings by offsetting the temperature in the house (2) when it is not occupied, the controllers (3) will just offset from different temperatures.

As the controller (3) always knows the position of each household resident (1), then no programming is necessary, the controller (3) will alter the temperature accordingly.

The controller (3) in a preferred embodiment learns (possible adaptively) the basic patterns of behaviour of the residents (1), enabling it with some degree of certainty to predict a following movement of a resident (1) given a specific behaviour, especially when the resident(s) arrive within some predetermined distance of the house (2). A plural of such basic patterns will be created, or mapped, for each resident (1), where such a map or basic pattern is a plural of data sets, where a data set as at least position(s) of the residents(s) (1) and the time (at day, possible also the calendar date). Optionally the estimated velocity of the resident(s) (1) also is included in the data(s) where the new data set(s) combined with at least one earlier resident data set (the at least two data sets) is used to choose to which of the established maps or basic patterns of the resident(s) (1) the at least two data sets makes the best fit, using this map or basic pattern to estimate the following behaviour and thereby when the resident is expected to arrive back to the house (2).

The energy control system, or the controller (3) of the energy control system, always monitors the resident's location at a pre-determined frequency, being the frequency at which data sets are being established;

this frequency will gradually be reduced over time to a minimum as the energy control system device learns and creates the maps or resident's basic patterns of behaviur. This frequency will be increased when residents changes their basic pattern or just when they divert significantly from any of the known maps or basic patterns of behaviour, and will decrease again when a new pattern is learned or mapped, or the resident falls back to the previous or another of the basic patterns or maps. This feature will prolong the standby time of their position identification devices, like cell phones (GPS device or similar).

A plural of such predetermined distances to the house (2) may be defined, also called zones, possibly with individual zones being defined for each resident (1), and possibly determined automatically from their typical basic behaviours. These zones have individual different distances from the house (2) and may be used to establish how to weight the maps and/or predictions of behaviours, so that they are given an increasing weight or importance for a decreasing distance to the house (2).

A number of additional parameters may be included into the algorithm, such as any calendar and time data, or external or outdoor environmental conditions (6) (temperature, humidity, rainy conditions, time of day, time of month, time of year etc.), the indoor environmental conditions (7) (temperature, humidity etc.), also being used as feedback parameters, and predetermined (user predetermined) indoor set points (5), such as the preferred indoor temperature set point. Among the environmental conditions (6) and (7) could be air temperature and humidity, where such parameters can be used by an adaptive regulator to predict the time needed to for example re-cool/heat the house to the set point (5), and in general being parts of an algorithm being dynamic in time, the adjustments of the device(s) (4) depending as well on the behaviours of the residents (1) and on the surrounding indoor and outdoor conditions, and in a more

advanced embodiment, also for example on the weather forecast possibly received from the internet.

As an example, the energy control system thermostat will regulate the temperature up or down (relative to a set point) according to the outdoor temperature, when all residents are away from household – and thereby enable energy savings. The off-set of temperature is regulated according to the shortest distance of resident to household combined with the maps learned by the energy control system device – ensuring that a set point comfort temperature is reached before return of any household resident.

The system may further take other ambient environmental conditions like rain, snow, wind, humidity, into consideration, increasing the predictability of the time needed to reach the indoor comfort environment, hence increasing the efficiency of the energy usage.

Other non-limiting examples of applications of the energy control system of the invention could be used is:

Regulating indoor lighting according to the amount of incoming sunlight. This will help save energy by actively increasing or decreasing the amount of reflected sunlight in relation to a more efficient cooling, heating of the building and optimized the indoor lighting.

Regulating of thermal load and the amount of air pollution (gases and the like given off by devices (4) for example when cooking in an oven) in the household to optimize the HVAC system according to the outdoor temperature, and the number of resident's present in the household present. The amount of air pollution is determined by the number of persons in the house and the number of electrical equipment work. The energy control system can therefore regulate the air pollution by controlling the circulated, re-circulated air and turn off non-essential stand-

by equipment (TV, PC, DVD, entertainment centre, electric tooth brush etc).

The energy control system may comprise micro switches, which can also be used to start and stop both essential and non-essential electric equipment fully automatically or by remote activation (e.g. from cell phone), where such equipment devices (4) could be washing machines, pre-heat pool etc..

In an further advanced embodiment of the invention, the energy control system comprises a peak load manager (8) combined with the energy control system controller (3) , where the peak load manager (8) controls an energy reservoir device (9) supporting minimizing peak load disturbance on the electricity grid. This is done, regardless if the household is occupied or not. The temperature of the household is decreased or increased, depending on outdoor conditions; prior to the peak (predictable peaks).By doing this, the household can maintain a comfortable indoor climate for a longer period of time increasing the on/off hysteresis, using the household as an energy accumulator.

In case of unpredictable peaks on the power grid, the non-essential stand-by equipment can be turned off for a longer time frame and essential equipment (freezer, refrigerator, AC, etc.) for a short time frame, thereby reducing the load on the electricity grid.

Any number of imaginable devices and systems may be controlled and/or regulated by the energy control system of the present invention.

One example is that the energy control system may automatically ensure the switching on of the burglar alarm.

As an additional feature, the energy control system may comprise a 'family finder' that can provide the location of any resident's cell phone upon request.

The separate devices of this invention are preferably standard devices as they are known in the art, such as the controller (3) and the peak load manager (8) preferably being computer micro chips with a software, and the energy reservoir devices (9) preferably are batteries of any kind known in the art. The needed data transfers, such as information's and instructions for the devices (4), the controller (8), the peak load manager (8) etc. may be by wire or wireless, and may be transferred by the telephone net or by internet or any other known system for transferring such data.

Claims:

1. Method of regulating the energy consumption of a device (4), the method comprising the regulation of the energy consuming device (4) in dependence of the position of the user (1) of the device (4), wherein this position is used to calculate the distance between the device (4) and the user (1).

2. Method according to claim 1, wherein the position of the user (1) and the time of day gives a data set, and where such data sets are used to generate maps of the typical daily behaviours of said users (1), said maps thus being a plural of data sets, and where the maps are used to estimate the users (1) following behaviour and regulates the device(s) (4) based on this estimate.

3. Method as in claim 2, wherein the position of the user is registered through a cell phone or a mobile phone, either by triangulation or by a built-in GPS in the cell phone or mobile phone.

4. Method as in claim 3, wherein the velocity of the user (1) relative to the device is also a part of the regulation.

5. Method as in claim 1, wherein external and internal environmental conditions to the house (2) also are used to regulated the energy consuming device(s) (4), such as humidity, temperature, rainy conditions, cloudiness etc.

6. Method a in any of the preceding claims, wherein the method further stores energy in energy reservoirs (9) prior to predictable peaks in the power grid and uses this energy to run the energy consuming device(s) (4) during the predictable peak.

7. An energy control system to regulate the energy consumption of energy consuming device(s) (4), the energy control system comprising;

- at least one portable position identification device being worn by at least one user (1) of the energy consuming device(s) (4) ,

- a controller (3),

Wherein said controller (3) at a frequency acquires and generates a data set for each portable position identification device, the data set at least comprising the present geographic position and the time of day, whereby the portable identification devices moves, and where such data sets are used to generate maps of the typical daily behaviours of said users (1), said maps being a collection of data sets, and where the maps are used to estimate the users (1) following behaviour and regulates the device(s) (4) based on this estimate.

8. Energy control system as in claim 5, wherein the system further comprises a peak load manager (8) controlling an energy reservoir device (9).

9. Energy control system according to claim 6 or 7, wherein the energy control system is connected to the telephone net and/or the internet, receiving information being used by the controller (3).

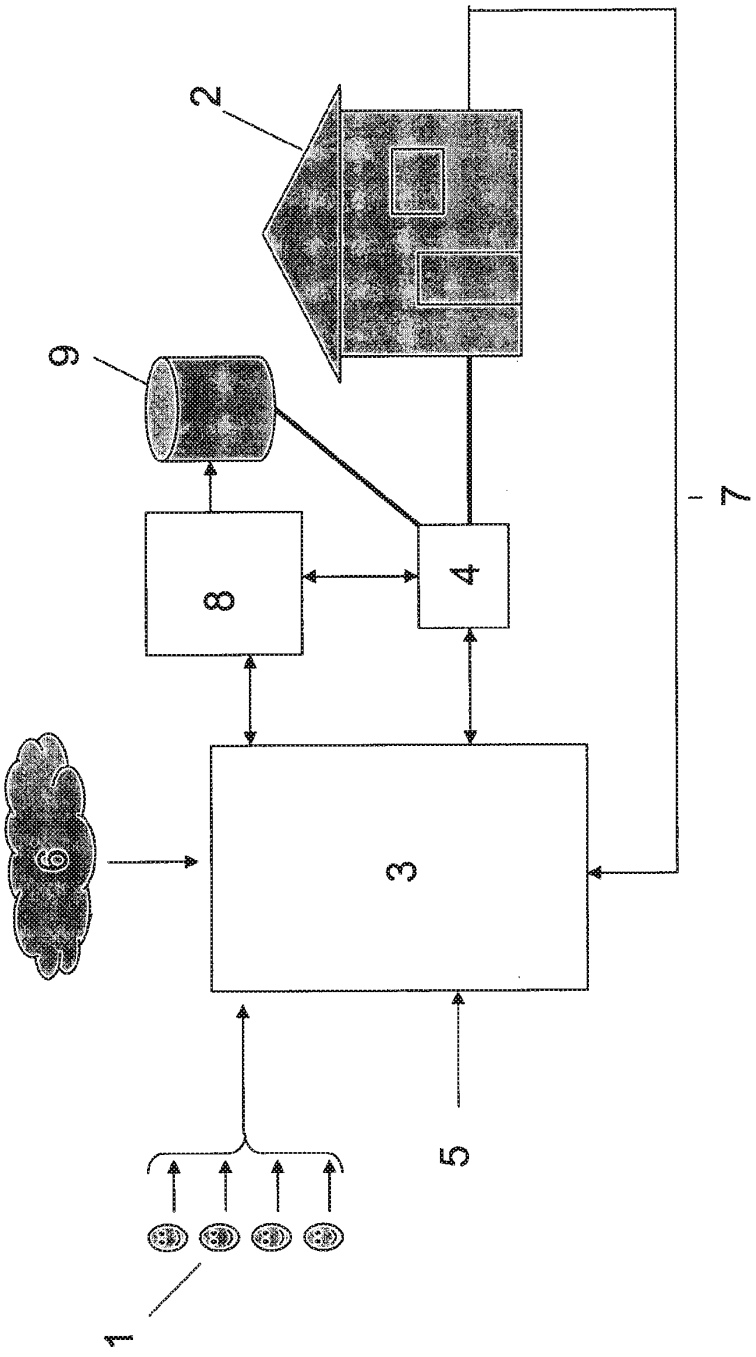


Fig. 1

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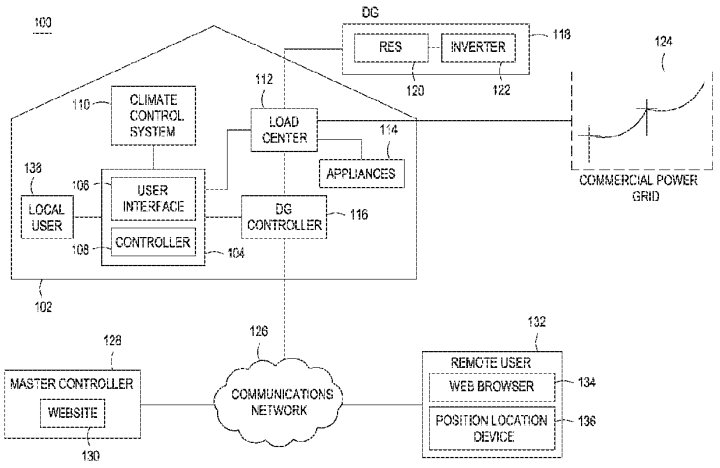


FIG. 1

(57) Abstract: A method and apparatus for controlling climate within a building. In one embodiment, the apparatus comprises a smart climate unit for (i) obtaining distributed generator (DG) information pertaining to operation of a DG that generates power for the building, and (ii) controlling at least one climate condition within the building based on at least one of the DG information, local input, or remote input.

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METHOD AND APPARATUS FOR SMART CLIMATE CONTROL

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] Embodiments of the present disclosure relate generally to climate control within a building, and, in particular, smart climate control within the building.

Description of the Related Art

[0002] Current worldwide growth in demand for energy is leading to a durable increase in energy usage and a rapid depletion of existing fossil fuels to supply the required energy. Many of today's energy users are in search of ways to utilize energy more efficiently and limit their overall energy consumption. In some cases, energy users may employ distributed generators (DGs) for harvesting power from renewable energy sources, such as solar, wind, hydro, or the like, in order to offset their usage of energy derived from fossil fuels.

[0003] For many energy users, climate control within residential and commercial buildings, i.e., heating, air conditioning, humidity control, and the like, represents one of the largest areas of energy consumption. Given that many buildings are unoccupied over extended periods of time, such as during daytime hours when homeowners are away from their homes or evening hours when workers are away from their businesses, appropriately managing the climate within a building during such times provides an opportunity to reduce energy consumption.

[0004] Therefore, there is a need in the art for a method and apparatus for efficiently controlling a climate within a building.

SUMMARY OF THE INVENTION

[0005] Embodiments of the present invention generally relate to a method and apparatus for controlling climate within a building. In one embodiment, the apparatus comprises a smart climate unit for (i) obtaining distributed generator (DG) information pertaining to operation of a DG that generates power for the building, and (ii) controlling at least one climate condition within the building based on at least one of the DG information, local input, or remote input.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] So that the manner in which the above recited features of the present invention can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

[0007] Figure 1 is a block diagram of a system employing smart climate control in accordance with one or more embodiments of the present invention;

[0008] Figure 2 is a block diagram of a smart climate unit controller in accordance with one or more embodiments of the present invention;

[0009] Figure 3 is a block diagram of a distributed generator (DG) controller in accordance with one or more embodiments of the present invention;

[0010] Figure 4 is a depiction of a smart climate unit in accordance with one or more embodiments of the present invention;

[0011] Figure 5 is a block diagram of a method for smart climate control in accordance with one or more embodiments of the present invention; and

[0012] Figure 6 is a block diagram of a method for location-based climate control in accordance with one or more embodiments of the present invention.

DETAILED DESCRIPTION

[0013] Figure 1 is a block diagram of a system 100 employing smart climate control in accordance with one or more embodiments of the present invention. This diagram only portrays one variation of the myriad of possible system configurations. The present invention can function in a variety of environments and systems.

[0014] The system 100 comprises a building 102, such as a residential or commercial building, coupled to a distributed generator (DG) 118 and a commercial

power grid 124. The building 102 comprises a smart climate unit 104, a climate control system 110, a load center 112, one or more appliances 114, and a DG controller 116. The commercial power grid 124 is coupled to the appliances 114 via the load center 112 for providing power to the appliances 114.

[0015] The DG system 119 comprises a renewable energy source (RES) 120 coupled to an inverter 122. The RES 120 may be any type of system for generating DC power from a renewable form of energy, such as wind, solar, hydro, and the like. The inverter 122 converts the generated DC power to AC power that is commercial power grid compliant and couples the AC power to the load center 112. The generated AC power may be further coupled from the load center 112 to the one or more appliances 114 and/or to the commercial power grid 124. Additionally or alternatively, generated energy may be stored for later use; for example, the generated energy may be stored utilizing batteries, heated water, hydro pumping, H_2O-to-hydrogen conversion, or the like.

[0016] In some embodiments, the inverter 122 may be a plurality of inverters utilized to convert the DC power from the RES 120 to AC power; for example, the RES 120 may comprise a plurality of photovoltaic (PV) modules where each PV module is coupled to an inverter in a one-to-one correspondence. Additionally, one or more DC/DC converters may be utilized within the DG 118, for example, coupled between the RES 120 and the inverter 122.

[0017] The DG controller 116 is coupled to the load center 112 and provides operational control of the DG 118 via the inverter 122. In some embodiments, the DG controller 116 provides such control utilizing power line communication (PLC) to communicate with the DG 118; additionally or alternatively, the DG controller 116 may utilize other types of wired and/or wireless techniques for communicating with the DG 118. The DG controller 116 is further communicatively coupled to a master controller 128 via a communications network 126 (e.g., the Internet) for sending information to/receiving information from the master control 128 pertaining to the operation of the DG 118. The DG controller 116 may utilize wired and/or wireless techniques for coupling to the communications network 126; in some embodiments,

the DG controller 116 may be coupled to the communications network 126 via a commercially available router.

[0018] In accordance with one or more embodiments of the present invention, the smart climate unit 104 is coupled to the climate control system 110 for driving the climate control system 110 to control the climate (heating, cooling, humidity, heat pump activity, and the like) within the building 102. The smart climate unit 104 provides status displays (e.g., current temperature, humidity level, settings, and the like) and user-controls locally and remotely to allow both local and remote users to gauge current climate conditions and settings and make adjustments as needed. Additionally, the smart climate unit 104 provides location-based control of the climate control system 110 (i.e., control of the climate control system 110 based on the locations of one or more users). The smart climate unit 104 is further coupled to the DG controller 116 for obtaining information related to the operation of the DG 118 (e.g., power production information). The smart climate unit 104 may then utilize such DG information to control the climate within the building 102.

[0019] The smart climate unit 104 may be wall mounted or positioned on a desk, table, or the like, and comprises a user interface 106 and a smart climate unit controller 108. The controller 108 provides local control of the smart climate unit 104 via the user interface 106. In some embodiments, the smart climate unit 104 may comprise an available (i.e., "off the shelf") thermostat device which, for example, comprises components such as a microprocessor and memory, and is suitably modified in accordance with the invention described herein.

[0020] The user interface 106 provides display capabilities (e.g., to display current status, settings, time of use rates, or the like) and user controls for operatively controlling the smart climate unit 104, for example, by touch screen, buttons, knobs, or the like. Additionally or alternatively, the smart climate unit 104 may be directly coupled to a display and/or an input/output device, such as a personal computer, personal digital assistant, or the like, for providing the user interface 106. In such embodiments, the smart climate unit 104 may be coupled to

Ex. 1004.0409

the device by wired techniques or wireless techniques, for example utilizing standards such as IEEE 802.11, Zigbee, Z-Wave, or the like.

[0021] The user interface 106 allows a local user 138 to configure the smart climate unit 104 for initial use and to manually change current settings of the smart climate unit 104 (e.g., increase current temperature, decrease current humidity, or the like). Additionally, the local user 138 may, via the user interface 106, generate and/or change one or more climate control profiles utilized by the smart climate unit 104 for operating the climate control system 110. Such climate control profiles may specify climate control parameters (e.g., preferred temperature, humidity, heat pump settings, and the like) based on criteria such as time, energy mode, user preference, user location, weather conditions, and the like. For example, time-based climate control profiles may specify settings that are based on time of day, day of week, month of year, groupings of certain hours and/or days (e.g., waking/sleeping time, working from home, pet-sitting, vacation periods, holidays), and the like. Energy mode-based climate control profiles may specify settings that are based on criteria related to energy usage, such as energy saver mode, time of use (TOU) rates, current energy consumption, supply conditions (e.g., energy production by the DG 118), peak energy consumption times, and the like. User preference-based climate control profiles may specify preferred settings for one or more users. Location-based climate control profiles may specify settings that are based on proximity of one or more users and/or current travel speed of the one or more users. Weather-based profiles may specify settings that are based on current and/or predicted weather conditions. The smart climate unit 104 may provide a "wizard" function for assisting the local user 138 to initially configure, program, and/or operate the smart climate unit 104.

[0022] In addition to providing the local control functionality described above, the controller 108 provides remote control of the smart climate unit 104, allowing a remote user 132 to remotely obtain analogous displays and control for the smart climate unit 104. The smart climate unit controller 108 is communicatively coupled to the communications network 126 such that the remote user 132 may utilize a conventional web browser 134 to remotely access and operate the smart climate

Ex. 1004.0410

unit 104. For example, the remote user 132 may access a website 130 supported by the master controller 128 (or a server having access to the master controller 128) to access the smart climate unit 104 via a password protected portal. The remote user 132 may then execute control of the smart climate unit 104 as if the remote user 132 were local to the smart climate unit 104. For example, the remote user 132 may perform initial configuration of the smart control unit 104 (e.g., utilizing the "wizard"), change current settings of the smart climate unit 104, create new or change existing climate control profiles for the smart climate unit 104, or similarly operate the smart climate unit 104. The remote user 132 may access the smart climate unit 104 in such a manner utilizing any suitable device that provides the web browser 134, such as a smart cell phone, a personal digital assistant, a personal computer, or the like. Additionally, the website 130 may support a plurality of smart climate units 104 deployed within other areas of the building 102 (e.g., different floors) or other buildings.

[0023] The smart climate unit controller 108 further provides location-based climate control for the building 102 based on a location of one or more users. For example, the controller 108 may provide climate control for the building 102 based on a location of the remote user 132. In some embodiments, the smart climate unit controller 108 utilizes a position location device 136 as a proxy for determining a location of the remote user 132 and operating the climate control system 110 based on the determined location. The position location device 136 may be any device for locating people and/or assets, e.g., a cell phone, a global positioning system (GPS), a personal digital assistant, ON-STAR service, or the like. For example, the smart climate unit controller 108 may determine the location of the remote user's cell phone utilizing a global positioning satellite (GPS) receiver of the cell phone, cell-triangulation features of the cell phone, or the like. The smart climate unit controller 108 may then drive the climate control system 110 to suitably adjust the temperature and/or humidity within the building 102 based on the determined location of the remote user 132. For example, the smart climate unit controller 108 may leverage existing site information, such as an address of the building 102, to control the

Ex. 1004.0411

climate control system 110 based on the remote user's proximity to the building 102 as well as speed of approaching the building 102.

[0024] In order to determine appropriate climate settings for the building 102 based on the location of the remote user 132, the smart climate unit controller 108 may maintain one or more location-based climate control profiles associated with the remote user 132. For example, the location-based climate control profiles may specify that air conditioning be turned on when the remote user 132 (i.e., utilizing the position location device 136 as a user-proxy) is within a predefined distance of the building 102, that a certain temperature and/or humidity level be maintained when the remote user 132 is within the building 102, or the like. The smart climate unit controller 108 may additionally factor in travel speed of the remote user 132 in addition to the remote user's distance from the building 102 for suitably operating the climate control system 110. The smart climate unit controller 108 may also maintain location-based climate control profiles for additional users (such as the local user 138) and/or groups of users (such as a family group), utilizing corresponding cell phones/other wireless portable devices as proxies for the additional users. The smart climate unit 104 may utilize the location of each user at a particular time to affect settings. For example, if a wife is home alone, her personal climate control profile will prevail, while if one or more family members are home, a "family" climate control profile will prevail.

[0025] In addition to providing local and remote programming capabilities, the smart climate unit 104 also provides climate and/or energy consumption data, statistics, and/or reports both locally and remotely. For example, the smart climate unit 104 may provide reports of climate control statistics during pre-defined or user-defined periods (e.g., total hours cooling, total hours heating, or the like) and/or energy related statistics (e.g., energy saver mode hours, energy consumption for cooling, energy consumption for heating, or the like). Such data, statistics, and/or reports may be displayed via the user interface 106 and/or the web browser 134, for example, as bar charts, pie charts, in spreadsheet format, or the like, as well as stored for future use. In some embodiments, the smart climate unit 104 may be coupled to a local printer for printing out desired reports/statistics and/or may allow

for downloading of report data in various formats, such as Comma Separated Values (CSV) format, for further analysis.

[0026] In some embodiments, the smart climate unit 104 may regulate energy consumption utilizing demand management. For example, based upon supply conditions, such as energy production by the DG 118, peak energy consumption times, time of use (TOU) rates, or the like, the smart climate unit 104 may optimally control the climate control system 110 for achieving a desired level of energy consumption (e.g., optimizing energy consumption versus cost), as well as control consumption decisions, energy storage decisions, or the like. Further, the smart climate unit 104 may additionally or alternatively control the climate control system 110 based on externally generated requests to regulate energy consumption. For example, the smart climate unit 104 may receive a request from an electric company (e.g., communicated via the powerline or the communications network 126) to regulate energy consumption in order to assist with peak load balancing; the smart climate unit 104 may then control the climate control system 110 accordingly. Additionally, the smart climate unit 104 may access current and/or predicted weather-related information, for example at weather websites via the communications network 126, and/or comprise weather-related sensors, and utilize such information for controlling the climate control system 110. For example, the smart climate unit 104 may evaluate potential power generation by the DG 118 based on current and/or predicted weather conditions and factor such information into establishing settings for the climate control system 110. The smart climate unit 104 may further utilize weather-related information to "learn" timeframes for adjusting temperature and/or humidity within the building 102, for example, based on external weather conditions. The smart climate unit 104 may then factor in the learned timeframes when operating the climate control system 110, for example, during application of any of the climate control profiles.

[0027] In some alternative embodiments, the appliances 114 may comprise one or more "smart" appliances that are controlled by the smart climate unit 104, for example, based on energy consumption, TOU rates, user proximity, or the like.

[0028] Figure 2 is a block diagram of a smart climate unit controller 108 in accordance with one or more embodiments of the present invention. The smart climate unit controller 108 comprises a transceiver 202 communicatively coupled to the DG controller 116. The transceiver 202 may utilize wireless (e.g., based on standards such as IEEE 802.11, Zigbee, Z-wave, or the like) and/or wired communication techniques for such communication.

[0029] The transceiver 202 is further coupled to at least one central processing unit (CPU) 204, and the CPU 204 is additionally coupled to support circuits 206 and a memory 208. The CPU 204 may comprise one or more conventionally available microprocessors. Alternatively, the CPU 204 may include one or more application specific integrated circuits (ASIC). The support circuits 206 are well known circuits used to promote functionality of the CPU 204. Such circuits include, but are not limited to, a cache, power supplies, clock circuits, buses, network cards, input/output (I/O) circuits, and the like.

[0030] The memory 208 may comprise random access memory, read only memory, removable disk memory, flash memory, and various combinations of these types of memory. The memory 208 is sometimes referred to as main memory and may, in part, be used as cache memory or buffer memory. The memory 208 generally stores an operating system (OS) 210 of the smart climate unit controller 108. The OS 210 may be one of a number of available operating systems for microcontrollers and/or microprocessors. In some embodiments where the smart climate unit 104 comprises a commercially available thermostat device, the OS 210 may be a default OS of the thermostat device.

[0031] The memory 208 may store various forms of application software, such as a smart climate unit control module 212 for operatively controlling the smart climate unit 104 as previously described with respect to Figure 1. Additionally, the memory 208 may store data 214 related to the operation of the smart climate unit 104. Such data may include climate control profiles for operating the climate control system 110 (e.g., profiles that are time-based, user location-based, user preference-based, or energy mode-based); archived statistics and/or reports for climate control data,

Ex. 1004.0414

energy consumption/production data, and/or weather related data; learned climate control behaviors (e.g., timeframes for temperature and/or humidity adjustments or the like); and/or any other data related to the operation of the smart climate unit 104. Additionally, the data 214 may include data pertaining to the operation of the DG 118, for example, for use in demand management control of the climate control system 110.

[0032] Figure 3 is a block diagram of a DG controller 116 in accordance with one or more embodiments of the present invention. The DG controller 116 comprises a transceiver 302 communicatively coupled to the smart climate unit controller 108 as well as the communications network 126. The transceiver 302 may utilize wireless (e.g., based on standards such as IEEE 802.11, Zigbee, Z-wave, or the like) and/or wired communication techniques for such communication; in some embodiments, the DG controller 116 may be coupled to the communications network 126 via a commercially available router.

[0033] The transceiver 302 is further coupled to at least one central processing unit (CPU) 304, and the CPU 304 is additionally coupled to support circuits 306 and a memory 308. The CPU 304 may comprise one or more conventionally available microprocessors. Alternatively, the CPU 304 may include one or more application specific integrated circuits (ASIC). The support circuits 306 are well known circuits used to promote functionality of the CPU 304. Such circuits include, but are not limited to, a cache, power supplies, clock circuits, buses, network cards, input/output (I/O) circuits, and the like.

[0034] The memory 308 may comprise random access memory, read only memory, removable disk memory, flash memory, and various combinations of these types of memory. The memory 308 is sometimes referred to as main memory and may, in part, be used as cache memory or buffer memory. The memory 308 generally stores an operating system (OS) 310 of the DG controller 116. The OS 310 may be one of a number of available operating systems for microcontrollers and/or microprocessors, such as, but not limited to, but not limited to, SOLARIS from SUN Microsystems, Inc., AIX from IBM Inc., HP-UX from Hewlett Packard

Ex. 1004.0415

Corporation, LINUX from Red Hat Software, Windows 2000 from Microsoft Corporation, and the like.

[0035] The memory 308 may store various forms of application software, such as a DG control module 312 for operatively controlling the DG 118 (i.e., via the inverter 122). Additionally, the memory 308 may store data 314 related to the operation of the DG 118, such as power production data or the like. The DG controller 116 may provide at least a portion of the data 314 to the smart climate unit controller 108 for use in operating the climate control system 110 as previously described.

[0036] The master controller 128 (not shown) is a type of controller, analogous to the DG controller 116, which may contain additional elements, such as application software for managing a plurality of DGs 118 as well as application software for managing the website 130.

[0037] Figure 4 is a depiction of a smart climate unit 104 in accordance with one or more embodiments of the present invention. The display interface 106 of the smart climate unit 104 comprises user controls 402 for adjusting settings of the smart climate unit 104. The user controls 402 may include buttons, knobs, touch screen features, or the like, for obtaining menus for operating the smart climate unit 104, displaying climate control related information (e.g., TOU rates, external weather conditions, energy consumption, or the like), increasing or decreasing current temperature and/or humidity levels, creating climate control profiles, viewing/changing saved information (such as any of the data 214), and controlling other features of the smart climate unit 104.

[0038] The display interface 106 additionally comprises a date/time display 404 for displaying the current date and/or time; a climate status display 406 for displaying information related to the current climate of the building 102 as well as current settings, such as current temperature and/or humidity, target temperature and/or humidity, current operating mode (e.g., heat, air conditioning), or the like.

[0039] The display interface 106 further comprises an energy mode display 408 for displaying information related to the current energy mode (e.g., current mode is

Ex. 1004.0416

normal or energy saver, current cost per kilowatt hour, or the like); a communications status indicator 410 for displaying the current status of the communications link, for example, to the DG controller 116; and an energy usage display 412 for displaying information pertaining to current energy consumption (e.g., power status is low/normal/high, cost per kilowatt hour, or the like). The display interface 106 may further comprise additional controls for operating the smart climate unit 104 and/or additional displays for presenting information related to the smart climate unit 104 as previously described.

[0040] Figure 5 is a block diagram of a method 500 for smart climate control in accordance with one or more embodiments of the present invention. In some embodiments, such as the embodiments described below, a smart climate unit is located within a commercial or residential building for locally and/or remotely operating a climate control system (e.g., to control temperature, humidity, heat pump activity, or the like) of the building (e.g., the smart climate unit 104 within the building 102 for driving the climate control system 110). The smart climate unit may further be coupled to a DG controller for receiving information pertaining to the operation of a DG that supplies power to the building, and the smart climate unit may utilize such information when operating the climate control system. Additionally, the DG controller may be coupled to a master controller, a remote user, or the like, via a communications network such as the Internet.

[0041] The method 500 begins at step 502 and proceeds to step 504, where a user desires to access the smart climate unit. If the user is within the building, the user may locally access the smart climate unit and the method 500 proceeds to step 506; alternatively, if the user is remotely located, the user may remotely access the smart climate unit and the method 500 proceeds to step 508. At step 506, the user may locally access the smart climate unit via a user interface of the smart climate unit, such as a touch screen display, buttons, knobs, or the like. Additionally or alternatively, the smart climate unit may be coupled to a separate display and/or input/output device, such as a personal computer, a personal digital assistant, or the like, for presenting a user interface to the user.

[0042] At step 508, the remotely located user may log in to the smart climate unit via a conventional web browser, for example as previously described with respect to Figure 1. The user may log in to the smart climate unit utilizing any suitable device that supports the web browser, such as a smart cell phone, a personal computer, a personal digital assistant, or the like. In some embodiments, the user may log in to the smart climate unit via a password protected portal.

[0043] Once the user has accessed the smart climate unit locally at step 506 or remotely at step 508, the method 500 proceeds to step 510. At step 510, a determination is made whether the user is performing an initial configuration of the smart climate unit. If the result of the determination at step 510 is yes, the method 500 proceeds to step 512 where the user performs the initial configuration. As part of the initial configuration, the user may manually set climate-related parameters to adjust current conditions (e.g., desired temperature, humidity) as well as generate one or more climate control profiles which may be stored within the smart climate unit for automatically operating the smart climate unit. Such profiles may specify climate control settings (e.g., preferred temperature, humidity, heat pump settings, and the like) based on criteria such as date/time, energy mode, user preference, user location, weather conditions, and the like. For example, time-based profiles may specify settings based on time of day, day of week, month of year, groupings of certain hours and/or days (e.g., waking/sleeping time, working from home, pet sitting, vacation periods, holidays), and the like. Energy mode-based profiles may specify settings that are based on criteria related to energy usage, such as energy saver mode, TOU rates, current energy consumption, supply conditions (e.g., energy production by a DG providing power to the building), peak energy consumption times, and the like. User preference-based profiles may specify preferred settings for one or more users. Location-based profiles may specify settings based on proximity of one or more users and/or current travel speed of the one or more users. Weather-based profiles may specify settings that are based on current and/or predicted weather conditions.

[0044] The smart climate unit may provide a "wizard" functionality for assisting the user during the initial configuration as well as during subsequent operation.

Once the initial configuration of the smart climate unit is completed, the method 500 proceeds to step 522.If, at step 510, the result of the determination is no, the method 500 proceeds to step 514. At step 514, the user may decide to change current settings of the smart climate unit and the method 500 proceeds to step 516; program the smart climate unit and the method 500 proceeds to step 518; or generate/access reports from the smart climate unit and the method 500 proceeds to step 520. The smart climate unit wizard may assist the user at any of the steps 516, 518, or 520.

[0045] At step 516, the user may adjust any of the current settings of the smart climate unit, such as temperature, humidity level, heat pump operation, energy mode, or the like; additionally, the user may activate/terminate any of the climate control profiles. The method 500 then proceeds to step 522.

[0046] At step 518, the user may create new or modify existing climate control profiles. The method 500 then proceeds to step 522.

[0047] At step 520, the user may generate current data and/or reports, as well as access archived data and/or reports, related to the operation of the smart climate unit. Such data and/or reports may be presented as pie charts, bar charts, spreadsheets, or the like, and may include information pertaining to climate control statistics during pre-defined or user-defined periods (e.g., total hours cooling, total hours heating, or the like); energy related statistics (e.g., energy saver mode hours, energy consumption for cooling, energy consumption for heating, or the like); current and/or predicted weather conditions; learned climate control behaviors (e.g., timeframes for temperature and/or humidity adjustments or the like); and/or any other data related to the operation of the smart climate unit. Additionally, the user may obtain data and/or reports pertaining to the operation of a distributed generator (DG) that provides power for the building, for example, as related to the operation of the smart climate unit.

[0048] The user may save generated data and/or reports within the smart climate unit; in some embodiments, the smart climate unit may be locally coupled to a separate storage device for storing data and/or reports and/or a printer for printing desired data and/or reports. The method 500 then proceeds to step 522.

[0049] At step 522, the smart climate unit controls the building's climate control system based upon the user's settings (i.e., manual settings and/or climate control profiles). In some embodiments, the smart climate unit may additionally regulate energy consumption utilizing demand management. For example, based upon supply conditions, such as energy production by a DG coupled to the building, peak energy consumption times, TOU rates, or the like, the smart climate unit may optimally control the climate control system for achieving a desired level of energy consumption (e.g., optimizing energy consumption versus cost). Further, the smart climate unit may additionally or alternatively control the building's climate control system based on externally generated requests to regulate energy consumption. For example, the smart climate unit may receive a request from an electric company (e.g., communicated via the powerline or the communications network) to regulate energy consumption in order to assist with peak load balancing; the smart climate unit may then control the climate control system accordingly. At step 524, a determination is made whether to continue. If the result of such determination is yes, the method 500 returns to step 514; if the result of such determination is no, the method 500 proceeds to step 526 where it ends.

[0050] Figure 6 is a block diagram of a method 600 for location-based climate control in accordance with one or more embodiments of the present invention. In some embodiments, such as the embodiment described below, a smart climate unit (e.g., the smart climate unit 104) is located within a residential or commercial building for operating the climate control system (e.g., to control temperature, humidity, heat pump activity, or the like) of the building. The smart climate unit contains one or more location-based climate control profiles (e.g., the climate control profiles previously described) for automatically operating the smart climate unit based on pre-set preferences of one or more users who access the building. The smart climate unit may further be coupled to a DG controller for receiving information pertaining to the operation of a DG that supplies power to the building, and the smart climate unit may utilize such information when operating the climate control system

[0051] The method 600 starts at step 602 and proceeds to step 604. At step 604, the smart climate unit communicates with one or more position location devices

Ex. 1004.0420

for determining locations of each applicable user. A position location device may be any device for locating people and/or assets, e.g., a cell phone, a global positioning system (GPS), a personal digital assistant, ON-STAR service, or the like. The smart climate unit obtains information from the position location device or devices, such as longitude and latitude coordinates, for determining the location of the one or more users.

[0052] The method 600 proceeds to step 606, where the smart climate unit determines a current location for each applicable user based on the position information obtained from the position location device or devices. For example, a user's cell phone number may be entered as part of their location-based climate control profile. The smart climate unit may then obtain position information that identifies a current position of the user's cell phone, for example, based on a global positioning satellite (GPS) receiver of the cell phone, cell-triangulation features of the cell phone, or the like. The smart climate unit utilizes the positioning information to determine a current location of the cell phone as a proxy for the user's location.

[0053] The smart climate unit may determine the user's location as an absolute position, e.g., a position based on longitude and latitude, other types of absolute coordinates, landmarks, or the like. Additionally or alternatively, the user's position may be determined as a relative position; for example, the user's distance from the building may be determined based on existing site information, such as an address of the building stored within the smart climate unit. As part of determining the user's current location, the smart climate unit may access databased information, such as addresses, information pertaining to landmarks, coordinates, or the like.

[0054] The smart climate unit may additionally determine a travel speed of the user; for example, the smart climate unit may obtain the travel speed from the position location device, compute the travel speed based on position information obtained from the position location device, or determine the travel speed by other techniques.

[0055] The method 600 proceeds to step 608. At step 608, location-based climate control profiles corresponding to the applicable users are accessed. The

location-based climate control profiles may be stored within the smart climate unit and/or external to the unit, and comprise desired climate settings (e.g., temperature, humidity, and/or heat pump control) for the users along with rules for operating the climate control system based on the locations of the users. For example, a first user's climate control profile may specify a preferred temperature and humidity setting, and may specify that the climate control system be activated to generate the desired temperature and humidity when the first user is within a certain number of miles of the building.

[0056] The method 600 proceeds to step 610, where the smart climate unit correlates the accessed location-based climate control profile information with the current user locations for determining suitable operative control of the climate control system. In some embodiments, the smart climate unit may "learn" timeframes required to reach certain temperature and/or humidity levels within the building, for example, based on external and/or predicted weather conditions, and factor in such learned information when operating the climate control system. At step 612 the smart climate unit operates the climate control system accordingly to adjust the building's climate based on the user locations. The smart climate unit may continually coordinate information (e.g., location data, user travel speed data, location-based climate control profile date) for a plurality of users at a plurality of different locations to optimally control the climate control system based on each user's location and preferences.

[0057] The method 600 then proceeds to step 614 where it ends.

[0058] The foregoing description of embodiments of the invention comprises a number of elements, devices, circuits and/or assemblies that perform various functions as described. These elements, devices, circuits, and/or assemblies are exemplary implementations of means for performing their respectively described functions.

[0059] While the foregoing is directed to embodiments of the present invention, other and further embodiments of the invention may be devised without departing

Ex. 1004.0422

from the basic scope thereof, and the scope thereof is determined by the claims that follow.

Ex. 1004.0423

PATENT
Attorney Docket No.: EE043PCT

CLAIMS:

1. An apparatus for controlling climate within a building, comprising:

a smart climate unit for (i) obtaining distributed generator (DG) information pertaining to operation of a DG that generates power for the building, and (ii) controlling at least one climate condition within the building based on at least one of the DG information, local input, or remote input.

2. The apparatus of claim 1, wherein the smart climate unit controls the at least one climate condition based on at least one of a climate control profile or a location of a user.

3. The apparatus of claim 2, wherein the climate control profile specifies at least one climate control setting based on at least one of time, energy mode, user preference, user location, or weather information.

4. The apparatus of claim 2, wherein the smart climate unit controls the at least one climate condition based on a travel speed of the user.

5. The apparatus of claim 2, wherein the smart climate unit determines the location of the user based on a position location device.

6. The apparatus of claim 1, wherein the smart climate unit controls the at least one climate condition using demand management.

7. The apparatus of claim 1, wherein the smart climate unit learns climate control information over time and uses the learned climate control information for controlling the at least one climate condition.

8. The apparatus as in any of claims 1-7, further comprising the DG.

9. A method for controlling climate within a building, comprising:

Ex. 1004.0424

receiving distributed generator (DG) information pertaining to the operation of a DG that couples power to the building;

determining at least one setting for controlling at least one climate condition within the building based on at least one of the DG information, local input, or remote input; and

operating a climate control system of the building based on the at least one setting.

10. The method of claim 9, wherein the at least one setting is determined based on at least one of a climate control profile or demand management.

11. The method of claim 10, wherein the climate control profile specifies the at least one setting based on at least one of time, energy mode, user preference, user location, or weather information.

12. The method of claim 9, further comprising determining a location of a user, wherein the at least one setting is determined based on the location.

13. The method of claim 12, further comprising determining a travel speed of the user, wherein the at least one setting is further determined based on the travel speed.

14. The method of claim 12, further comprising receiving position information corresponding to a position location device, wherein the location is determined based on the position information.

15. The method of claim 9, further comprising learning climate control information over time, wherein the at least one setting is determined based on the learned climate control information.

Ex. 1004.0425

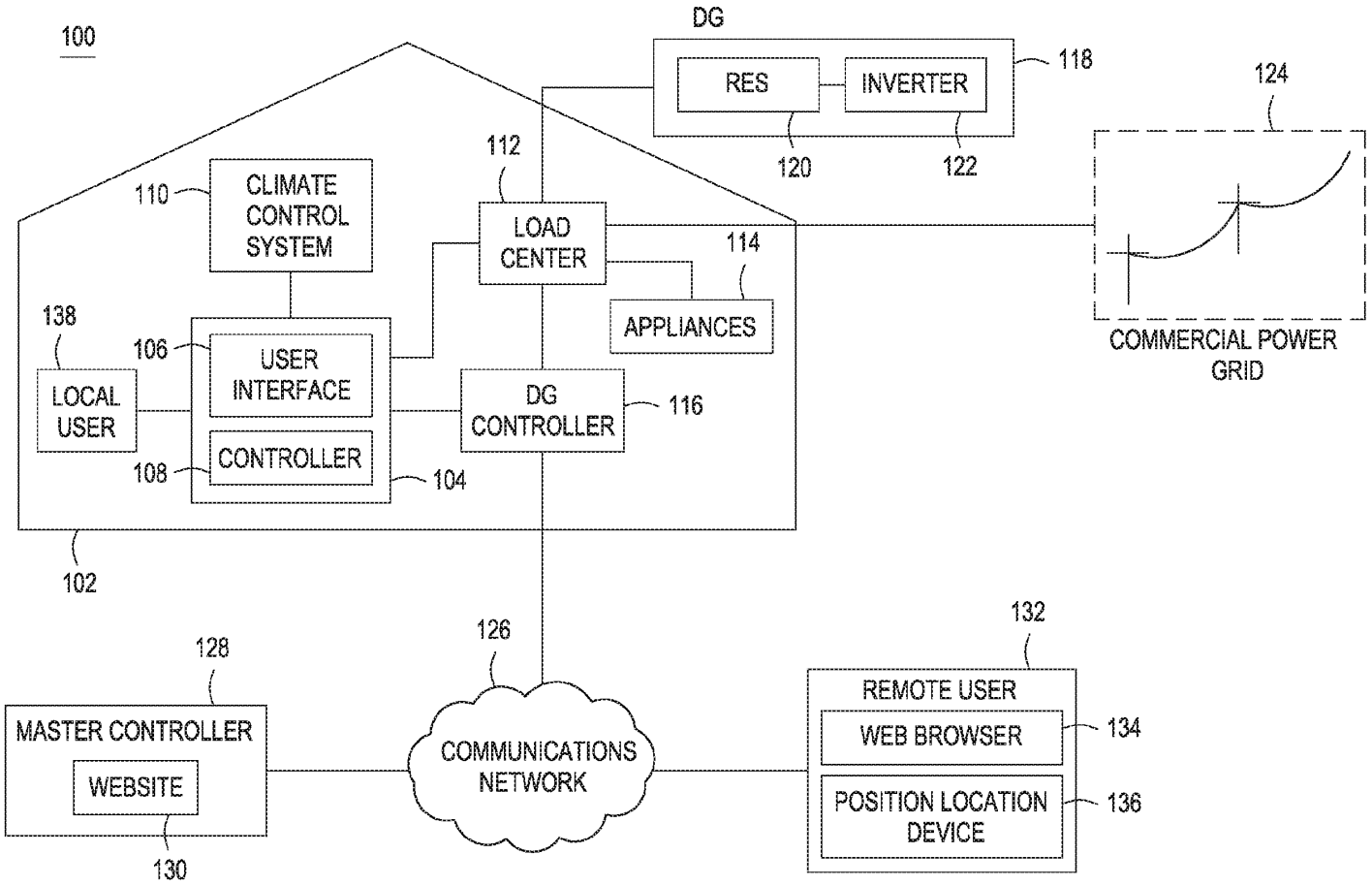

100
DG
RES
INVERTER
118
120
122
124
112
110
CLIMATE CONTROL SYSTEM
LOAD CENTER
114
APPLIANCES
COMMERCIAL POWER GRID
138
106
LOCAL USER
USER INTERFACE
DG CONTROLLER
116
CONTROLLER
108
104
102
126
132
128
REMOTE USER
MASTER CONTROLLER
WEBSITE
COMMUNICATIONS NETWORK
WEB BROWSER
134
POSITION LOCATION DEVICE
136
130

FIG. 1

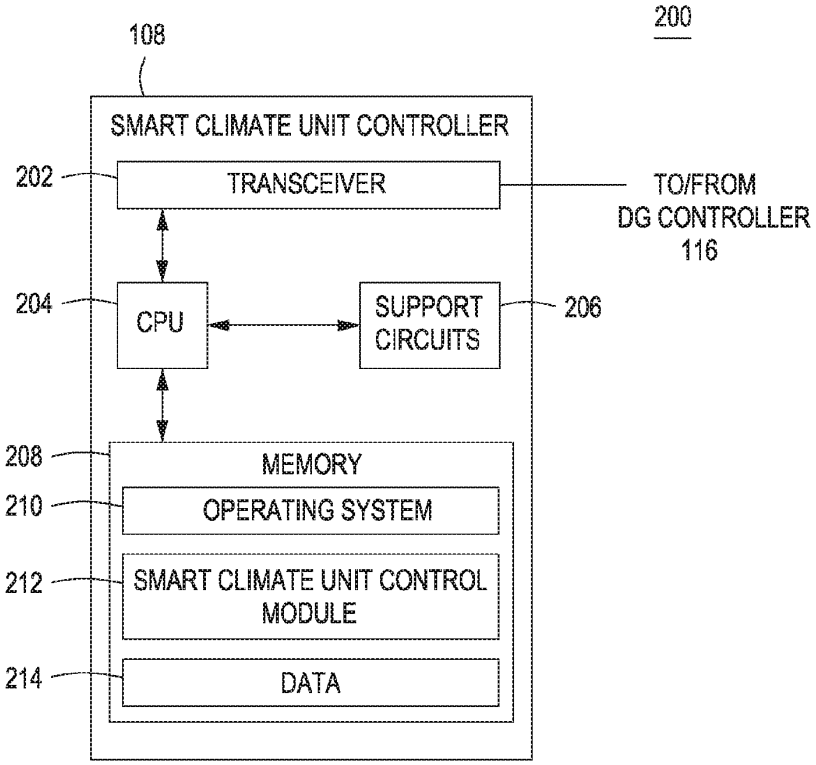

200
108
SMART CLIMATE UNIT CONTROLLER
202
TRANSCEIVER
TO/FROM
DG CONTROLLER
116
204
CPU
SUPPORT
CIRCUITS
206
208
MEMORY
210
OPERATING SYSTEM
212
SMART CLIMATE UNIT CONTROL
MODULE
214
DATA

FIG. 2

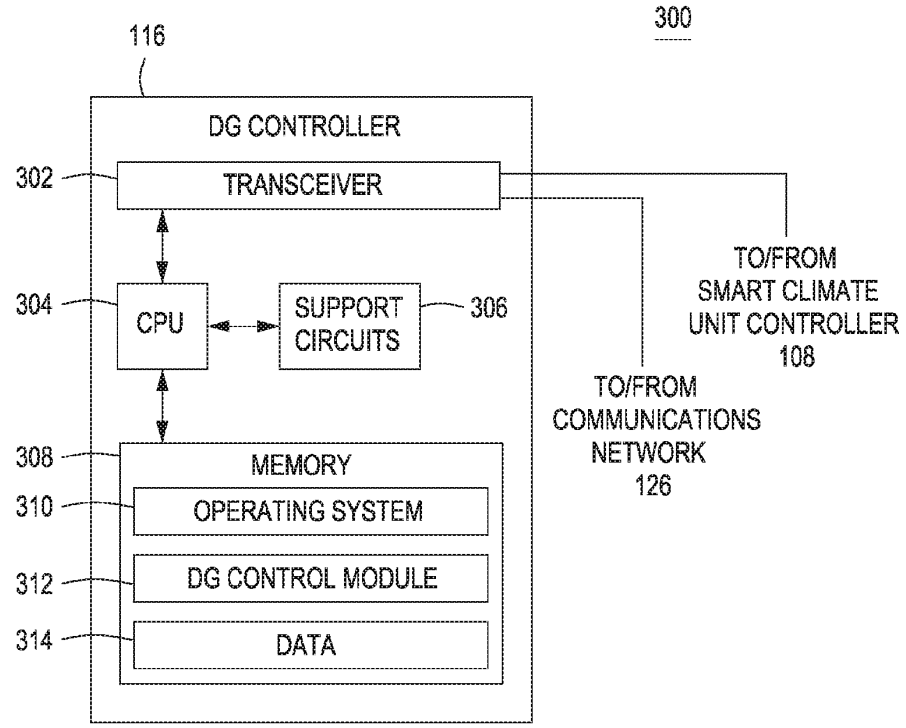

300
116
DG CONTROLLER
302
TRANSCEIVER
TO/FROM
SMART CLIMATE
UNIT CONTROLLER
108
304
CPU
SUPPORT
CIRCUITS
306
TO/FROM
COMMUNICATIONS
NETWORK
126
308
MEMORY
310
OPERATING SYSTEM
312
DG CONTROL MODULE
314
DATA

FIG. 3

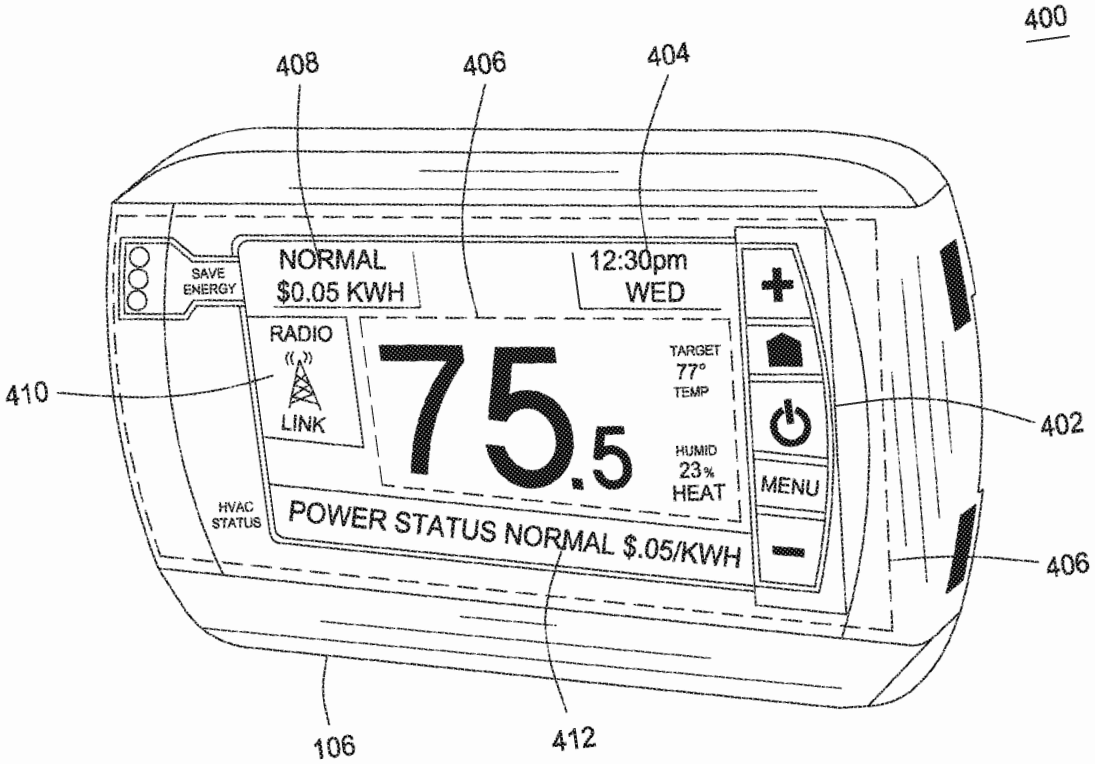

400
408
406
404
SAVE ENERGY
NORMAL
$0.05 KWH
12:30pm
WED
RADIO
LINK
410
75.5
TARGET
77°
TEMP
HUMID
23%
HEAT
MENU
402
406
HVAC STATUS
POWER STATUS NORMAL $.05/KWH
106
412

FIG. 4

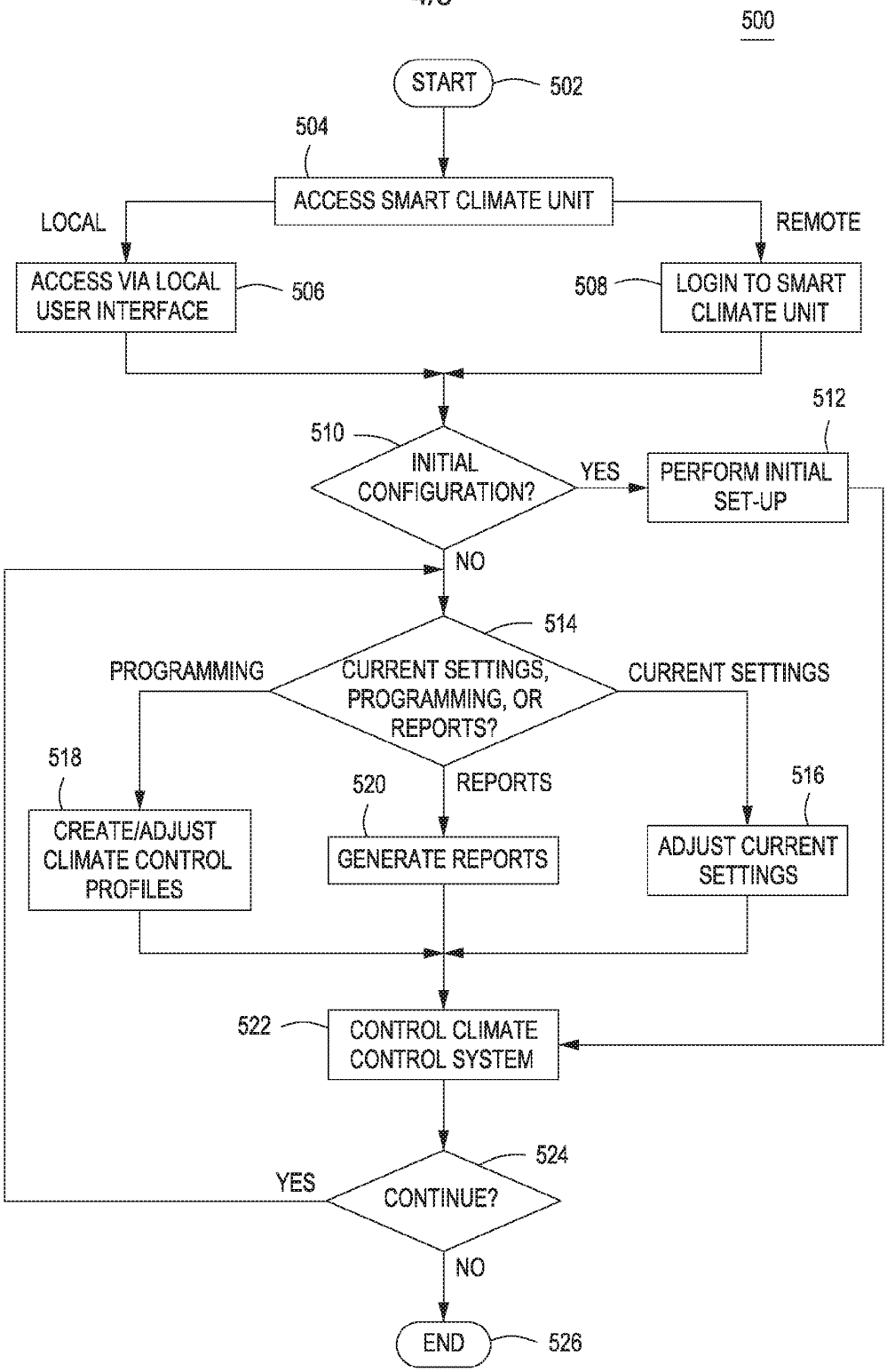

500
START
502
504
ACCESS SMART CLIMATE UNIT
LOCAL
REMOTE
ACCESS VIA LOCAL USER INTERFACE
506
508
LOGIN TO SMART CLIMATE UNIT
512
510
INITIAL CONFIGURATION?
YES
PERFORM INITIAL SET-UP
NO
514
PROGRAMMING
CURRENT SETTINGS, PROGRAMMING, OR REPORTS?
CURRENT SETTINGS
518
520
REPORTS
516
CREATE/ADJUST CLIMATE CONTROL PROFILES
GENERATE REPORTS
ADJUST CURRENT SETTINGS
522
CONTROL CLIMATE CONTROL SYSTEM
524
YES
CONTINUE?
NO
END
526

FIG. 5

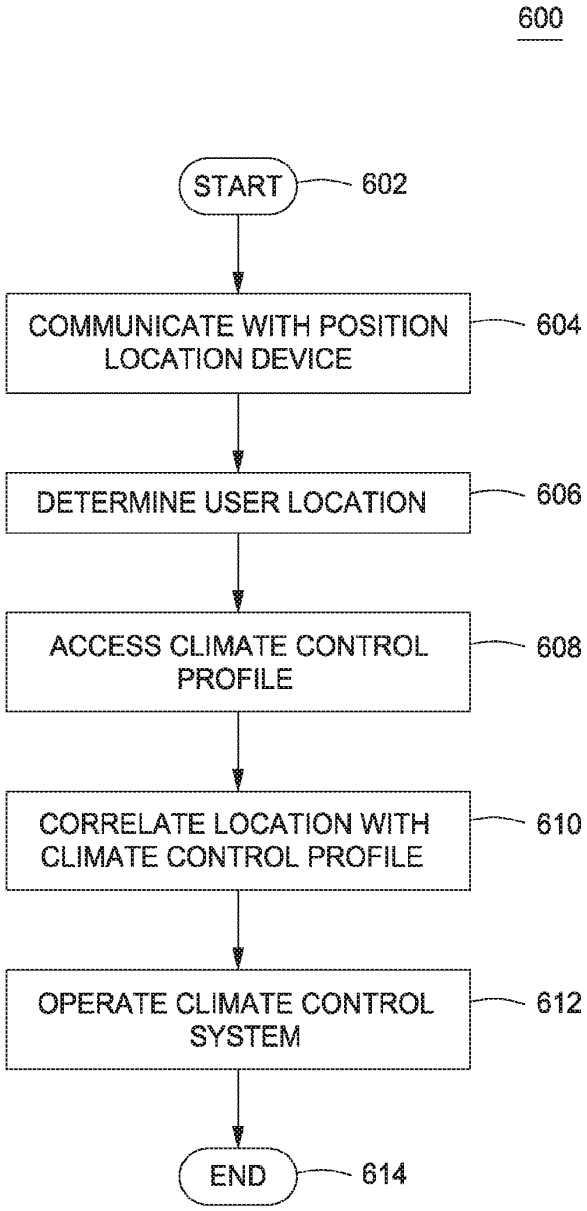

600
START
602
COMMUNICATE WITH POSITION LOCATION DEVICE
604
DETERMINE USER LOCATION
606
ACCESS CLIMATE CONTROL PROFILE
608
CORRELATE LOCATION WITH CLIMATE CONTROL PROFILE
610
OPERATE CLIMATE CONTROL SYSTEM
612
END
614

FIG. 6

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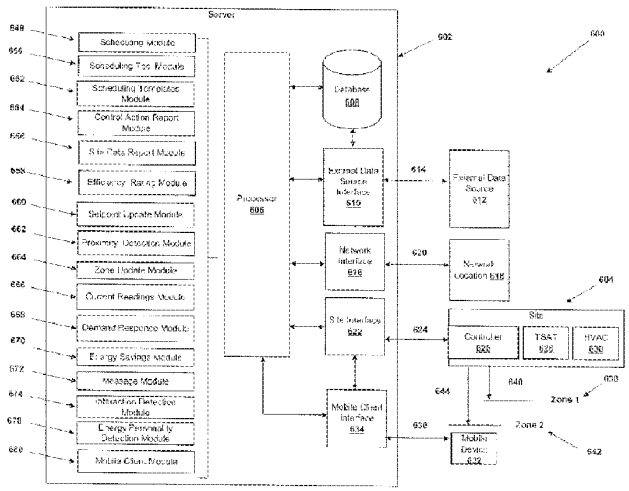
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[Continued on next page]

(54) Title: ENERGY MANAGEMENT SYSTEM AND METHOD

FIG. 6



(57) Abstract: A home energy management system includes a database configured to store site report data received from a plurality of residential sites using a wireless home energy network at each site. Each residential site includes a thermostat accessible to the wireless home energy network. A processor is operably coupled to the database and configured to access the site report data and detect a current temperature set-point of the thermostat at a first residential site; detect a first seasonal profile of the thermostat; detect a current operating mode of a HVAC system operably coupled to the thermostat; and determine a thermostat schedule of the thermostat using the first seasonal profile and the current operating mode of the HVAC system.

WO 2011/011404 A1

---- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

ENERGY MANAGEMENT SYSTEM AND METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims benefit of United States Provisional Patent Application Serial No. 61/255,678 entitled a "Proximity Based Home Energy Management System and Method", filed on October 28, 2009, and United States Provisional Patent Application Serial No. 61/235,798 entitled an "Alternative Energy Asset Management System with Intelligent Data Framework Capabilities, filed on August 21, 2009, and United States Provisional Patent Application Serial No. 61/226,899 entitled a "Congestion Detection, Curtailment, Storage, and Dispatch Module," filed on July 20, 2009, and United States Provisional Patent Application Serial No. 61/227,860 entitled a " Congestion Detection, Curtailment, Storage, and Dispatch Module," filed on July 23, 2009.

Field of the Disclosure

[0002] This disclosure relates generally to home systems, and more particularly to an energy management system and method.

BACKGROUND

[0003] Current energy management systems take a passive role to residential energy management. For example, consumers lack energy awareness and are typically left with having to evaluate a monthly bill to determine how much energy was consumed. Additionally, consumers lack transparency into what the leading causes of energy consumption are at their residences. Some utility companies are providing energy display only technologies that will allow consumers to see what the current price of energy may be. However, such displays take a passive role to conservation, and leaving it up to the consumer to manually curtail their use.

Ex. 1004.0433

[0004] In certain regions, information infrastructure is lacking to enable utility companies and customers to access real-time energy consumption. For example, some regions have smart meters that are capable measuring and reporting consumption data. However, there is a lack of communication and analytical infrastructure to allow utility companies to analyze future demand and schedule energy production. For example, some utilities are providing demand response systems that react to load levels, and force curtailment on residential, industrial, and commercial customers. Such programs have not been well received as they typically inconvenience the end user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] It will be appreciated that for simplicity and clarity of illustration, elements illustrated in the Figures have not necessarily been drawn to scale. For example, the dimensions of some of the elements are exaggerated relative to other elements. Embodiments incorporating teachings of the present disclosure are shown and described with respect to the drawings presented herein, in which:

[0006] FIG. 1 illustrates a block diagram of an energy management system and energy transmission system according to an aspect of the disclosure;

[0007] FIG. 2 illustrates a energy management system operable to manage energy at a site according to an aspect of the disclosure;

[0008] FIG. 3 illustrates a flow diagram of a method of managing energy at a site according to an aspect of the disclosure;

[0009] FIG. 4 illustrates a block diagram of a controller according to an aspect of the disclosure;

[0010] FIG. 5A illustrates a block diagram of a mobile device operable to be used with an energy management system according to another aspect of the disclosure;

Ex. 1004.0434

[0011] FIG. 5B illustrates a block diagram of an energy management user interface according to another aspect of the disclosure;

[0012] FIG. 6 illustrates a block diagram of an energy management system according to another aspect of the disclosure;

[0013] FIG. 7 illustrates an energy management user interface according to an aspect of the disclosure;

[0014] FIG. 8 illustrates an energy management system interface operable to report energy usage and savings information according to a further aspect of the disclosure;

[0015] FIG. 9 illustrates an energy management system interface operable to access and edit user and site information according to a further aspect of the disclosure;

[0016] FIG. 10 illustrates an energy management scheduling user interface operable to schedule energy use at a residential site according to a further aspect of the disclosure;

[0017] FIG. 11 illustrates an wireless thermostat user interface operable according to an aspect of the disclosure;

[0018] FIG. 12 illustrates a block diagram of a wireless thermostat according to a further aspect of the disclosure;

[0019] FIG. 13 illustrates a block diagram of an energy network bridge according to a further aspect of the disclosure;

[0020] FIG. 14 illustrates a block diagram of a demand response system according to a further aspect of the disclosure;

[0021] FIG. 15 illustrates a block diagram of a aggregate demand schedule system according to a further aspect of the disclosure; and

Ex. 1004.0435

[0022] FIG. 16 illustrates a flow diagram of a method of managing energy use at a residence according to a further aspect of the disclosure.

[0023] The use of the same reference symbols in different drawings indicates similar or identical items.

DETAILED DESCRIPTION OF DRAWINGS

[0024] The following description in combination with the Figures is provided to assist in understanding the teachings disclosed herein. The following discussion will focus on specific implementations and embodiments of the teachings. This focus is provided to assist in describing the teachings and should not be interpreted as a limitation on the scope or applicability of the teachings. However, other teachings can certainly be utilized in this application. The teachings can also be utilized in other applications and with several different types of architectures such as distributed computing architectures, client/server architectures, or middleware server architectures and associated components.

[0025] Devices or programs that are in communication with one another need not be in continuous communication with each other unless expressly specified otherwise. In addition, devices or programs that are in communication with one another may communicate directly or indirectly through one or more intermediaries.

[0026] Embodiments discussed below describe, in part, distributed computing solutions that manage all or part of a communicative interaction between network elements. In this context, a communicative interaction may be intending to send information, sending information, requesting information, receiving information, receiving a request for information, or any combination thereof. As such, a communicative interaction could be unidirectional, bidirectional, multi-directional, or any combination thereof. In some circumstances, a communicative interaction could be relatively complex and involve two or more network elements. For example, a communicative interaction may be "a

Ex. 1004.0436

conversation" or series of related communications between a client and a server – each network element sending and receiving information to and from the other. The communicative interaction between the network elements is not necessarily limited to only one specific form. A network element may be a node, a piece of hardware, software, firmware, middleware, another component of a computing system, or any combination thereof.

[0027] For purposes of this disclosure, an energy management system, network device, or any combination thereof can include any instrumentality or aggregate of instrumentalities operable to compute, classify, process, transmit, receive, retrieve, originate, switch, store, display, manifest, detect, record, reproduce, handle, or utilize any form of information, intelligence, or data for business, scientific, control, entertainment, or other purposes. For example, an energy management system, network device, or any combination thereof can include any combination of a personal computer, a PDA, a consumer electronic device, a media device, a smart phone, a cellular or mobile phone, a smart utility meter, an advanced metering infrastructure, a smart energy device, an energy display device, a home automation controller, an energy hub, a smart energy gateway, a set-top box, a digital media subscriber system, a cable modem, a fiber optic enabled communications device, a media gateway, a home media management system, a network server or storage device, an energy substation, a vehicle charging station, a renewable energy production device, a renewable energy control device, an energy storage management system, a smart appliance, an HVAC system, a water pump, a heat pump, a hot water heater, a thermostat, an energy controller, an irrigation system, a lighting system, an alarm system, a smart power outlet, an energy detection device, a power measurement device, a power measurement unit (PMU), an air handler, a wireless air damper, a humidity control system, a heat and motion sensing device, a smart power outlet, a switch router, wireless router, or other network communication device, or any other suitable device or system, and can vary in size, shape, performance, functionality, and price.

Ex. 1004.0437

[0028] According to an aspect, an energy management system can include memory, one or more processing resources or controllers such as a central processing unit (CPU) or hardware or software control logic. Additional components of the energy management system can include one or more storage devices, one or more wireless, wired or any combination thereof of communications ports to communicate with external devices as well as various input and output (I/O) devices, such as a keyboard, a mouse, pointers, controllers, and display devices. The energy management system can also include one or more buses operable to transmit communications between the various hardware components, and can communicate using wireline communication data buses, wireless network communication, or any combination thereof.

[0029] As used herein, a wireless energy network can include various types and variants of wireless communication configurable to manage energy at a site, including associated protocols or enhancements thereto including, but not limited to, any combination or portion of, IEEE 802.15-based wireless communication, Zigbee communication, INSETEON communication, X10 communication protocol, Z-Wave communication, Bluetooth communication, WIFI communication, IEEE 802.11-based communication, WiMAX communication, IEEE 802.16-based communication, various proprietary wireless communications, or any combination thereof.

[0030] As described herein, a flow charted technique, method, or algorithm may be described in a series of sequential actions. Unless expressly stated to the contrary, the sequence of the actions and the party performing the actions may be freely changed without departing from the scope of the teachings. Actions may be added, deleted, or altered in several ways. Similarly, the actions may be re-ordered or looped. Further, although processes, methods, algorithms or the like may be described in a sequential order, such processes, methods, algorithms, or any combination thereof may be operable to be performed in alternative orders. Further, some actions within a process, method, or algorithm may be performed simultaneously during at least a point in time (e.g., actions

Ex. 1004.0438

performed in parallel), can also be performed in whole, in part, or any combination thereof.

[0031] As used herein, the terms "comprises," "comprising," "includes," "including, " "has," "having" or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a process, method, article, system, or apparatus that comprises a list of features is not necessarily limited only to those features but may include other features not expressly listed or inherent to such process, method, article, system, or apparatus. Further, unless expressly stated to the contrary, "or" refers to an inclusive-or and not to an exclusive-or. For example, a condition A or B is satisfied by any one of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

[0032] Also, the use of "a" or "an" is employed to describe elements and components described herein. This is done merely for convenience and to give a general sense of the scope of the invention. This description should be read to include one or at least one and the singular also includes the plural, or vice versa, unless it is clear that it is meant otherwise. For example, when a single device is described herein, more than one device may be used in place of a single device. Similarly, where more than one device is described herein, a single device may be substituted for that one device.

[0033] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of embodiments of the present invention, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety, unless a particular passage is cited. In case of conflict, the present specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

Ex. 1004.0439

[0034] To the extent not described herein, many details regarding specific materials, processing acts, and circuits are conventional and may be found in textbooks and other sources within the computing, electronics, and software arts.

[0035] In accordance with an aspect of the disclosure, an energy management system is disclosed. The energy management system can include a database configured to store site report data received from a plurality of residential sites using a wireless home energy network at each site. According to an aspect, each residential site can include a thermostat accessible to the wireless home energy network. The energy management system can also include a processor operably coupled to the database and configured to access the site report data, detect a current temperature set-point of the thermostat at a first residential site, and detect a first seasonal profile of the thermostat. The processor can also detect a current operating mode of a HVAC system operably coupled to the thermostat, and determine a thermostat schedule of the thermostat using the first seasonal profile and the current operating mode of the HVAC system.

[0036] FIG. 1 illustrates a block diagram of an energy management system, illustrated generally at 100, according to an aspect of the disclosure. Energy management system 100 can include an energy source 102 configured to generate energy that can be coupled to an energy transmission system 104 to satisfy a load or demand at a first site 106, second site 108, third site 110, or any combination thereof. Energy transmission system 104 can be configured to be coupled to one or more of first site 106, second site 108, third site 110, or any combination thereof.

[0037] According to an aspect, first site 106 can include a distributed energy generation (DEG) asset 112. DEG asset 112 can include various types of energy producing assets such as a natural gas generator, fuel cell generator, solar array, solar concentrator, wind turbine generator, battery array, electric vehicle, hyrdo-power generator, any type of

Ex. 1004.0440

generator, or any combination thereof capable of outputting energy to energy transmission system 104.

[0038] According to a further aspect, second site 108 can include a virtual capacity generation (VCG) asset 114. VCG 114 can include an energy consumption device configured to reduce energy consumption or load placed on energy transmission system 104 during various periods. For example, VCG asset 108 can include equipment located a commercial facility, industrial facility and the like. According to another aspect, second site 102 can include a retail center having energy consuming devices that can be managed to reduce energy consumption. In other forms, second site 108 can include a residential site having VCG assets that include energy consuming devices such as an HVAC system, heat pump, hot water heater, lighting systems, entertainments systems, refrigerators, or any type of electricity consuming device or system, or any combination thereof. According to a further aspect, third site 110 can include a combination of a assets such as DEG asset 116 and a VCG asset 118.

[0039] According to another aspect, first site 106 can be coupled to server 120 using an Internet or broadband connection 122. Second site 108 can be coupled to server 120 using a second Internet or broadband connection 124. Third site 110 can be coupled to server 120 using a third Internet or broadband connection 126. Various other types of connections can also be deployed by energy management system 100 as needed or desired.

[0040] According to another aspect, portions or combinations of energy transmission system 104 can be used within one or more markets such as ERCOT, Southwest Power Pool (SPP), California Independent system operator (CAISO), Western Electric Coordinating Council (WECC), other grids or markets, future national or regional grids, operators, councils, or any combination or portions thereof can be accessed using energy management system 100.

Ex. 1004.0441

[0041] According to a further aspect, energy management system 100 can utilize energy management information (EMI) to manage energy production, consumption, curtailment, load shedding, purchase decisions, demand response decisions, or any combination thereof. For example, EMI can include any combination of data sources such as real-time congestion data, energy transmission line operating conditions, syncrophasor data, firm owned alternative energy generator operating status, non-firm owned alternative energy generator operating status, locational marginal pricing data, congestion revenue rights data, energy storage capacity, stored energy output capacity, real time energy pricing data, historical energy pricing data, real time nodal demand data, historical nodal demand data, real time zonal demand data, historical zonal demand data, external market demand data, historical external market demand data, nodal price data, real time energy price data, real time energy demand data, historical energy demand data, historical energy price data, firm owned alternative energy generator data, non-firm owned alternative energy generator data, est. firm owned alternative energy generator output schedule, estimated non-firm owned alternative energy generator output schedule, macro environmental data, micro environmental data, real-time grid congestion data, historical grid congestion data, renewable energy credit information, carbon credit cap and trade pricing information, fixed and variable costs for operating alternative energy generators, production tax credit (PTC) pricing information, investment tax credit (ITC) information, federal grant information, credit-to-grant comparison analysis data, PTC to ITC analysis data, interest / finance data for alternative energy generators, asset depreciation schedules, available solar and wind output capacity, distributed energy production scheduling data, feed-in tariff data, baseline energy generator data, load utilization data, transmission efficiency data, congestion right revenue data, priority dispatch data, federal renewable portfolio standard (RPS) data, state renewable portfolio standard (RPS) data, net-metering data, current or forecasted % coal production data, current or forecasted % natural gas production data, current or forecasted % green house gas production data, current or future coal pricing data, current or future natural gas pricing data, current or future oil pricing data, current or

Ex. 1004.0442

future energy transmission pricing data, forecasted transmission price setting events, virtual capacity data, historical site performance data, seasonal weather and performance data, aggregate scheduling demand data, collaborative demand response data, historical device consumption data, forecasted device consumption data, or any combination thereof.

[0042] FIG. 2 illustrates an energy management system, illustrated generally at 200 and configured to be used at a site 202 according to an aspect of the disclosure. Site 202 can include a residential site, and industrial site, a manufacturing site, a commercial site, or any combination thereof. According to an aspect, energy management system 200 can include a server 204 located at a remote location that can be communicatively coupled to a network 206. According to a further aspect, site 202 can include a controller 216 capable of connecting to a wireless thermostat (TSTAT) 208, an associated mobile device 210, one or more smart appliances 212, a distributed energy generating asset 214, or any combination thereof. In a form, controller 216 can establish a wireless energy network 242 using a wireless communication described herein. Various combinations of networks and variants thereof can also be deployed by controller 216 to establish wireless energy network 242.

[0043] According to a further aspect, mobile device 210 can communicate with controller 216 using a WIFI or 802.11 based communication, Bluetooth communication, Zigbee communication, or various other wireless communication, or any combination thereof. According to a further aspect, mobile device 210 an communicate with an information network 240 using a subscriber based wireless data communication network such as a 3G network, 4G network, EDGE network, a cellular network, WiMAX, other wireless data communication, or any combination thereof. According to a further aspect, site 202 can include a gateway 218 configured as a broadband gateway such as a DSL gateway, cable system gateway, fiber optic gateway, or any combination thereof.

[0044] According to another aspect, energy management system 200 can include an advanced metering infrastructure (AMI) gateway 242 configured to communicate with a

Ex. 1004.0443

smart metering device 250. Smart metering device 250 can include a utility or power company owned metering device and can be configured to communicate using a wireless network such as a cellular network, a mesh network, WiMAX network, or any combination thereof. According to an aspect, controller 216 can communicate with AMI gateway 242 using an AMI network 248 communicated by AMI gateway 242.

[0045] According to a further aspect, energy management system 200 can include server 204 configurable to include various energy management logic, modules, interfaces, database sources, or various combinations thereof to manage energy use at site 200. Server 204 can also include a processor 222 that can be configured as multiple processors having one or more processing cores as needed or desired, one or more databases 224 that can be internal or external to server 204, and memory 226 configurable to store data. According to an aspect, server 204 can be located in a single location however multiple locations, and server configurations including cloud computing, distributed computing, dedicated computing, or any combination thereof can be deployed. According to an aspect, controller 216 can include portions or all of server 204 and can deploy some or all of the capabilities of server 204.

[0046] According to another aspect, server 204 can include a site interface 220 operable to be coupled to network 206 and gateway 218 to communicate data between site 202 and server 204. Server 204 can also include a mobile client interface 226 that can be coupled to a wireless telecommunications communication gateway such as a WAP gateway and the like. According to an aspect, mobile client interface 226 can communicate with one or more mobile devices 210, using information network 240 or another data network provided by a wireless telecommunications provider. Mobile client interface 226, mobile device 210, an information network 240, or various combinations thereof can include secure connection capabilities such as SSL connections or other carrier supported secure connection capabilities. Server 204 can also include an energy price monitor 228, a demand response module 230, an efficiency rating module 232, a proximity detection

Ex. 1004.0444

module 234, a scheduling module 236, an energy savings module 238, a messaging module 240, or any combination thereof.

[0047] According to an aspect, energy price monitor 228 can be deployed by processor 222 and can access EMI stored within database 224 or a remote data source to monitor energy pricing of site 202.

[0048] According to an aspect, demand response module 230 can be deployed by processor 222 and can access EMI stored within database 224 or a remote data source to manage demand response preferences and capabilities of site 202.

[0049] According to an aspect, efficiency rating module 232 can be deployed by processor 222 and can access EMI stored within database 224 or a remote data source to determine an efficiency rating, thermal response, virtual capacity capabilities, performance data, or various other of site 202.

[0050] According to an aspect, proximity detection module 234 can be deployed by processor 222 and can access EMI stored within database 224 or a remote data source to detect a location of mobile device 210 relative to site 202, and modify operating conditions of site 202 based on a proximity of mobile device 210 to site 202.

[0051] According to an aspect, scheduling module 236 can be deployed by processor 222 and can access EMI stored within database 224 or a remote data source to schedule energy use or operations of one or more energy consuming devices at site 202.

[0052] According to an aspect, energy savings module 238 can be deployed by processor 222 and can access EMI stored within database 224 or a remote data source to determine a past or forecasted energy savings of site 202. In a form, server 204 can include user account login information at a utility company or energy provider that can enable a user to gain access to meter data. As such, energy savings module 238 can pull EMI data stored at a third party website, and output past or forecasted energy savings of site 202.

Ex. 1004.0445

[0053] According to an aspect, messaging module 240 can be deployed by processor 222 and can access EMI stored within database 224 or a remote data source to communicate messages. For example, messaging module 240 can use an email address, mobile device identifier, SMS gateway data, network device identifier data, IP address of controller 216, IP address of gateway 218, IP address of AMI gateway 242, or any combination thereof to communicate messages or other energy management information.

[0054] According to a further aspect, energy management system 200 and controller 216 can access consumption data at site 202 using AMI gateway 242. For example, controller 216 can include a wireless communication module (not expressly illustrated in FIG. 2) such as a Zigbee communication module (e.g. 802.15.4), WIFI module, Bluetooth module or various other wireless modules, or any combination thereof. Controller 216 can include one or more profiles stored within a memory device (not expressly illustrated in FIG. 2) configured to include data that will enable controller 216 to join AMI gateway 242. For example, a profile can include various attributes to initiate or establish communication using one or more security levels as needed or desired.

[0055] According to a further aspect, energy management system 200 can be used with an energy management application accessible or deployed by mobile device 210 or other computing device. For example, the energy management application can be used to control TSTAT 208, one or more smart appliances 212 or various other devices at site 202. A user can access the energy management application using mobile device 210 or other computing device and read the current settings, operating conditions, or various other types of energy management information associated with site 202. For example, a user can view if TSTAT 208 and an associated HVAC system (not expressly illustrated in FIG. 2) is on or off, a mode such as heat, A/C, or fan, or any combination thereof. In other forms, the user can use the energy management application to access multiple thermostats or zones at site 202. Although the energy management application has been described in the context of accessing TSTAT 208, it should be understood that other network devices,

smart appliances, lighting systems, or any other energy consuming or network accessible device or any combination thereof can be accessed using the energy management application.

[0056] According to a further aspect, mobile device 210 can include a mobile device application that can upload location data to server 204, controller 216, TSTAT 210, smart appliances 212, various other devices capable of receiving location data, or any combination thereof. For example, in a particular form mobile device 210 can report a current location using a location application program interface (API) of mobile device 210, and can upload location data to server 204 using mobile client interface 226. Server 204 can then deploy proximity detection module 234 to determine whether one or more operating conditions should be altered at site 202. For example, proximity detection module 234 can include rules based logic to determine if an operating condition of a resource at site 202 should be altered. For example, if a user is greater than two miles away from site 202, and is moving away from site 202, server 204 can generate a control action report to be communicated to site 202. For example, a control action report can include adjusting TSTAT 208 up a specific number of degrees relative based on the distance and direction a user may be from site 202.

[0057] According to a particular aspect, a user may have previously established an upper setting limit a user would like an internal temperature to reach at site 202 without having an associated HVAC unit turning on. The upper setting limit can be sent to TSTAT 208 based on how far a user may be from site 202. A lower limit can be established for a heating unit as well. These limits can be entered using mobile device 210, a web-based user interface, or any combination thereof.

[0058] According to another aspect, server 204 can characterize site 202 to determine operating characteristics and performance data of site 202 and associated energy consuming devices at site 202. For example, server 204 can use efficiency rating module 232 to monitor performance data at site 202. Performance data can include measured

Ex. 1004.0447

performance data detected by controller 216, performance specifications of an energy consuming device that can be based on a model number or other identification data of the device, the size or square footage of site 202, efficiency improvements or specifications of site 202, various other EMI data, or any combination thereof. As performance of an energy consuming device may be detected, an energy alert can be sent using messaging module 240. In another form, an energy alert can be sent to a third party to initiate a service call at site 202. For example, one or more third parties may subscribe to a service to buy leads based on an energy consuming devices performance eroding. Server 204 can include a lead generation module (not expressly illustrated in FIG. 2) that can be communicated using messaging module 240 to a subscriber such as a service company, appliance provider, and the like.

[0059] In another form, performance data can be used to determine when to adjust an operating condition of an energy consuming device based on a schedule, proximal location of the user and mobile device, in response to a demand response event, in response to a consumer setting of a desired operating condition based on an energy savings mode (e.g. low, med, high), or any combination thereof.

[0060] According to a particular aspect, controller 216 can be configured as a plug-device that can be plugged directly to a wall socket or other power receptacle and can include various components (not expressly shown in FIG. 2). Controller 216 can also include a network interface or Ethernet port, one or more USB interfaces or mini-USB interfaces, an SDIO slot, additional data or plug interfaces, or any combination thereof. Controller 216 can include an internal or external AC, DC, AC to DC converter power module, or any combination thereof to power controller 216. According to an aspect, controller 216 can be provided as a small form factor unit to allow for easy installation, use, and discretionary placement. For example, controller 216 can include a plug computer based on Marvell Corporation's Kirkwood ® microprocessor, Part Number 6281 and associated components. In another form, controller 216 can include a plug computer including

Ex. 1004.0448

specifications described in "Sheeva Plug Development Kit Reference Design", version 1.1, and previous versions which are herein incorporated by reference. Other processors having various other speeds and supporting components can also be used. According to an aspect, controller 216 can include various buses that can be used to install one or more wireless modules. For example, controller 216 can include a UART bus interface that can be used to interface a Zigbee module, WIFI module, Bluetooth Module, various other modules or combinations thereof. Various other buses can also be used including but not limited to a USB bus, a SPI bus, an SDIO bus, a mini-USB bus, or any combination thereof. Controller 216 can include buses that can be located internal or external to a housing of controller 216.

[0061] According to an aspect, energy management system 200 can include one or more network devices, such as TSTAT 208, smart appliances 212, or various other network devices installed at a residential site such as a home or residence. Controller 216 can establish a wireless energy network 242 capable of communicating with a network device at site 202. Energy management system 200 can also include server 204 disposed remotely from site 202 and capable of generating a control action report to control the network device. Controller 216 can also be located at site 202 including a residential site. Controller 202 can be in communication with server 204. According to an aspect, controller 202 can establish initiate a plurality of operating status requests of the network device, and receive device data in response to at least one of the operating status requests. Controller 202 can further generate a site report including the device data, and initiate a communication of the site report to server 204. During the communication of the site report from controller 202 to server 204, controller 202 can detect an availability of a control action report at server 202 in conjunction with the communication of the site report. As such, a secure connection can be initiated from site 202 to communicate site reports and receive control action reports without having to have server 204 initiate a communication with site 202.

Ex. 1004.0449

[0062] According to another aspect, server 202 can generate control action report prior to a site report upload, in association with a site report upload, or any combinations thereof. For example, one or more control action reports can be generated and queued in advance of a site report upload. In other forms, a control action report can be generated during a site report upload. In yet another form, a control action report can be generated in response to information uploaded within the site report. As such, various combinations of control action report generation techniques can be deployed as needed or desired.

[0063] According to an aspect, energy management system 200 can be used to generate a control action report in response to a distance mobile client 210 may be from site 202. For example, site 202 can include a network device, such as TSTAT 208, joined to wireless energy network 242. According to an aspect, controller 216 can be configured to establish wireless energy network 242 using a wireless mesh network and initiate a plurality of operating status requests. For example, controller 216 can access TSTAT 208 using wireless energy network 242 at a first operating status request interval. Controller 216 can be used to generate a site report that can include device data of TSTAT 208 at a site report interval. According to an aspect, a site report interval can be the same interval as the first operating status request interval. In other forms, each interval can be different. For example, the first operating status report request interval can be set to thirty seconds and the site report interval can be set to sixty seconds. As such, two cycles of data can be acquired. Various combinations of intervals can be used as desired.

[0064] According to a further aspect, controller 216 can initiate a communication of site report to a remote server such as server 204 using gateway 218. For example, gateway 218 can include a residential broadband connection 206 capable of establishing a secure gateway connection between site 202 and server 204 using a public communication network. According to an aspect, residential broadband connection 206 does not include a cellular communications based network.

Ex. 1004.0450

[0065] In another form, control data can be provided in response to a detection of a travel direction and a distance between mobile device 210 having location reporting device, and site 202. For example, as a user of mobile device 210 is moving away from site 202, server 204 can detect a direction and distance mobile device 210 may be from residential site 202. Server 204 can then determine if a control action should be generated. For example, as mobile device 210 moves away from residential site 202, TSTAT 208 setting can be adjusted up during a warm or summer season (or down during a cold or winter season) to reduce energy consumption. Other network devices can also be adjusted as needed or desired.

[0066] According to a further aspect, energy management system 200 can use energy pricing monitor 228 to generate a control action report. For example, energy pricing monitor 228 can be configured to detect energy pricing within an energy market, and initiate curtailing use of a network device, such as TSTAT 208, smart appliance 212, other network devices at site 202, or any combination thereof. For example, energy pricing monitor 228 can output a control action report in response to an unfavorable pricing condition, and further upon the detection of a travel direction and a distance between mobile device 210 and site 202. In another form, energy pricing monitor 228 can also initiate use of one or more network devices at site 202 in response to a favorable pricing condition, and a detection of a travel direction and a distance between mobile device 210 and residential site 202. In this manner, a user's travel direction, distance, and current energy pricing within a market can be used to determine how energy consumption can occur at site 202.

[0067] According to a further aspect, energy management system 200 can also use demand response module 230 to detect a demand response condition and respond accordingly. For example, demand response module 230 can be used to detect a grid condition favorable to a demand response event and detect a profile preference setting of an user or site manager of site 202. For example, a user or site manager can set a profile

Ex. 1004.0451

to always participate, not participate, or have a request sent to collaborate on whether to participate. Other profile settings can also be used such as determining an economic or monetary value to a user or site manager if participating in a demand response event. For example, a favorable grid condition can include an increase in the price of energy due to an undersupply of energy within an energy transmission system or market (not expressly illustrated in FIG. 2). In another form, a favorable condition can include an oversupply of energy purchased by an energy provider of site 202. Additionally, a high demand period can be detected and the oversupply of energy can be increased using a demand response event. In another form, a favorable grid condition can include a time interval when transmission pricing to use an energy transmission system may be determined. As such, an energy provider would receive an economic benefit from reducing load when the transmission rate or rate for using transmission lines would be determined. Various combinations of favorable grid conditions can be detected as needed or desired in association with determining a demand response event to curtail energy use at site 202.

[0068] According to an aspect, energy management system 200 can use demand response module 230 configured to detect an energy capacity of site 202 having a residence. For example, demand response module 230 can detect a grid condition favorable to a demand response event, and can also detect a preference of an resident or owner of the residence to participate in demand response events. Demand response module 230 can also determine an energy capacity of site 202 using historical device consumption data received in a site report, and forecasted device consumption data. Control data can then be generated to alter an operating condition of the network device in response to the grid condition and the preference of the owner and the energy capacity of site 202.

[0069] According to a further aspect, server 204 can determine an energy capacity of site 202 using device data received in association with site reports received from site 202. For example, site report data can be used with efficiency rating module 232 to determine a virtual generation capacity or energy reduction capacity of site 202. Upon detecting an

Ex. 1004.0452

available capacity, demand response module 230 can output a curtailment action to be used within a control action report to be communicated to site 202. For example, a curtailment action can include an updated control data to alter a current operating condition of one or more network devices connected to wireless energy network 242 at site 202.

[0070] According to a further aspect, controller 216 can be configured to detect a new set-point value within a control action report, and identify TSTAT 208 to be adjusted to the new set-point value. In some forms, multiple wireless thermostats can be accessed via wireless energy network 242 and adjusted as desired. Controller 216 can communicate a different set-point values to each of the wireless thermostats. Controller 216 can initiate an outputting of new set-point values to TSTAT 208 and others using wireless energy network 242.

[0071] According to an aspect, energy management system 200 can use proximity detection module 234 to detect a distance mobile device 210 may be from site 202 including a residential site. For example, proximity detection module 234 can access location data stored within database 224 and provided by mobile device 210 using mobile client interface 226. Proximity detection module 234 can further detect mobile device 210 within a first zone (e.g. less than one (1) mile from the site, less than three (3) miles from site, greater than five (5) miles from site, etc.). Proximity detection module can further detect a current thermostat setting of TSTAT 208, and an indoor temperature detected at site 202 and communicated within a site data report communicated from site 202. Proximity detection module 234 can then determine a percentage adjustment to adjust a current setting of TSTAT 208, and output the percentage adjustment as a new set-point value to be used within a control action report. For example, if mobile device 210 can be detect as being greater than three (3) miles from site 202, TSTAT 208 can be adjusted to within 75% of the maximum setting in a summer season, or minimum setting in a winter season. As such, a site 202 can be managed based on a user's proximity to a site, which

Ex. 1004.0453

zone a user may be located in, and current seasonal schedule or setting being used at a site 202.

[0072] According to another aspect, energy management system 200 can include TSTAT 208 configured as a wireless thermostat capable of joining wireless energy network 242 operable as a wireless home energy network. According to an aspect, TSTAT 208 can be configured to not include an enabled local programming schedule configured to control an HVAC system of site 202. For example, TSTAT 208 can include sufficient memory to store a set-point value, but may be not include scheduling capabilities at TSTAT 208. As such, a simplified user interface of TSTAT 208 can be deployed. For example, if TSTAT 208 includes a scheduling feature, energy management system 200 can be used to disable the scheduling feature located at TSTAT 208. As such, TSTAT 208 can be considered a non-programmable thermostat capable of connecting to wireless energy network 242, and set-point values or other control actions can be received using wireless energy network 242. In this manner, scheduling use of TSTAT 208 can be provided using on-line or web application based scheduling tool.

[0073] According to a further aspect, controller 216 can be further configured to initiate joining TSTAT 208 to wireless energy network 242 using a unique identifier of TSTAT 208. A unique identifier of TSTAT 208 can be received from server 204 and a local schedule and or scheduling capabilities of TSTAT 208 can be disabled. In this manner, an overall design complexity of a thermostat can be reduced and scheduling capabilities can be provided using a schedule created within a network environment and output by controller 216, server 204, mobile device 210, or any combination of sources capable of providing schedule information or control action data to TSTAT 208.

[0074] According to another aspect, energy management system 200 can also use scheduling module 236 to schedule use of a network device located at site 202 and capable of connecting to wireless energy network 242. Additionally, multiple user schedules can be stored within database 224 and used by site 202. For example, scheduling module 236

Ex. 1004.0454

can be used to detect a first user schedule accessible to controller 216. The first user schedule can include a first schedule event configured to alter an operating condition of a network device such as TSTAT 208, smart appliance 212, or other energy consuming network devices. According to an aspect, the first user schedule can be operably linked to mobile device 210 having a location detection device. The first user schedule can be used or not used based on a distance mobile device 210 may be from residence 202. In this manner, as user returns to residential site 202, a user schedule can be activated and used.

[0075] According to another aspect, energy management system 200 can include a second user schedule accessible to controller 216. For example, a second user schedule can include scheduling data to schedule a second schedule event configured to alter an operating condition of a network device at site 202. The second user schedule can be operably linked to a second mobile device having a location reporting device (not expressly illustrated in FIG. 2). For example, the second user schedule can be used or not used based on a distance a second mobile device may be from site 202. In another form, mobile device 210 may not be located at site 202, but a second mobile device may located be at site 202. In this form, a second user schedule may be based on detecting the second mobile device located at site 202. According to an aspect, the second user schedule can be disabled when the second user leaves the site 202 and a proximity mode can be enabled. According to a further aspect, a second user schedule may not be operably linked to any mobile device. As such, controller 216 can use a second user's schedule to schedule events in response to a detection of mobile device 210 being a distance away from residential site 202. In this manner, multiple user schedules and proximity control of energy use can be deployed at a common site.

[0076] According to an aspect, energy management system 200 can also include controller 242 capable of detecting advanced metering infrastructure (AMI) wireless network 248 output by smart metering device 250. For example, smart metering device 250 can include, or can be coupled to, AMI / Gateway 242 capable of outputting AMI wireless

network 248. In other forms, smart metering device 250 can be configured to output AMI wireless network 248 directly.

[0077] According to another aspect, controller 216 can be configured with a communication interface (not expressly illustrated in FIG. 2) to enable joining AMI wireless network 248. In this manner, controller 216 can gain access to AMI wireless network 248 to receive AMI data. In a further aspect, controller 216 can use the AMI data to alter an operating condition of a network device at site 202, output AMI data using a display of a network device, communicate AMI data to server 204, or any combination thereof. According to a further aspect, controller 216 can communicate the AMI data with site report data as a site report to server 204. As such, AMI data and site report data can be used at server 204.

[0078] According to a further aspect, controller 216 can connect to AMI wireless network 248 at a first security level, and alter an operating condition of a network device connected to wireless energy network 242 at a second security level. According to an aspect, wireless energy network 242 can be deployed at the same security level as AMI wireless network 248, can be deployed at a different security level than AMI wireless network 248, or any combination thereof.

[0079] According to a further aspect, a user or site profile can be used to enable use of control actions initiated or received by AMI wireless network 248. For example, a site manager or user can establish a profile setting to enable or disable a utility company to alter an operating condition of a network device at a residence. As such, controller 216 can access a profile setting prior to connecting to AMI wireless network 248, enabling use of a control action received using the AMI wireless network 248, or any combination thereof. In other forms, controller 216 can access server 204 to detect profile settings.

[0080] According to another aspect, energy management system 200 can also include controller 216 configured to communicate using a Zigbee network and a WIFI network.

For example, controller 216 can include a ZigBee enabled communication device (not expressly illustrated in FIG. 2) capable of initiating wireless energy network 242 at site 202 that includes a residential site. Controller 242 can also include a WIFI enabled communication device (not expressly illustrated in FIG. 2) capable of initiating WIFI network 244 operable to be coupled to mobile device 210 that may be WIFI enabled, or other WIFI enabled devices, systems, or any combination thereof.

[0081] According to a further aspect, controller 216 using WIFI network 244 can be used to alter an operating condition at site 202 in response to detecting mobile device establishing or losing a WIFI connection to WIFI network 244. For example, a user schedule can be enabled when a WIFI connection of mobile device 210 can be detected, and an operating condition of one or more network devices connected to wireless energy network 242. As mobile device 210 leaves site 202, an operating condition of one or more network devices can be altered upon a detection of a WIFI connection of mobile device 210 to WIFI network 244 being lost.

[0082] According to an aspect, mobile device 210 can communicate with controller 216 to access site data, site reports, control action data, AMI data, or various other types of EMI data available using WIFI network 244. According to an aspect, mobile device 210 can initiate control actions, control action reports, or combinations thereof that can alter an operating condition of a network device coupled to wireless energy network 242. According to a further aspect,

[0083] According to another aspect, controller 216 configured with a WIFI communication device can enable a connection to a home computer system, laptop computer, Netbook, home server, IPAD®, home automation system, router, or other WIFI enabled system or devices (not expressly illustrated in FIG. 2), or any combination thereof. For example, a user can use an IPAD to access controller 216. Using WIFI network 244 and wireless energy network 242, a user can receive operating status information, initiate control actions of network devices, schedule energy use, or various

Ex. 1004.0457

other energy management activities. In some forms, controller 216 may not have access to network 206. Controller 216 can include portions or all of the capabilities of server 204 to schedule energy use, generate scheduling data, access site data, generate control action data, or any combination thereof. As such, in some instances network 206 may not be established (e.g. in a new construction site, etc.), or if a network failure or an absence of network availability occurs, a user can access network devices at site 202 and manage energy use.

[0084] According to another aspect, controller 216 can detect when mobile device 210 connects to WIFI network 244 and alter an operating condition of a network device coupled to wireless energy network 242. For example, as mobile device 210 moves or transitions away from site 202, controller 216 can detect a signal loss and alter an operating condition at site 202. According to an aspect, controller 216 can include control action data to be used upon detecting a signal loss. In other forms, controller 216 can report the signal loss to server 204 within, or external to a site report. Server 204 can then determine a control action (if any) in response to a reporting of the WIFI signal being lost.

[0085] According to a further aspect, server 204 can initiate a text message using messaging module 240 to be sent to mobile device 210. User of mobile device 210 can then view the text message and respond to alter an operating condition at site 202. For example, a user can place site 202 in proximity mode which will enable an energy efficiency schedule associated with the user. In other forms, a user can access an energy management application accessible to mobile device 210 and alter an operating condition at site 202. Various combinations of messaging communications (e.g. SMS text, email, social network messaging, social network postings, etc.), message content, and various combinations thereof can be used to inform a user of mobile device 210 that an operating condition can be altered in response to mobile device 210 not being connected to a WIFI signal at site 202, a detection of mobile device 210 being a distance from site 202 using location detection, or any combination thereof.

Ex. 1004.0458

[0086] According to another aspect, controller 216 can also connect to mobile device 210 using WIFI network 244 and communicate information using mobile device 210 and information network 240. For example, mobile device 210 can connect to information network 240 which can be a wireless subscriber based information network. Mobile device 210 can receive energy management information from an information source accessible to information network 240. According to an aspect, mobile device 210 can include a mobile energy management application that can be used to access server 204 or other information source(s). Mobile device 210 can be used to upload information such as a site report, network device data, operating statuses, or various other types of information that can be obtained at site 202 using wireless energy network 242. According to a further aspect, mobile device 210 can receive information such as control action reports, control data, environmental data, scheduling data, user profile data, network device profile data, Zigbee based profile data, WIFI data, configuration data, network device data updates or firmware updates, controller data updates or firmware updates, or various other types of EMI data or any combination thereof that can be communicated to mobile device 210 using information network 240. Mobile device 210 can then communicate received information to controller 216 using WIFI network 244. Controller 216 can use the received information to manage energy use at site 202.

[0087] According to a further aspect, controller 216 can be configured to request profile data, profile updates, network device updates, or any combination thereof of a network device using WIFI network 244, wireless AMI network 248, network 206, or any combination thereof. For example, controller 216 can detect a Zigbee enabled network device at site 202. Controller 216 can identify unique identifier of the Zigbee enabled network device, and request a profile of the Zigbee enabled network using WIFI network 244. For example, mobile device 210 can request a Zigbee profile using information network 240. In another form, a home computer, laptop computer, IPAD® etc. can request the Zigbee profile using network 206. In another form, controller 216 can access

Ex. 1004.0459

wireless AMI network 248 to request a Zigbee profile. As such, controller 216 can be configured to request profile data, profile updates, network device updates, various other types of information to manage network device, or any combination thereof of a network device using one or more networks accessible to controller 216.

[0088] According to a further aspect, controller 216 can be incorporated into a network device. For example, controller 216 and TSTAT 208 can be combined into the same unit. Controller 216 can also include an 802.15.4 based wireless communication device (not expressly shown in FIG. 2) operable to establish wireless energy network 242. Controller 216 can also include an 802.11 based wireless communication device (not expressly shown in FIG. 2) operable to communicate with mobile device 210. Using the 802.11 based wireless communication device, controller 216 can communicate with gateway 218 having a residential broadband wireless router capable of establishing an 802.11 based wireless communication network at site 202. In this manner, combining controller 216 and TSTAT 208 can lead to a reduction in the number of separate devices deployed at site 202.

[0089] According to a further aspect, controller 216 can include a processor (not expressly illustrated in FIG. 2) configured to deploy a web server capable of enabling web services. For example, controller 216 can connect to WIFI network 244 and a computer system at site 202. The computer system can include a browser configured to access an IP address of the web server of controller 216 to manage one or more network devices coupled to wireless energy network 242. In a particular form, controller 216 can include a scheduling tool configured to be output by the web server and accessible using WIFI network 244. According to a further aspect, controller 216 can be coupled to mobile device 210 and controller 216 can be configured to enable access to a subscriber based wireless information network 240 using a connection to the 802.11 based wireless communication device of controller 216.

Ex. 1004.0460

[0090] FIG 3 illustrates a method of managing energy at a site according to an aspect of the disclosure. Portions or all of the method of FIG. 3 can be used with portions or all of the energy management systems, devices, or apparatuses disclosed herein, or any other type of system, controller, device, module, processor, or any combination thereof, operable to employ all, or portions of, the method of FIG. 3. Additionally, the method can be embodied in various types of encoded logic including software, firmware, hardware, or other forms of digital storage mediums, computer readable mediums, or logic, or any combination thereof, operable to provide all, or portions, of the method of FIG. 3.

[0091] The method begins generally at block 300. At decision block 302, the method detects whether an energy network has been established. For example, a wireless energy network can be established and can include one or more networks that can be used to manage energy use at a site. According to an aspect, a wireless energy network can be established using a wireless enabled controller located at a residence. At decision block 302, a detection of an energy network, AMI enabled network, WIFI enabled network, Zigbee enabled network, WiMAX network, or any other type of energy network, or any combination thereof can be detected. If at decision block 302, one or more networks may not be detected, the method can proceed to decision block 304. At decision block 304, the method can detect if there is an AMI network available. If at decision block 304 there is an AMI network available, the network can proceed to block 306 and the AMI network can be joined. For example, the AMI network can include a specific protocol and security level to establish communication or allow a joining of the network. For example, the AMI network may require an encryption key-based security that can require specific keys, certificates, etc. to enable access. According to another aspect, the AMI network may include a smart grid based security described in Smart Grid standards. As such, various combinations of joining the AMI network can be deployed. Upon joining the AMI network, the method can proceed to decision block 308.

Ex. 1004.0461

[0092] In some forms, an AMI network may be available and the method can be modified to determine whether to join the AMI network. If at decision block 304, an AMI network may not be detected (or may not be joined), the method can proceed to decision block 308. At decision block 308, the method can detect if a WIFI network (e.g. 802.11 based network) may be available. If a WIFI network is not detected or is not available, the method can proceed to block 310 and a WIFI network can be established. For example, a controller, network device, smart appliance, or various other types of energy consuming devices can include a WIFI communication device capable of initiating a WIFI network. As such, at block 310 a WIFI network can be established and the method can proceed to block 312. If at decision block 308 a WIFI network exists, or if a WIFI network should not be established, the method can proceed to block 312. In some forms, an additional WIFI network can be established at block 310 and the method can be modified to allow a bridging between the two WIFI networks.

[0093] According to an aspect, at block 312 an energy network can be established to manage one or more network devices. For example, an energy network can include a wireless energy network that is based on a Smart Grid standards and protocols such as a Zigbee based protocol. Various other types of communication can also be used to establish an energy network. An energy network can be established by outputting a wireless network at a site to enable a network device to join the energy network.

[0094] Upon establishing an energy network, the method can proceed to block 314 a network device capable of connecting to the energy network can be detected. For example, a network device can include a Zigbee enabled communication device capable of joining a Zigbee enabled energy network. A unique identifier of the network device can be detected and a profile can be obtained at block 316. In some forms, a unique identifier can be previously obtained by a controller deploying the energy network. For example, a unique identifier can be obtained from a server accessible to a controller, via a WIFI or other network accessible to a controller, or any combination thereof. In other forms, an

Ex. 1004.0462

external information source can be capable of providing a unique identifier, or a list of unique identifiers to identify a valid network device that can be joined to the energy network. A controller can then use the unique identifier, and the profile, to establish or join the network device to the energy network.

[0095] In another form, a profile of a network device may not be immediately available, or may have been revised. As such, a profile can be obtained using a WIFI network, an AMI network, an Internet or broadband network, or any combination thereof. For example, a unique identifier, a model number, a serial number, a device class identifier, or any combination thereof that can be communicated to an external source or information network to obtain a profile can be used. A profile can then be identified and used to join the network device to the energy network.

[0096] According to a further aspect, obtaining a profile at block 316 can include initiating a request using a controller and an information network accessible to a mobile device capable of communicating with a WIFI network at a site. For example, a profile can be provided by connecting a mobile device to a wireless information network such as a 3G data network, 4G data network, or other subscriber based wireless information network. The mobile device and then communicate the profile to the controller using the WIFI network at the site. The controller can then receive the profile and use at least a portion of the profile within the energy network.

[0097] According to an aspect, upon obtaining a profile, the method can proceed to block 318 and the network device can be joined to the energy network. For example, the network device can be joined at a security level that is different than required by an AMI network, or other secure network. In some forms, the network device can be joined to multiple networks or combination of networks while joined to the energy network. In other forms, the network device can be joined to only the energy network. In still other forms, an AMI network connection can be established to enable an AMI network to access the network device, and the network device can unjoin or disconnect the AMI network and

Ex. 1004.0463

join the energy network. In another form, information received from the AMI network can be used to alter an operating condition of the network device using the energy network. Various other permutations of joining a network device to an energy network or other networks can also be realized as needed or desired.

[0098] According to a further aspect, a network device can join the energy network using a standardized profile, such as a Zigbee profile. In addition, a network device can be joined using a profile modifier that can extend the functionality of the Zigbee profile associated with a specific network device. For example, a controller establishing the energy network can access profile modifiers to enhance use of a specific network device.

[0099] According to a further aspect, an AMI network can be joined during a period of time, and then the energy network can be joined during a separate time period. As such, various combinations of joining a network device to one or more networks can be used as needed or desired to manage energy use of a network device. Additionally, the method can be modified to join additional network devices to one or more networks as needed or desired. Upon joining one or more network devices, the method can proceed to block 320 and then to decision block 322.

[00100] At decision block 322, the method can detect whether a proximity mode associated with a site and energy network is enabled or disabled. For example, proximity mode can include associating a mobile device with a residential site, and automatically controlling a network device based on detecting a location the mobile device may be from the residential site. One or more mobile devices associated with a site can include a location reporting device capable of outputting a location report. The location reporting device can use various technologies to report location including GPS, GPRS, cell tower triangulation, or various other location reporting technologies. In another form, a location reporting device of a mobile device can also include a WIFI radio capable of being connected to a WIFI network. As such, a mobile device can be connected to a WIFI

Ex. 1004.0464

network at the site using a WIFI connection, and as a WIFI connection is established or lost, a proximity mode can be enabled and disabled accordingly.

[00101] According to an aspect, at block 322 if proximity mode is enabled, the method can proceed to block 344 as described below. If at decision block 322 proximity mode may not be enabled, the method can proceed to decision block 324 to detect if a user schedule is available. For example, a user schedule can include an event schedule to control one or more network devices. According to an aspect, one or more user's can create a schedule that can be accessed by a controller, and used to control one or more wireless thermostats or other network devices that can be joined to the energy network. According to a further aspect, a user schedule can be linked to a mobile device of the user. In some forms, the mobile device can include a location detection device configured to report locations of the mobile device.

[00102] According to an aspect, if a user schedule may not be detected, the method can proceed to block 356 and an event can be identified. For example, an event can include one or more programmed events that can be created and accessed at a specific time, date, period, or other to alter an operating condition of a network device. For example, a user may not have provided a user schedule to schedule energy use of a hot water system at a residence. As such, a default schedule can be accessed to identify an event and schedule or manage use of the hot water heater. For example, an event can include decreasing a hot water heater ten (10) degrees at midnight. Another event can include increasing a hot water heater fifteen (15) degrees at five (5) A.M. In another form, a network device can include a wireless thermostat that can be used to control an HVAC system based on a time of day or other attribute. For example, a weather forecast can be determined, and an event can be scheduled to adjust a wireless thermostat accessible to the energy network. Various other environmental conditions, grid conditions, user profiles, device profiles, energy pricing, or any combination of energy management information can be used to schedule or create an event.

Ex. 1004.0465

[00103] Upon identifying an event, the method can proceed to decision block 326 and detect whether to schedule the event. For example, if an event is configured to be scheduled at a specific time of day, the method can detect the event at decision block 326. If an event may not be detected, the method can proceed to decision block 322 and repeats.

[00104] According to an aspect, if at decision block 326 an event should be scheduled, the method can proceed to block 328 and the event can be scheduled. For example, a network device can be identified, an operating condition to be altered can be identified, a time of day to alter the operating condition can be identified, a period of time to alter an operating condition can be identified, a device profile can be used, or any combination of data that can be used to schedule an event can be used. According to another aspect, the method can include initiating a scheduled event at block 328 using a portion of a programming schedule stored within a memory of the controller associated with the energy network. For example, portions of event data can be communicated from a remote server to the controller, and used with a programming schedule stored within the controller to schedule an event. In this manner, one or more sources can be used alone or in combination to schedule events.

[00105] According to a further aspect, upon scheduling the event, the method can proceed to block 330 and a control action can to be communicated to a network device. For example, a control action can include control action data or device data sufficient to alter an operating condition of a network device. In some forms, data formatted according to a standard profile, such as a Zigbee Home Automation profile, Zigbee Energy Profile, and the like. In other forms, control action data can include a device identifier, a message format to output a message, a parameter or feature of a network device to alter, an updated set-point or operating condition of the network device, a network or security key, a date and time, or any combination thereof.

Ex. 1004.0466

[00106] According to an aspect, the method can proceed to block 332 and the control action can be output to the energy network as an outgoing message and received by the network device as an incoming message. For example, the network device can detect the outgoing message communicated within the energy network using a unique identifier of the network device.

[00107] At block 334, upon the network device receiving the incoming message, a control action can be extracted from the incoming message and the operating condition at the network device can be altered using the control action data. For example, an dishwasher may be turned on, a clothes washer or dryer turned on, lights within a home can altered, a thermostat can be adjusted, a hot water hear can be adjusted, or various other types of control actions can be initiated as needed or desired.

[00108] At block 336, network device data can be obtained from the network device using the energy network. For example, a network device can receive a request to output operating status information as network device data to the energy network. In other forms, the network device can be enabled to periodically publish status information to the energy network and received by the controller. Upon outputting the network device data, the method can then proceed to block 338 and a site report can be generated. For example, a site report can include network device data received from one or more network devices accessible to the home energy network. Site report data can be stored locally to the controller, and processed to confirm an updating of the control action. The site report data can be stored within a site report and communicated to a remote server configurable to receive and process the site report data within a site report. According to an aspect, a site report can be communicated to a remote server configurable to receive site reports from the controller using a broadband connection initiated by the controller. Other forms of communication can also be used to communicate a site report as needed or desired. Upon generating a site report, the method can proceed to decision block 302.

Ex. 1004.0467

[00109] According to an aspect, if at decision block 322 proximity detection may be enabled, the method can proceed to block 344 and a location report can be received. For example, a location report can include location data output from a location reporting device such as a mobile device. In other forms, a location report can be generated in response to a detection that a mobile device having a WIFI radio may be within range, or out of range, of the WIFI network at the site. As such, the method can be used to alter an operating condition of the network device using the energy network in response to detecting the location reporting device establishing or losing a WIFI connection to the WIFI network.

[00110] According to an aspect, the method can proceed to decision block 346 and can detect if a location change has occurred. If a location change has not occurred, the method can proceed to block 348 and detects whether to alter an operating condition. If an operating condition of one or more network devices may not be altered, the method can proceed to block 350, and to block 322.

[00111] According to another aspect, if at decision block 346 a location change may be detected, the method can proceed to block 350 and detects a distance a location reporting device may be from an associated site. The method can then proceed to block 352 and detects the direction of the mobile device. For example, if the distance has increased from a previous location reported, the method can detect that a user may be moving away from a site. In other forms, a detected direction can include moving toward a site, moving away from a site, or not moving at all.

[00112] Upon detecting a direction, the method can proceed to decision block 348 and detects whether to alter an operating condition of a network device. For example, in addition to detecting a distance and direction a user may be from a residence, various other types of information can also be used to alter an operating condition. For example, data such as real time velocity data, average velocity data, estimated length of time a user may

Ex. 1004.0468

take to return to a site, thermostat scheduling data, network device scheduling data, site report data, real-time weather condition data, traffic condition data, user driving pattern data, daily driving pattern data, GPS mapping data, home energy efficiency ratings, demand response data, curtailment data, energy pricing data, grid condition data, various other types of EMI, or any combination thereof.

[00113] Upon detecting an operating condition to alter, the method can proceed to block 354 and initiates a control action. For example, a server remote to a site can be used to generate a control action that can be included within a control action report and communicated to the controller at the site. In a form, the control action report can be communicated in association with an upload of a site report. According to another aspect, a control action can be generated by the controller. For example, a location and direction of a mobile device can be identified and communicated to the controller. The controller can then determine whether to generate a control action using the location data and direction data, and possible other data as needed or desired. The method can then proceed to block 328 as generally described above. If at decision block 348 an operating condition of a network device should not be altered, the method can proceed to block 350 and to block 322.

[00114] According to an aspect, the method can be provided to detect a distance between the location reporting device and the site using a previously stored location of the residence and a new location of the location reporting device. At decision block 354 altering an operating condition can include altering an operating condition of the network device in response to detecting the location reporting device is travelling away from the residence. Further, altering an operating condition of the network device in response to detecting the location reporting device is travelling toward the residence.

[00115] According to another aspect, the method can be provided to detect a location reporting device at a first distance at block 350, and at decision block 348 initiate a control action. As the location reporting device may be detected at a second distance, a

Ex. 1004.0469

second control action can be initiated. For example, a control action can include setting a first temperature set-point of a thermostat in response to detecting the first distance. The method can further be provided to detect the location reporting device at a second distance different from the first distance, and set the temperature set-point to a second value.

[00116] According to a further aspect, the method can be modified to detect an upper and lower thermostat set-point limits of a network device. For example, an upper set-point limit can include a maximum a temperature that should be reached within a site during a warm season. A set-point of a thermostat can then be determined by determining the difference between a previous set-point and the maximum set-point. In some forms, a percentage adjustment, such as 30%, 50%, 75%, etc. of the resulting difference between a maximum set-point and a base set point can be used to determine a new set-point. For example, if a thermostat is set to seventy (70) degrees and has a maximum set-point of eighty (80) degrees, the delta between the two being ten (10) degrees. A new set-point can then be generated by multiplying this delta by a percentage, such as 50%, and adding it to the current set point. In this example, a new setting of seventy five (75) degrees would be the resulting set-point. In other forms, the method can use the maximum and minimum set-points, resulting or current set-points, in association with a time of day, a distance or distances a user may be from a site, or various other data that can be used to determine a set-point using maximum and minimum set-point values.

[00117] FIG. 4 illustrates a block diagram of an energy management apparatus, illustrated generally as controller 400, according to an aspect of the disclosure. Controller 400 can include a processor 402 and memory 404 configurable to store data. Memory 404 can be configured as on-board memory of processor 402, or in other forms can also include expandable memory such as DDR memory, Flash Memory, EPROM, ROM, or various other forms, or any combination thereof generally illustrated as memory 404.

[00118] According to an aspect, controller 400 can include buses 406, 408, 410 configured to couple data and signals to various components within controller 400.

Ex. 1004.0470

Although illustrated as multiple buses 406, 408, 410, controller 400 can include a single bus, multiple buses, or any combination thereof. Various types of bus configurations can be used as needed or desired including, but not limited to, any combination or portion of a serial bus, a parallel bus, a serial – parallel bus, a universal serial bus, industry standard bus, controller area network bus, a serial peripheral bus, a universal asynchronous receiver transmitter bus, a control bus, standard digital input output bus, or any combination thereof.

[00119] According to an aspect, controller 400 can also include a communication interface 430, an information network interface 416, an external bus interface 420, an application program interface 440, or any combination thereof configurable to be coupled to one or more of buses 406, 408, 410 or any combination thereof. According to an aspect, any combination of interfaces 430, 416, 420, 440 can be configured in any combination of hardware, software, or firmware, and can include any combination or portion of a serial bus interface, a parallel bus interface, a serial – parallel bus interface, a universal serial bus interface, industry standard bus interface, controller area network bus interface, a serial peripheral interface, a universal asynchronous receiver transmitter interface, a control bus interface, standard digital input output interface, or any combination thereof.

[00120] According to a further aspect, controller 400 can also include a power supply 412 capable of providing power to controller 400. Power supply 412 can be an internal power supply and in other forms can be provided external to controller 400. Controller 400 can also include a broadband device 414 configured to be coupled to a broadband network. For example, broadband device can include an Ethernet communication module, a Cable or coaxial-based communication module, and can include communication logic to receive and transmit data between controller 400 and an information network such as a LAN, WAN, local network, the Internet, and the like.

Ex. 1004.0471

Broadband device 414 can include TCP/IP communication capabilities and can also be security enabled to transmit SSL data between controller 400 and an information network.

[00121] According to a further aspect, controller 400 can also include an information network interface 416, a wireless information network device 418, and an external bus interface 420. Controller 400 can also include a Zigbee enabled communication device 422, a WIFI device 424, an Advanced Metering Infrastructure device 426, a support and updates module 428, and a communication interface 430. Controller 400 can also include an operating system 450 that can be executed by processor 402.

[00122] According to an aspect, controller 400 can be configured to use any type or combination of wireline or wireless communication to manage energy use at a site, including, but not limited to, power-line communication, wire line communication, wireless communication, Zigbee based communication, INSETEON based communication, X10 based communication, Z-Wave based communication, WiMAX based communication, Bluetooth based communication, WIFI based communication, 802.11-based communication, 802.15-based communication, 802.16-based communication, proprietary communication, other communications described herein, or any combination thereof.

[00123] According to a further aspect, controller 400 can include a network device profile module 432, a security module 434, a controller module 436, and a proximity detection module 438. Controller 400 can also include device profiles 442, user profiles 444, home profiles 446, and profile modifiers 448. One or more of the modules, profiles, or any combination thereof can be provided as encoded logic such as a ROM, PROM, EPROM, EEPROM, or various combinations thereof and accessible to processor 402 as needed or desired. In other forms, one or more of the modules, profiles, or any combination thereof can be stored within a memory device such as memory 404, within a

Ex. 1004.0472

removable flash drive (not expressly illustrated in FIG. 4), an external data storage device (not expressly illustrated in FIG. 4), or any combination thereof.

[00124] According to further aspect, controller 400 can include processor 402 operable to manage energy use at a site. Processor 400 can be configured to convert an incoming message received from a wireless energy network (not expressly illustrated in FIG. 4) into XML enabled output data. Processor 400 can also format an outgoing message to be output to a wireless energy network using XML enabled input data. According to an aspect, XML enabled input data includes a network device identifier of a network device accessible using a wireless energy network. Controller 400 can also include communication interface 430 configurable to enable access to communication device, such as Zigbee device 422, WIFI device 424, AMI device 426, or any other device accessible to controller 400 and having access to a wireless energy network. According to an aspect, communication interface 430 can be configured to detect an outgoing message formatted by processor 402 and configure the outgoing message to a message bus format that can be coupled to bus 408 and a communication device such as Zigbee device 422. For example, outgoing message can include network device data configured to be output to a wireless energy network, but processed into a message bus format prior to outputting to a communication device. Communication interface 430 can then convert the outgoing message from a message bus format to a format that can be output by a specific communication device. For example, if the outgoing message was intended to be output using WIFI device 424, communication interface can detect that the message was to be sent on a WIFI network and can convert the outgoing message from a message bus format to a WIFI device format. Communication interface 430 can then output the WIFI device formatted message to WIFI device 424.

[00125] According to a further aspect, communication interface 430 can be configured to detect an incoming message received from a wireless energy network using a communication device such as Zigbee device 422, WIFI device 424, AMI device 426, or

Ex. 1004.0473

any other device accessible to controller 400 and having access to a wireless energy network. Incoming message can include incoming network device data received from a network device. Communication interface 430 can convert an incoming message from a communication device format to access an incoming network device data received from a network device, and output the incoming network device data using a message bus format that can be used by processor 402.

[00126] According to another aspect, controller 400 can include a wireless data module, such as Zigbee device 422, WIFI device 424, AMI device 426, or any other device accessible to controller 400 and having access to a wireless energy network. A wireless data module can be accessible to processor 402 and configured to generate profile data to be used with an outgoing message. For example, processor 402 can access network device profile module 434 and use a network device profile of a network device accessible to the wireless energy network to output a message receivable by a specific network device. Network device data can be formatted using a network device profile of a specific network type of the wireless energy network. In some forms, a network device profile may not include information sufficient to output network device data. As such, profile modifiers 448 can be provided and can include profile modification data of the network device not available within the network device profiles 442 that can be used to communicate with a network device coupled to an energy network accessible to controller 400.

[00127] For example, device profiles 442 can include a Zigbee thermostat device profile having home automation profile data and smart energy profile data. Profile modification data 448 can be used to access additional profile information to format an outgoing Zigbee message and access a Zigbee enabled thermostat coupled to a wireless energy network accessible to controller 400. In this manner, additional features and functionality that may not exist within Zigbee profile standards can be accessed by using

Ex. 1004.0474

profile modifier data 448. As such, functionality of a Zigbee enabled device can be expanded beyond a standard Zigbee profile.

[00128] According to another aspect, controller 400 can include a first user profile stored within user profiles 444 and accessible to processor 402. For example, a first user profile can include a first time schedule to operate a network device and a control setting to control the network device. User profiles 444 can also include a first user identifier to identify a first user and can also be include a network device identifier to identify the network device to control or alter.

[00129] According to another aspect, controller 400 can include a second user profile within user profiles 444 and accessible to processor 402 that is different than the first user profile. A second user profile can include a second time schedule to operate a network device and at least one control setting to control the network device. The second user profile can also include a second user identifier to identify the second user and a network device identifier to identify the network device.

[00130] According to a further aspect, processor 402 can determine when to use a first user profile or a second user profile. For example, processor 402 can access user profiles 444 to detecting the user profiles, and initiate outputting an outgoing message using the first user schedule or the second user schedule. Processor 402 can then be used to monitor when to alter the operating condition provided by the first user schedule, to an operating condition of a second user schedule. In this manner, multiple user schedules can be used by controller 400 to control a network device.

[00131] According to a further aspect, processor 402 can be used to detect an input to a network device as a user schedule is being used, and store a new setting of the network device in association with the deployed user schedule. For example, processor 402 can detect a current user profile being used, and further detect an interaction with a network device during use of a first user schedule. Upon detecting an interaction,

processor 402 can initiate an update to the first user profile in response to detecting the interaction.

[00132] According to an aspect, processor 402 can be used to convert data received using broadband device 414 to a format that can be output to a wireless energy network. Also, processor 402 can also be configured to convert data received from the wireless energy network to a format that can be used by broadband device 414. For example, processor 402 can include a Linux enabled processor configured to convert an incoming message received from Zigbee device 422 to an XML enabled output data. Additionally, processor 402 can format XML enabled input data received from broadband device 414 to an outgoing Zigbee message that can be output using Zigbee device 422.

[00133] According to a further aspect, controller 400 can be configured as a server and can deploy several processes of applications that can be used, including, but not limited to Ubuntu Version 9.04, Java SE Version 6, "lighttpd HTTP Server", Servlets, FastCGI, Apache log4j, Eclipse, Apache Ant, or any equivalent operating environments or software, or any combination thereof.

[00134] According to an aspect, processor 402 using a Java operating environment can initiate generation of a Java output object using XML enabled input data received from broadband device 414. The Java output object can include network device data of a ZigBee enabled network device accessible to a wireless energy network and Zigbee device 422. Processor 402 can further initiate generation of XML enabled output data from an incoming message received from Zigbee device 422 using a Java input object configured to accesses network device data using a network device profile stored within device profiles 422, and a profile modifiers 448 as needed or desired.

[00135] According to an aspect, controller 400 can use communication interface 430 and API 440 to enable access to ZigBee device 422 operably coupled to bus 408 and accessible to API 440. As such API 440 can be used by processor 402 during use of one

Ex. 1004.0476

or more modules to access Zigbee device 422, WIFI device 424, AMI device, 426 or any combination thereof to communicate network data using a wireless energy network. As such, processor 402 can make API calls to API 440 to access various functions of one or more communication devices 422, 424, 426.

[00136] According to another aspect, controller 400, can be used to coordinate a wireless energy network, and use data within the wireless energy network that was received from an external information source accessible to controller 400. For example, broadband device 414 can be coupled to an information network. Broadband device 414 can further be coupled to information network interface 416 operable to access external data sources that can be communicatively coupled to broadband device 414. Controller 400 can initiate coordinating a wireless energy network, and initiate outputting XML enabled output data as site report data to information network interface 416 to be communicated to an external data source using broadband device 414. Site report data can include a portion or representation of network device data received by Zigbee device 422, or other device accessing the wireless energy network. According to an aspect, controller 400 can also receive control action report data using broadband device 414. For example, control action report data can include XML enabled input data that can be output as network device data using the wireless energy network.

[00137] According to a further aspect, controller 400 can be configured to access a wireless energy network at more than one security level. For example, processor 402 can use security module 434 configured to initiate supporting coordinating a wireless energy network at a first security level and enable access to a network device at a first security level. For example, processor 402 can initiate receipt of an incoming message using Zigbee device 422 at the first security level. Upon gaining access and communicating device data, processor 402 can disconnect the network device. In another form, security module 434 and processor 402 can then initiate access to a second network device at a second security level using Zigbee device 422, and enable access to the second network

Ex. 1004.0477

device using the second security level. Processor 402 can initiate receipt of a second incoming message at the second security level, and upon receipt of device data disable access to the second network device. As such, controller 400 can use a single Zigbee device 422 to access multiple network devices using more than one security level.

[00138] According to an aspect, controller 400 can be used to access more than one wireless energy network. For example, processor 402 can initiate using a first wireless communication device, such as Zigbee device 422, to coordinate a first wireless energy network. Processor 402 can also initiate using a second wireless communication device, such as a second Zigbee device (not expressly illustrated in FIG. 4), or other wireless device, to coordinate a second wireless energy network. As such, processor 402 can access one or more network devices coupled to one or more wireless energy networks. According to another aspect, a second Zigbee device, or other wireless device can be used to join a second wireless energy network instead of coordinating the second wireless energy network. For example, the second wireless energy network can include an advanced metering infrastructure (AMI) enabled network operably associated with an AMI enabled smart meter. AMI device 426 can include a second ZigBee device, or other wireless communication device, capable of joining an AMI enabled network of an AMI enabled smart meter (not expressly illustrated in FIG. 4). As such, smart meter data can be accessed by controller 400 as needed or desired. For example, AMI data or smart meter data can be obtained on a periodic basis and communicated in association with a site report having network device data. As such, broadband device 414, wireless information network device 418, or other information network devices can be used to site report data that can include AMI data acquired using controller 400.

[00139] According to another aspect, controller 400 can use AMI device 426 to access an AMI enabled smart meter to alter an operating condition of a network device accessible to controller 400 using Zigbee device 422. For example, AMI device 426 can include an advanced metering infrastructure (AMI) enabled interface capable of initiating

Ex. 1004.0478

access to an AMI enabled smart meter. Controller 400 can use AMI device 426 to receive AMI data from an AMI enabled smart meter. Processor 402 can be used to initiate altering an operating condition of a network device in response to detecting AMI data received from the AMI enabled smart meter. Processor 402 can further be used to detect a smart energy control request output by an AMI enabled smart meter, and initiate using the smart energy control request at the network device.

[00140] In some forms, a control request may be obviated by controller 400 by not allowing an AMI initiated control request to be enabled. For example, processor 402 can access home profiles 446 and determine whether a control action initiated by an AMI enabled smart meter should be enabled or disabled. As such, controller 400 can be used to monitor control actions being output by an AMI enabled smart meter or other utility provided system, and alter the request as desired. For example, a user may create a home profile 446 that would not allow for a curtailment action of a network device. In other forms, home profile 446 may enable a curtailment action over a period or schedule, and disable a curtailment action over another period or schedule. As such, controller 400 can determine a valid period or schedule to enable and disable a curtailment action initiated by an AMI enabled smart meter.

[00141] According to a further aspect, controller 400 can reset an operating condition in the event an AMI enabled smart meter alters an operating condition of a network device. For example, an AMI enabled smart meter may be able to control a network device. Controller 400 can monitor an operating condition of the network device, and in the event an operating condition has been altered to a setting that is not scheduled by controller 400, controller 400 can respond to the operating condition by notifying a user, or automatically altering the operating condition to a preferred setting.

[00142] According to another aspect, controller 400 can be used to access an information network outside of the wireless home energy network. For example, information network interface 416 can be configured to access an information network

Ex. 1004.0479

using broadband device 414, wireless information network device 418, external bus interface 420, or any combination thereof. According to an aspect, wireless information network device 418 can include a subscriber based network device, or in other forms can include a WIFI network access device, or various combinations thereof. According to an aspect, wireless information network device 418 can include WIFI device 424 that can be used to access an information network. As such, WIFI device 424 can be used to access an information network, an wireless energy network, a local wireless information network, or any combination thereof.

[00143] According to an aspect, controller 400 can use WIFI device 424 to be coupled to a WIFI enabled communication device such as a mobile device, smart phone, home computer, laptop computer, Netbook, or any other WIFI enabled device capable of connecting to a WIFI network. Communication interface 430 and processor 402 can be used to enable a WIFI enabled communication device to access network device data, site data, or any combination of data accessible using the wireless energy network. Control actions can also be requested using the WIFI enabled communication device and connection to control a network device coupled to the wireless energy network accessible by controller 400. For example, a mobile device access a WIFI network can be used to access a wireless energy network having a network device. In other forms, controller 400 can include a web server capable of communicating web services that can be accessed by a mobile device (or other system or device), via a web based environment. For example, controller 400 can output portions or all of a graphical user interface as described in FIGs. 7-10 herein, or other graphical user interfaces that can be output by a web server. As such, a user having a WIFI enable communication device can be coupled to controller 400 using WIFI device 424 and monitor, create and manage operating conditions, home profiles, user profiles, device profiles, user schedules, proximity detection, demand response preferences, energy savings preferences, other control settings, view site data, or any combination thereof. Other settings and operating conditions can be accessed, monitored, or managed as needed or desired.

Ex. 1004.0480

[00144] According to another aspect, controller 400 can include proximity detection module 438 that can be accessed by processor 402 to enable and disable proximity control at a site. For example, proximity detection module 438 and processor can be used to detect a distance between a mobile device having a location reporting device and the site. Processor 402 can be used to identify a current operating condition of a network device, and identify an updated operating condition of the network device in response to the detected distance. Processor 402 can be used to initiate generation of an outgoing message to include an updated operating condition in response to the distance. According to a further aspect, controller 400 can be configured to receive location data using an information network having a server configured to communicate location data associated with a mobile device having a location reporting device that is associated with a site. Location data can be stored within memory 404 and used to monitor a distance and direction between a site and the mobile device. As such, controller 400 can initiate control actions using the location data, and the location data need not be stored in a server remotely located to a site. Various control actions can be generated using various types of conditions including detecting a distance, determining a control zone having a distance or interval, travel pattern of a mobile device, monitoring current and future weather data, monitoring real-time traffic data, monitoring energy pricing data, monitoring home efficiency data, or using any combination of energy management information in association with providing proximity control of a site.

[00145] According to an aspect, controller 400 can include a plug computer employing a Linux based server configured to manage energy use at a site. For example, controller 400 can include a Java enabled processor as processor 402, memory 404 configured to store incoming and outgoing wireless energy network messages, Zigbee device 422 capable of accessing a wireless energy network, and information network interface 416 capable of initiating communication with an information network. Controller 400 can also include communication interface 430 operably coupled to bus 408

Ex. 1004.0481

and Zigbee device 422 coupled to bus 408. Through utilizing a Java enabled processor and Linux operating system, controller 400 can deploy a web server (not expressly illustrated in FIG. 4) and a Java environment to handle and convert XML data received using a web server into Java objects that can be used to communicate network device data and various other types of data.

[00146] For example, processor 400 can be used to convert an incoming message received from a wireless energy network using the Zigbee device 422 into XML enabled output data. Processor 402 can format an outgoing message to be output to a wireless energy network using XML enabled input data that includes a network device identifier of a network device accessible using a wireless energy network. Communication interface 430 can be configured to detect the outgoing message formatted by processor 402 to be output using the wireless energy network, and configure the outgoing message to a message bus format to be output to communication bus 408. In some forms, the outgoing message can include network device data configured to be output to a wireless energy network. Communication interface 430 can further detect an incoming message received from a wireless energy network that includes incoming network device data. Communication interface 430 can be used to convert the incoming message accessed from bus 408 from the message bus format to detect incoming network device data that can be output to processor 402. Processor 402 can then be used to generate site data including the network device data, and a site report that can be communicated using information network interface 416.

[00147] FIG. 5A illustrates a block diagram of a mobile device, generally illustrated at 500, according to an aspect of the disclosure. Mobile device 500 can be configured as a smart phone or handheld computer, tablet, and the like such as an I-Phone® device, a Blackberry® device, an Android® device, an IPad® or various other devices or systems. Mobile device 500 can include a processor 502, a memory 504, an I/O device 506 such as a keypad, touch screen, function buttons, a mini qwerty board, or any other type of input

Ex. 1004.0482

device capable providing control of mobile device 500 or any combination thereof. I/O devices 506 can also include a speaker for outputting sound, and a microphone for detecting sound. Mobile device 500 can also include a display 508 such as color LCD display, touch screen display, or any combination thereof. According to a further aspect, one of more of I/O devices 506 can be displayed within display 508 having touch screen capabilities, such as selectable GUI elements that can be used to control features, functions, or various other application of mobile device 500. As such, mobile device 500 can be configured to use numerous applications that output graphical elements configurable to control mobile device 500 and applications accessible by mobile device 500.

[00148] According to a further aspect, mobile device 500 can also include an energy management application 510 accessible to processor 502 and configured to enable a user to manage energy use of at a site in a mobile environment. Mobile device 500 can also include a location reporting device 515, such as GPS technology, cell tower location technology, triangulation technology or any combination thereof. Portions of location reporting device 515 can be located within mobile device 500 however in other forms, a wireless network can include functionality that can be selectively accessed to detect a location of mobile device 500.

[00149] According to a further aspect, mobile device 500 can also include a network interface 514 configurable to enable access to a WIFI device 516, a Bluetooth device 518, a ZigBee device 520, or any combinations thereof. According to a further aspect, mobile device 500 can also include a wireless data network device 522 that can be configured with one or more RF radios capable of connecting to one or more wireless networks such as a 3G network, 4G network, PCS network, EDGE network, cellular network, or any combination thereof.

[00150] As illustrated in FIG. 5B, mobile device 500 can also include an energy management user interface 530 capable of being displayed within display 508. Energy

Ex. 1004.0483

management user interface 530 can include a user information section 532 that can display various types of user data such as a location of a site being managed, an energy provider providing energy to the site being managed, an energy personality of the user based on the user's interaction with energy use at the residential site, or various other types of user profile information.

[00151] According to a further aspect, energy management user interface 530 can include a current readings section 534 configured to display a current readings and operating conditions of a site. For example, current readings can include a current inside temperature, outside temperature, proximity setting, energy alert setting, savings rate, status of network devices being managed such as lights, HVAC system, hot water heater system, sprinkler system, refrigerator system, washing machine system, distributed energy generation system such as a solar array, battery storage device, fuel cell, wind turbine generator, or any combination thereof. Other network devices can also be managed as needed or desired. Current readings section 534 can include a selectable graphical element that can be selected to access additional site information. Site information displayed within current readings 534 can be accessed from a remote server capable of managing or storing site reports that include site data and device data. In other forms, site information, current reading, operating conditions, or any combination thereof can be accessed using a WIFI device 516 of mobile device 500.

[00152] According to a further aspect, energy management user interface 530 can include a current settings section configured to enable a user to alter an operating condition of a network device being managed. For example, current settings section 536 can include current setting of one or more thermostats at a site, settings of any other network device being managed at a site. Current settings section 536 can also include general settings to manage a site. For example, a general setting can include a proximity detection setting, a demand response setting, an energy alerts settings, a savings setting, schedules, calendars, events, a vacation setting to enable a vacation schedule, or any other

Ex. 1004.0484

type of setting that can be used to manage energy consumption or network devices at a site, or any combination thereof. Current settings section 536 can also include a graphical element that can be selected to access additional settings as needed or desired.

[00153] According to a further aspect, energy management user interface 530 can include a current savings section 538 configured to enable a user to access energy savings information and adjust as needed or desired. For example, an energy savings amount obtained at a site can be realized. A user may also be able to access an energy saving selector (not expressly illustrated in FIG. 5B) to modify an energy savings level. For example, a user can change a savings level to low, medium, high, or various other savings metrics. According to another aspect, a user may access a vacation mode (not expressly illustrated in FIG. 5B) and alter an operating condition of a site by selecting a vacation mode using mobile device 500. As such, various energy savings settings can be selected as needed or desired.

[00154] According to a further aspect, mobile device 500 can provide proximity updates, site report requests, site control commands, configuration data, settings, scheduling data, text messages such as SMS, MMS and others, and various other types of information or data or any combination thereof that can be used with an energy management system. According to another aspect, mobile device 500 may not have full functionality or capabilities of a smart phone or other device capable of running an application. For example, a mobile device such as a cell phone may not be capable of loading an application such as an energy management application. However, the mobile device may have sufficient functionality to allow an energy management system to contact the mobile device. For example, an adverse operating condition may be detected at a site (e.g. temperature set-point of thermostat is out of range, lights are left on, etc.). As such, the energy management system can identify the mobile device and send a message, such as a text message, an email message, or any combination thereof, capable of being received and displayed by the mobile device. In some forms, a user can receive the

Ex. 1004.0485

message and respond to the message, enabling the user to control the operating condition of the network device at the site. For example, the user can respond to the message via a text message, an email message, or another messaging application accessible to the mobile device. As such, a mobile device that may not be able to run energy management application 510 can be used to control an operating condition at an associated site.

[00155] During operation, a user can access operating status and generate control actions to control a network device (not expressly illustrated in FIG. 5A or 5B) at a site. For example, mobile device can receive and send messages, such as text messages, HTTP enabled messages, XML enabled messages, email messages, data, or any combination thereof. For example, if an outside temperature at a site is increasing or forecasted to increase, and the price of energy is increasing or scheduled to increase, mobile device 500 can receive a message to inform the user of the condition. The user can respond to the message as desired. In other forms, a suggestion can be sent to the user. For example, a suggestion to increase a thermostat or indoor temperature by three degrees can be received by mobile device 500. Upon receiving the message, the user can respond to the message using a text or other messaging technology. In other forms, a user can access energy management application 510 and initiate a control action to adjust the thermostat to different set-point. In this manner, a user can become aware of a current operating or forecasted condition in a mobile environment, and respond as needed or desired.

[00156] According to another aspect, mobile device 500 can include a portion or all of energy management application 510 running in the background, in the foreground, or any combination thereof. According to an aspect, energy management application 510 can be launched automatically when a message or energy alert may be received by mobile device 500.

[00157] According to a further aspect, energy management application 510 can be operable to work with an energy management system to update a control action field within a database. For example, mobile device 500 and energy management application

Ex. 1004.0486

510 can initiate updating a control field within a database to identify a control action. Energy management application 510 can further update a new set-point within the database. As such, an energy management system can generate a control action report or data during a site upload. In this manner, a user of mobile device 500 can update control setting using a remote server or energy management system, and control actions can be generated to alter an operating condition at a site.

[00158] According to another aspect, energy management application 510 can output recommendation settings of a network device to the user. For example, a user can select a low savings, medium savings, or a high savings at a residential site using current settings 536. A user can select a savings level, and mobile device 500 can communicate a message to an energy management system associated with the site and mobile device 500 to generate a control action to alter an operating condition at a site based on a savings level setting. For example, an energy management system can calculate new settings of one or more network devices, intervals to set the network devices, start and stop times, and the like. In some instances, settings can be determined based on a forecasted weather, forecasted energy pricing, forecasted energy availability, proximity of mobile device 500 from a site, or various other types of data. Settings can be stored within a database and control actions can be initiated as needed or desired.

[00159] According to a further aspect, an energy alert message received by mobile device 500 can be used to alter or display an energy status icon, alter an application icon, alter a status within a social network, or various combinations thereof. For example, a user can then select the energy status icon using mobile device 500 and an associated application can be presented to a user to allow a user to alter an operating condition as desired. In some forms, a user's election to reduce energy consumption during peak times or other times can be fed into their social network as an energy savings message or update. A user's energy personality can also be output from mobile device or associated web service to be updated within a social network as needed or desired.

Ex. 1004.0487

[00160] According to a further aspect, mobile device 500 can include proximity detection module 524 operably associated with energy management application 510 and location reporting device 512. Proximity detection module 524 can be provided as a part of energy management application 510, location reporting device 512, may be provided as a separate module, or any combination thereof. According to an aspect, proximity detection module 524 can be used with location reporting device 512 to detect a distance mobile device 500 may be from an assiciated site. For example, proximity detection module 524 can be operated as a background process that periodically requests a location from location reporting device 512. Location reporting device 512 can use various location reporting methods (e.g. GPS, triangulation, etc.) to detect a current location, and an associated API of location reporting device 512. According to an aspect, proximity detection module 524 can request an accuracy of a location to be provided by location reporting device 512, and a response time. For example, if a GPS signal may not be available to mobile device 500, location reporting device 512 can be requested by proximity detection module 524 to detect a location using a triangulation technique or other technique within 500 milliseconds. In another form, proximity detection module 524 can alter reporting parameters of location reporting device 512 in response to a relative location mobile device 500 may be from an associated site. For example, mobile device 500 may be greater than five (5) miles from an associated site, and location reporting device 524 can alter a distance accuracy, response time, method used, or various other location reporting parameters that can be selected.

[00161] According to another aspect, proximity detection module 524 can be used to initiate altering an operating condition of an associated site in response to a location of mobile device 500. For example, proximity detection module 524 can be used to detect mobile device 500 being greater than two miles away from an associated site, and a direction that is moving away from an associated site. Proximity detection module 524 can output a location and direction to energy management application 510, and energy

Ex. 1004.0488

management application 510 can detect whether to initiate a control action at an associated site.

[00162] According to a further aspect, proximity detection module 524 can be used to detect a location at a modifiable interval (e.g. one (1) minute, five (5) minutes, etc.) to reduce the amount battery drain or power consumption of mobile device 500. For example, as mobile device 500 may be moving away from an associated site, and an interval to access location data using location reporting device 512 can be increased (e.g. set from one (1) minute to three (3) minutes). In another form, as mobile device 500 moves closer to an associated site, proximity detection module 524 request at location from location reporting device 512 at a shorter interval (e.g. set from five (5) minutes to (1) minute). Various combinations of intervals can be deployed as needed or desired. In other forms, energy pricing at a period of time can also be used to alter reporting of a location reporting device 512. Various other combinations of using data to alter reporting of a location can also be used as needed or desired to reduce battery consumption or other operating conditions of mobile device 500.

[00163] According to a further aspect, proximity detection module 524, energy management application 510, or another portion of mobile device 500, or any combination thereof can be used as an energy management system. For example, an energy management system, such as energy management system 200 illustrated in FIG. 2, energy management system 600 illustrated in FIG. 6, an energy management system located at a site, hosted within a network, a apparatus or device capable of energy management, or any combination thereof can be used. According to an aspect, an energy management system can receive location data reported by location reporting device 512, and alter an operating condition of mobile device 500 based on a relative location mobile device 500 may be from an associated site. As such, an energy management system can be used to alter an operating condition of mobile device 500.

Ex. 1004.0489

[00164] According to another aspect, sampling of location reporting device 512 can be updated using energy management application 510, an energy server operably associated with mobile device 500, or any combination thereof. For example, mobile device 500 can be detected by an energy management system as being between three and five miles from a site. An energy management system or application can further detect mobile device 500 travelling away from an associated site. As such, access to location reporting device 512 can be reduced thereby reducing energy consumption of mobile device 500.

[00165] According to a further aspect, a user of mobile device 500 may enter a building where a location based signal, such as a GPS signal, may not be able to be accessed or have limited access. As such, a sampling interval of location reporting device 512 may be altered to conserve energy. Upon a user exiting a building and a location of mobile device 500 being detected, a sampling interval can be returned to a previous value or a new value as needed or desired. According to further aspect, a sampling interval can be sent to mobile device 500 from another source such as an energy management system. In other forms, updated sampling intervals can be stored within mobile device 500 and accessed as needed or desired. In other forms, a distance from a site, a sampling interval, direction, or various combinations of data can be communicated to mobile device 500 to be used to alter access to location reporting device 512.

[00166] According to another aspect, mobile device 500 can include software trap routines to be used when a location may go undetected. For example, energy management application 510 can use proximity detection module 524 that accesses location reporting device 512 to obtain a location. However, if a location is not obtained, or invalid, or any combination thereof, a software trap routine can be used to keep the proximity module, or background process from exiting. In this manner, energy management application 510 and various modules, associated processes, or any combination thereof can be

Ex. 1004.0490

continuously run without having to receive valid location data, and terminating the background process.

[00167] According to a further aspect, mobile device 500 can incorporate various portions or functionality of energy management system 200, controller 300, energy management system 600, wireless thermostat 1200, or various other systems, apparatuses, modules, GUI's or any combination thereof described herein as needed or desired to manage energy use in a mobile environment using mobile device 500. Additionally, mobile device 500 can use various types of data accessible to mobile device 500 including, but not limited to EMI data disclosed herein. According to an aspect, an application icon (not expressly illustrated in FIG. 5B) can be provided in a association with energy management application 510. For example, an icon can be used to access energy management application 510 can in some forms, can be altered to display energy consumption information, settings information or various other types of information without a user having to launch energy management application 510. For example, energy management application 510 can alter text information (e.g. device settings, current readings, lights on/off, etc.). An example can include displaying a current thermostat setting of a thermostat at a site, altering a color of an icon based on an energy savings or consumption level, alter a color based on proximity information, display a current temperature within a site, or various combinations thereof. As such, a user need not launch an energy management application 510 to EMI data associated with a site.

[00168] FIG. 6 illustrates a block diagram of an energy management system, generally illustrated at 600, according to another aspect of the disclosure. Energy management system 600 can include a server 602 operable to be coupled a site 604. Server 602 can include a processor 606 and a database 608. Server 602 can include an external data source interface 610 that can be coupled to an external data source 612 using a network connection 614. External data source 612 can include one or more data sources capable of providing access to EMI data, various other types of data, or any combination

Ex. 1004.0491

thereof. According to a further aspect, external data source 612 can also include third party sources. For example, an external data source 612 can include subscription based, non-subscription based, or any combination thereof of data having weather conditions, traffic conditions, grid operating conditions, wholesale energy prices, real-time energy pricing, dynamic pricing information, fixed pricing information, forecasted energy pricing, forecasted energy consumption, forecasted energy production, alternative energy production, distributed alternative energy production, zonal demand or operating conditions, nodal demand or operating conditions, or other EMI data that can be accessed using a third party.

[00169] According to a further aspect, server 602 can also include a network interface 616 that can be coupled to a network location 618 using a network connection 620. Network location 618 can be used to access to EMI data, various other types of data, or any combination thereof. Server 602 can also use network interface 620 to access a public network, a private network, a semi-private network or any combination thereof. According to an aspect, network interface 616 can include a network communication device (not expressly illustrated in FIG. 6) and a web server operable to enable access to the Internet or other communication network. Server 602 can also include a site interface 622 that can be coupled to site 604 using a network connection 624 operable to be coupled to a home controller 626. According to an aspect, site interface 622 can be realized as a web services based application configured to receive information initiated by site 604.

[00170] According to an aspect, site 604 can also include a wireless thermostat, TSTAT 628, operably coupled to NVAC system, HVAC 630. Site 604 can further include a mobile device 632 associated with site 604. Mobile device 632 can be coupled to a mobile client interface 634, such as a WAP or other mobile device gateway capable of communicating using a mobile information network 636. According to an aspect, energy management system 600 can be operably to provide a first zone 638 having a first distance 640, and a second zone 642 having a second distance 642. First zone 638 and second zone

Ex. 1004.0492

642 can be used to control TSTAT 628 and HVAC 630. For example, first zone 638 and second zone 642 can be provided as a boundary that can be determined in various ways to control one or more energy consuming devices at site 604.

[00171] According to another aspect, server 602 and processor 606 can include one or more processors having one or more core processors. Server 602 can also use any combination of software modules, firmware, encoded logic, or any combination thereof to manage energy use. For example, server 602 can use a scheduling module 648, a scheduling tool module 650, a scheduling templates module 652, a control action report module 654, a site data report module 656, an efficiency rating module 658, a set-point update module 660, a proximity detection module 662, a zone update module 664, a current readings module 666, a demand response module 668, an energy savings module 670, a message module 672, an interaction detection module 674, an energy personality module 678, or any combination thereof.

[00172] According to an aspect, database 608 can be configured to store EMI data, control action data, site report data or any combination thereof. For example, database 608 can store data received from one or more residential sites associated with server 602. For example, site 604 can access TSTAT 628 using a wireless energy network deployed at site 604. Processor 606 can be configured to access site report data stored within database 608. Processor 606 can detect a current temperature set-point within the site data and an associated date and time of TSTAT 628 at site 604. Processor 606 can detect a current temperature reading at site 604, and can further detect seasonal settings stored within database 608. For example, a seasonal profile can include seasonal settings that can include settings of a winter schedule, a summer schedule, or various combinations of seasons and settings. According to an aspect, processor 606 can detect a current operating mode of HVAC 630 operably coupled to TSTAT 628, and determine a thermostat schedule to be used with TSTAT 628. For example, if HVAC 630 may be in an A/C mode, a summer profile, schedule and the like can be deployed which can include

Ex. 1004.0493

temperature settings that can be different than a winter profile. For example, scheduling module 648 can be used to determine a date, a time or time interval, thermostat setting, operating mode, or any combination thereof, and store a schedule within database 608.

[00173] According to another aspect, server 602 can also generate control action reports using control action report module 654. For example, processor 606 can initiate generation of a control action report to communicate to site 604. A control action report can be generated in various ways with various types of data and settings to control an operating environment at site 604. For example, a control action report can be generated by setting a control action field within database 608.

[00174] According to a further aspect, energy management system 600 can use seasonal settings to control HVAC 630. For example, energy management system 600 can detect an operating mode of HVAV 630 and alter a set-point in using the detected operating mode and an associated seasonal profile. For example, an updated temperature set-point can include a value between a current temperature set-point and a minimum seasonal set-point in response to the current operating mode of HVAC 630 being in a heating mode. An updated temperature set-point can also have a value between a current temperature set-point and a maximum seasonal set-point in response to the current operating mode of HVAC 630 being in a cooling mode. Server 602 can generate a control action report that can also includes settings or data generated in response to an efficiency rating of site 604, an estimated time period to generate an updated temperature reading, an updated temperature set-point, a current energy price, and a future energy price or any combination thereof.

[00175] According to another aspect, server 602 can be used to generate a control action report using proximity detection module 662. For example, processor 606 can detect a distance between a location reporting device, such as mobile device 632 and site 604. Processor 606 can further detect a zone, such as first zone 638, second zone 642 or additional zones as desired. Using a detected zone, processor 606 can initiate generation

Ex. 1004.0494

of a control action report to be communicated to site 604 in response to a current zone. In this manner, various network devices (not expressly illustrated in FIG. 6) at site 604 can be automatically controlled on a zone by zone basis as mobile device 632 moves away from, or towards, site 604.

[00176] According to another aspect, one or more of the zones 638, 642, additional zones (not expressly illustrated in FIG. 6), or any combination thereof can be updated automatically using updated conditions. For example, processor 606 can use a zone update module 664 on a periodic basis to update zones using various types of data. For example, processor 606 can detect an efficiency rating of site 604, detect an external temperature at site 604 from an external data source 612 or other sources, determine a real-time travel time between mobile device 632 having location reporting capabilities and site 604. Processor 606 can modify distance 640, 644, or any combination thereof. For example, an efficiency rating of site 604, external temperature at site 604, estimated real-time travel time to or from site 604, various other EMI, or any combination thereof can be used. Although illustrated as being sequential, zones 638, 642 can be modified independently, together, or any combination thereof.

[00177] According to another aspect, server 602 can use proximity detection module 662 to detect when mobile device 632 may be moving away from site 604, and adjust HVAC 630 using thermostat 628. For example, processor 606 can detect mobile device 632 moving away from site 604. Processor 606 can further detect a percentage change value associated with a current zone, and further detect a base set-point of TSTAT 628. Processor 606 can further determine a difference between the base set-point, and a minimum seasonal set-point in response to a current operating mode of the HVAC 630. For example, if the HVAC 630 is in a heating mode a percentage change can be determined to adjust use of a heating unit.

[00178] According to a further aspect, server 602 can determine a difference between a base set-point and a maximum seasonal set-point in response to a current

Ex. 1004.0495

operating mode of the HVAC being in a cooling mode. As such, processor 606 can determine an updated thermostat set-point as a percent change based on the determined difference. Processor 606 can initiate generation of a control action report including an updated thermostat set-point to be used at site 604.

[00179] According to another aspect, server 602 can be used to generate an aggregated demand schedule. For example, processor 606 can determine energy demand of a plurality of residences in a region using scheduling module 648. For example, processor 606 can identify a group of residential sites within a specified region (not expressly illustrated in FIG. 6) and access thermostat schedules of each of the residential sites within the group. Processor 606 can also aggregate scheduling data using thermostat schedules, and initiate an outputting of the aggregated scheduling data. Aggregated scheduling data can include time intervals, settings, etc. and in some forms can also include an estimate of energy consumption based on an efficiency rating of residential sites, consumption profiles, location data, or various other site attributes that can be used to calculate an aggregated demand. According to an aspect, aggregated data can be used to forecast load, energy production, virtual capacity, demand response capacity, grid congestion, or any combination of grid attributes that can use aggregated scheduling data.

[00180] According to another aspect, energy management system 600 can also include a web services enabled scheduling tool to schedule energy use at a residential site. For example, processor 606 can use scheduling tool module 650 to generate a web based or network based graphical user interface that includes a scheduling tool. FIG 8A-D illustrate examples of a web services enabled scheduling tool and user interfaces that can be output using scheduling tool module 650. For example, processor 606 can output a thermostat selector configurable to enable selection of one or more wireless thermostats located at site 604. An event scheduler operably associated with the thermostat selector and configurable to enable a user to graphically select a utilization schedule of the one or more wireless thermostats can also be output by processor 606. Processor 606 can also be

Ex. 1004.0496

used to update a utilization schedule to include a time of day and temperature setting. Scheduling tool module 650 can be used to control the one or more network devices that can include wireless thermostats, smart appliances and the like. Scheduling tool module 650 can be used to output an energy savings preference selector configured to graphically modify the utilization schedule, and display a resulting energy savings, a weather forecasting tool, and various other types of tools or scheduling features to assist in managing or scheduling use of a network device.

[00181] According to another aspect, server 602 can also use interaction detection module 674 to detect when a user may alter an operating mode of a network device. For example, interaction detection module 674 can detect when a user may adjust a thermostat at a specific time of the day, and suggest a modification of a utilization schedule to a user during a user access to scheduling tool output using scheduling tool module 650. A user can then elect to have the utilization schedule updated to include the suggestion as needed or desired.

[00182] According to another aspect, server 602 and scheduling tool module 650 can be used to enable additional features and functions. For example, a scheduling tool can be used to display a proximity control selector configured to enable and disable proximity control of a residential site, a demand response selector configured to enable and disable participation in demand response event, a vacation mode selector to enable and disable a vacation schedule, an auto update selector configured to enable an automatic update of the utilization schedule in response to a detection of a user interaction with the one or more network device, or various other controls that can be used to manage energy use at a site, or any combination thereof.

[00183] According to another aspect, server 602 and scheduling tool module 650 can be used to enable and disable demand response capabilities. For example, a scheduling tool can used to provide a demand response selector (not expressly illustrated in FIG. 6) operable to be displayed with a scheduling tool. A demand response selector

Ex. 1004.0497

can include several settings such as an always participate selection configured to always enable a curtailment of an HVAC system in response to a demand response event, a never participate selection configured to not allow a curtailment of the HVAC system in response to a demand response event, a request participation selection configured to initiate a communication, such as an email, text message, instant message, social network message, or various combinations thereof to the user to request participation in a demand response event. A demand response selector can be operably associated with demand response module 668 to initiate demand response inquiries, analyses, and deployments.

[00184] According to another aspect, server 602 can also use scheduling template module 652 to generate utilization templates that a user can access and modify to schedule energy use. For example, a plurality of energy templates can be accessed by a scheduling tool. Templates can include a predetermined utilization schedule selectable by the user based on a user's scheduling profile. A selected predetermined utilization schedule can be modifiable by a user using a scheduling tool module 650, and saved as needed or desired. According to an aspect, server 602 can output an on-line questionnaire or survey that a user can participate in to determine an energy template to use.

[00185] According to a further aspect, server 602 can also use energy personality detection module 678 to detect an interaction profile of a user. For example, a user may be an urban professional having a long work commute which may result in a first portion of a utilization schedule. Upon arriving at a residential site, a user may interact with their thermostat to which will result in a different portion of a utilization schedule. For example, a user may like an indoor temperature to be colder when going to bed. As such, a personality of the user while away and while at home can be used to automatically generate a user's schedule. According to another aspect, an energy personality indicia or character can be generated and output with a user's on-line scheduling tool, within a user's social network, or any combination thereof. For example, processor 606 can detect an interaction of a user with a wireless thermostat, and display of an energy personality

Ex. 1004.0498

indicia in response to the interaction. A user can then enable or disable display of the energy personality indicia within a social network such as Facebook®, MySpace®, etc.. In other forms, processor 606 can be used to modify the indicia based on an overall energy savings a user has accomplished at their residential site. For example, processor 606 can use energy savings module 670 to determine an energy savings of the individual and alter the energy personality indicia accordingly. In another form, a user can set up a messaging service or account using Twitter ® and the like to output energy savings updates to a subscriber base in response to an energy saving initiate, participating in demand response events, alter energy use, or various other forms. According to a further aspect, a Twitter ® account or other messaging service can be used on a community basis to inform a group of individuals of energy management events. For example, an "energy action day" or "energy alerts" can be posted using a Twitter ® account to subscribers and a subscriber can curtail energy use using energy management system 600 or various other energy management systems as needed or desired. Other forms of messaging or any combination thereof can be used as needed or desired.

[00186] According to another aspect, server 602 can be used to determine a sample size of residential sites and corresponding schedules to forecast energy consumption over an interval. For example, processor 606 can be used to determine a random sample size of residential sites in connection with estimating an energy consumption of a specific region such as a zip code, street or series of streets, substations supporting residential sites, node-to-node, or any combination thereof or other methods of determining a region. Upon identifying a sample size of a region, residential sites can be identified within the region. For example, processor 606 can then determine associated thermostat schedules of residential sites within the specified region using scheduling module 648. Server 602 can output thermostat scheduling data of the plurality of sites in connection with scheduling or forecasting energy use.

Ex. 1004.0499

[00187] According to another aspect, server 602 can also be used to enable a demand response initiated at site 604. For example, processor 606 can use demand response module 668 to detect an enabled demand response setting of site 604. Processor 606 can further detect a demand response event condition and enable a curtailment action of HVAC 630 if a user of site 604 has selected participation in a demand response event. An energy reduction capacity of site 604 can be determined using efficiency rating module 658, scheduling module 648, proximity detection module 662, or various other modules, data sources, or any combination thereof.

[00188] According to another aspect, server 602 can also use demand response module 668 to contact individuals prior to curtailing energy use at site 604. For example, processor 606 can initiate a demand response event request communication to communicate to the users of a plurality of sites. Processor 606 can detect a user response level to participate in a demand response event, and enable a curtailment of a corresponding HVAC system or other energy consuming devices at a site of a user electing to participate in the demand response event. In this manner, user's may not be forced to participate in demand response events but can have real-time election capabilities to participate as needed or desired.

[00189] According to an aspect, server 602 can send a text message that includes a request to participate in a demand response event. In some forms, a text message can include an agreement to pay the user to participate in a demand response event. Payment can take various forms such as credits, cash, rewards, points, contribution to education funds, discounts on energy rates, or any combination thereof. Server 602 can receive a response from using mobile client interface 634 and process the response using message module 672 to determine a desire to participate or not.

[00190] According to another aspect, server 602 can be used with scheduling module 648 to determine an aggregate capacity to reduce energy consumption. For

Ex. 1004.0500

example, processor 606 can be used to identify a group of residences within the plurality of residences and determine an energy reduction capacity of each of the residences within the group using an efficiency rating of each of the residences within the group. Upon determining an efficiency rating of each residence, processor 606 can detect other data to be used to determine an available capacity. For example, current weather conditions at each residential site can be detected, a user's energy schedule or thermostat schedule can be used, a response to text messages or emails electing to participate can be determined, grid conditions can be used, or any combination thereof. Upon estimating an available capacity, an aggregate energy reduction capacity based on the energy reduction capacity of each of the residences within the group can be determined.

[00191] According to another aspect, server 602 can use an aggregate energy reduction capacity in association with an auction. For example, processor 606 can initiate an auction of virtual energy capacity to retail energy providers electing to bid an available energy capacity. In other forms, a third party can host an auction and energy management system 600 can output an available capacity in association with an upcoming auction event, peak demand period, transmission rate determination period, or any combination thereof. For example, processor 606 can initiate an auction process to sell the aggregate energy reduction capacity to a third party, and detect a sale of the aggregate energy reduction capacity in connection with the auction process. Upon a sale occurring, processor 606 can initiate a curtailment of an HVAC system, other energy consuming devices, or any combination thereof, at each of the residences within the group.

[00192] According to another aspect, energy management system 600 can include mobile client interface 634 operable to be coupled to mobile device 632 associated with site 604. For example, mobile client interface 634 can include a WAP gateway or other mobile client gateway to enable server 602 access to mobile device 632. Mobile client interface 634 can be provided as a part of server 602, however in other forms, portions or all of mobile client interface 634 can be provided by a specific wireless network provider.

Ex. 1004.0501

As such, mobile client interface 634 can be configured to communicate with a specific carrier having a WAP gateway. Mobile client interface 634 can be used to communicate EMI or control data between WAP gateway and server 602 using any combination wireless or terrestrial communication technologies. Additionally, WAP gateway can also include logic or modules that can provide mobile device users access to EMI data or control data generated by mobile device 632, server 602, energy management system 600, or any portions and combinations thereof.

[00193] According to an aspect, mobile client interface 632 can receive a site readings request of site 604 from mobile device 632. For example, processor 606 can detect the site reading request and initiate access to database 608 to retrieve site report data of site 604. Processor 606 can format the site report data as mobile device data, and output the mobile device data to mobile device 632 using mobile device network 636.

[00194] According to another aspect, mobile client interface 634 can receive a request from mobile device 632 to modify a current temperature set-point of HVAC system 630. For example, processor 606 can process a received request from mobile device 632 and initiate generation of a control report using control action report module 654. The control action report can include a reference to an updated temperature set-point communicated from mobile device 632 to mobile client interface 634. Processor 606 can set a variable or field within database 608 to alter a set-point. Upon site 604 initiating access to server 602, processor 606 can access a variable or field associated with site 604, and generate a control action report or control data to be communicated to site 604 using site interface 622. As such, upon a temperature set-point being updated at site 604, home controller 626 can communicate a control action confirmation data, site report, status information, or various combinations thereof to confirm the updated temperature set-point. Processor 606 can output a confirmation of the updated temperature set-point to the mobile client interface 634 upon receiving a confirmation, and can output an updated temperature set-point to mobile device 632.

Ex. 1004.0502

[00195] According to another aspect, mobile device 632 can be used to enable and disable operating modes of one or more network devices located at site 604. For example, mobile device 632 can include a mobile application loaded on mobile device 632 that can be used to control settings at site 604. FIG. 5A and B illustrate examples of energy management application and functionality that can be used by mobile device 632 although other applications and functions can also be deployed using mobile device 632 as needed or desire. According to another aspect, mobile device 632 can access a web based application associated with server 602 using a web browser of mobile device 632 to enable and disable operating modes or conditions at site 602. For example, mobile device 632 can alter a proximity setting, alter one or more environmental control zones, access current readings, modify a vacation setting, modify energy use schedules, or various other operating modes or data associated with controlling or maintaining operating modes of network devices located at site 604 as needed or desired.

[00196] According to another aspect, energy management system 600, can be used to send messages to mobile device 632 in connection with an altered operating condition at site 634. For example, processor 606 can access site data received from site 604, and further detect a manual input condition provided at TSTAT 628. For example, a user may have decreased a temperature set-point of TSTAT 628. Processor 606 can detect whether a user is at home using location data received from mobile device 632 and proximity detection module 660. Upon detecting the condition, processor 606 can determine if it should initiate a text message indicating the manual input condition. For example, processor 606 can use message module 672 to format and output a text message indicating the condition change of TSTAT 628, and ouptut the text message using mobile client interface 634. A user can then alter the condition using mobile device 632 as desired. In other forms, an email message or other electronic message can also be sent to a user. For example, a message can be displayed within a window of a computer system associated with the user. In other forms, a text message can be sent to multiple mobile devices

Ex. 1004.0503

associated with site 604. Various other combinations of alerting a user of site 604 of a manual change to an operating condition can be used as needed or desired.

[00197] FIG. 7 illustrates an energy management user interface (EMUI), illustrated generally at 700, according to an aspect of the disclosure. In some forms, EMUI 700 can be accessed using a mobile device, desktop computer, Netbook, laptop computer, smart phone, a energy display device, a smart thermostat, a home automation control terminal, and IPad ® or any combination of devices capable of displaying energy management user interfaces.

[00198] According to an aspect, EMUI 700 can include a user information section 702 configured to display one or more user names 704, a residential site address 706, a mobile phone number 708 associated with residential site address 706. User information section 702 can further display a current energy provider 710 associated with residential site address 705, and a current best rate 712 of a third party energy provider available at residential site address 706. An advertisement 714 section can also be displayed, and an edit details link 716 can be displayed to enable a user to access, edit, modify, delete, manage, etc. information displayed within user information section 702. FIG 9 described herein includes an example of a user interface that can be used to edit user information displayed within user information section 702. User information section 702 can also display an energy personality 740 associated with hers name 704. Energy personality 740 can also be linked to one or more social networks as needed or desired.

[00199] According to a further aspect, a current readings section 718 can be displayed within EMUI 700. Current readings section 718 can include, for example, a current date and time section 720 with a current inside temperature and outside temperature at a residential site. Current readings section 718 can further include a current thermostat set-point 722 of a thermostat located at a residential site. More than one thermostat can be deployed at a residential site and current thermostat set-point 722 can include references such as "Main", "2", "3" or some other indicia configured to enable

Ex. 1004.0504

access to current thermostat readings of multiple thermostats at a residential site. A user can also modify the name or number of a thermostat, zone, etc. using an edit feature of thermostat set-point 722.

[00200] According to a further aspect, a current readings section 718 can also include an energy savings level 724 configured to indicate a savings level that relates to current thermostat set-point 722. For example, as current thermostat set-point 722 is set to a low set-point, an air conditioner unit may run more frequently and cause a low energy savings. As such, a visual indication of an energy savings can be displayed in association with a current set-point giving a user feedback on energy consumption based on a thermostat set point. In some forms, a user can adjust a thermostat set-point up or down, and an energy savings level can be altered in near real-time based on the users selection. For example, various programming languages such as DHTML, AJAX, Flash, HTML 5, and the like can be used to show a near real-time update of one or more fields within EMUI 700.

[00201] According to a further aspect, EMUI 700 can also include a demand response notification selector 726 configured to enable participation in demand response events, disable participation in demand response events, and enable a text message (or other messages) to be sent to a user to request participation in a demand response event. According to a further aspect, EMUI 700 can also include a proximity detection selector 728 configured to enable proximity detection of one or more mobile devices associated with a residential site.

[00202] According to another aspect, EMUI 700 can also include an energy usage / savings section 730 that can display a current annual savings 732, a current monthly savings 734, a demand response savings 736, and a view more data link 738. According to an aspect, view more data link 738 can be operably associated with accessing portions or all of EMUI 800 described in FIG. 8.

Ex. 1004.0505

[00203] FIG. 8 illustrates an energy management user interface operable to report energy usage and savings information, illustrated generally as EMUI 800, according to a further aspect of the disclosure. According to an aspect, EMUI 800 can include an energy usage / savings section 802, operable to display a current annual savings 804, a current monthly savings 808, and a current demand response savings 808 realized by a user participating in demand response events. EMUI 800 can also include an estimated annual savings section 810, a managed vs. unmanaged energy consumption graph 812, and a comparative consumption graph 814. According to an aspect, a user can select a comparison graph that includes a community graph configured to compare a user's energy consumption to others in a residential community, a state comparison graph configured to compare a user's energy consumption to others within a state, and a national graph configured to compare a user's energy consumption to a current national average.

[00204] According to a further aspect, EMUI 800 can also include a daily usage graph 816 configured to indicate energy consumption and savings on an hour-by-hour basis. For example, if a user selects a medium energy savings settings, daily usage graph can display a daily savings in dollars, KWh or any combination thereof. Daily usage graph 816 can further include a graph indicated what the consumption would have been if energy use was left unmanaged. According to a further aspect, daily usage graph 816 can also include a day selector 818 configured to enable a user to select a day of the week to view energy consumption and savings.

[00205] According to another aspect, EMUI 800 can also include a monthly usage and savings graph section 820 configurable to output monthly energy usage and savings information of each day of the month. For example, a monthly graph can include a daily, weekly, or other pairing bar graph configured to display a monthly energy usage and savings at a residential site. A user can navigate between a month using month selector 822 and a specific month's consumption and savings graph can be displayed. In some instances, only a portion of a specific month's data may be available to be displayed. As

Ex. 1004.0506

such, only a portion of a graph may be displayed as desired. According to a further aspect, monthly usage and savings graph section 820 can also include an link to access annual savings as needed or desired.

[00206] According to another aspect, EMUI 800 can further be used to access and display performance data of an adjacent home, a similar sized home, one or more of the same or similar energy consuming devices (e.g. HVAC, hot water heater, other smart appliances), or any combination thereof. EMUI 800 can compare performance of each of the other residences and devices, and provide feedback to a user about the user's relative performance. For example, EMUI 800 can output a visual indication of power consumed, such as a graph, chart, etc. In other forms, a comparable residential site can also be displayed using EMUI 800. For example, a same or similar sized home can be used as a baseline comparison.

[00207] In other forms, EMUI 800 can be used to enable a user access to energy efficient devices and systems, and a user can forecast energy reduction and savings through use of an energy efficient system. As such, energy consuming devices that may be introduced and have a greater efficiency rating can be identified and communicated to a consumer. According to another form, EMUI 800 can display a click-through or micro-site to allow a user to access third party product energy efficient offerings. In other forms, EMUI 800 can enable access to a "green energy" marketplace that will enable a user to review energy efficient products and services. Such products and services can be selected by a user and associated XML data, meta data, and the like can be fed into EMUI 800. EMUI 800 can be configured to use the third party data and refresh data displayed within EMUI 800 to display an estimated saving if used at the user's residential site. As such, EMUI 800 can determine an estimate of what energy savings may be for their residential site, allowing a user to make an informed purchase decision. For example, a user may wish to add a solar array or other type of energy producing system to their residential site. EMUI 800 can be used to estimate the amount of energy that may be saved based on a

Ex. 1004.0507

user's actual historical energy use. As such, a payback period associated with purchasing can be displayed to a consumer.

[00208] FIG. 9 illustrates an energy management user interface (EMUI) operable to access and edit user and site information, illustrated generally at 900, according to a further aspect of the disclosure. EMUI 900 can include a user profile 902 configured to display and enable a user to edit changes to user information. User profile 902 can include a user selector 904 configurable to add and remove user's associate with a site, a user name field 906, an energy personality type field and/or indicia 908, a social network selector 910, a residential site address 912, and a mobile number 914 associated with a residential site address 912. According to a further aspect, user profile 902 can also include an energy text message alert selector 916, a proximity detection selector 918, and a current HVAC provider information field 920.

[00209] According to an aspect, user selector 904 can be configured to enable a user to select a user data to edit. For example, multiple users can be associated with a residential site and a user's information can be accessed by selecting user selector 904. In other forms, a user can log into a web site or other application and may only be able to have limited access to user specific data associated with a residential site. According to another aspect, user information selector 904 can be used to add additional users to be associated with a residential site. As such, a master user or administrator login can form (not expressly illustrated in FIG. 9) can be provided to manage user information. In some aspects, a user profile 902 can include pre-populated information to reduce the amount of information a user may need to input. Additionally, information associated with the residential site can be accessed and used with the additional user as needed or desired.

[00210] According to a further aspect, EMUI 900 can also include an energy provider section 922 which can include retail, utility, or third party energy information. For example, a current energy provider can be displayed and a current energy rate and plan currently being used can also be displayed. Energy provider section 922 can also

Ex. 1004.0508

indicate a best rate plan at a current provider, and a best local rate available through another provider. Energy provider section 922 can also include a savings calculator element 934 capable of initiating a savings calculation of the residential site using a best available rate of a current provider, other providers, or any combination thereof. Savings calculator element 9434 can also use historical site data, scheduling data of the residential site, forecasted energy consumption, future energy pricing, or various other EMI or any combination thereof to determine annual savings. Site consumption can then be used to determine what an overall cost of energy would be when using a given rate plan. Other intervals (e.g. monthly, weekly, daily, etc.) can also be calculated as needed or desired. As such, a user can identify a plan that would align with usage habits and scheduling data at a residential site.

[00211] According to a further aspect of the disclosure, EMUI 900 can also include a user posting and reviews section 924. User posting and reviews section 926 can include a content selector 926 capable of selecting energy blogs, green energy reviews, markets and the like. For example, as a user selects 'My Energy Blogs,' a list of energy blog titles can be displayed including a user energy blog 928 configured to enable a user to edit and publish their own energy blog. A user can publish their energy blog to an energy blog websites, social networks, third party sites, content providers, or any combination thereof. A third party energy blog 930 can also be listed within user posting and reviews section 926 allowing third party bloggers, articles, content providers, RSS feeds, Twitter ® Feeds, or any combination thereof, to provide content. According to an aspect, a user can add a blog, news feed, social network, Twitter ® account, etc. to user posting and reviews section 926 as desired. User selector within user posting and reviews section 924 can allow a user can to select between user content associated with a site and read/write/access privileges can be enabled and disabled accordingly.

[00212] According to a further aspect, user posting and reviews section 926 can also include a 'Green Energy Reviews' section configured to review energy saving products,

Ex. 1004.0509

environmentally friendly products, green energy producing systems, or any combination thereof. User posting and reviews section 926 can also include a 'Markets' section configured to enable a user to access green energy product websites or marketplaces having green energy products. For example, a marketplace can be used to consolidate available green energy products, such as smart appliances, and further identify third party pricing and websites selling green energy products. As such, a user can read reviews of new energy saving products and access the energy products using user posting and reviews section 926. In some instances, EMUI 900 can be used to enable E-commerce between a posting site within markets section, green energy reviews section, retail energy providers, etc. allowing a firm hosting EMUI 900 to be paid a portion of revenue resulting from a sale.

[00213] FIG. 10 illustrates an energy management user interface (EMUI) operable to schedule energy use at a residential site, illustrated generally as EMUI 1000 according to a further aspect of the disclosure. EMUI 1000 may be illustrated in association with managing one or more user schedules, thermostats, HVAC systems, zones, sites or any combination thereof. In other forms, EMUI 1000 can be modified to schedule energy use of various energy consumption devices at a site as needed or desired. Additionally, portions or all of EMUI 1000 can be accessed using a computer system capable of accessing the Internet, can be configured as mobile application that can be used with a smart phone or handheld computer, tablet, and the like such as an I-Phone® device, a Blackberry® device, an Android® device, an IPad® or various other devices or systems, or any combination thereof.

[00214] According to an aspect, EMUI 1000 includes a thermostat display 1002 configured to enable a user to adjust a temperature of one or more thermostats located at a residential site. Thermostat display 1002 can include a date and time display, a thermostat selector 1004, and a thermostat controller 1006. EMUI 1000 can also include a savings selector 1008 configured to enable a user to select a low savings level, a medium savings

Ex. 1004.0510

level, or a high savings level. Savings selector 1008 can be operably associated with an estimated savings display 1010 and a scheduling tool 1012. For example, a user can select a low savings using savings selector 1008 and an estimated savings can be calculated and displayed within estimated savings display 1010. According to a further aspect, a user can select a savings level using savings selector 1008. As such, resulting thermostat settings can be displayed within scheduling tool 1012 thereby providing a user a visual indication of a resulting temperature setting. According to a further aspect, savings selector 1008 can also be operably associated with scheduling tool 1012 to display more than one temperature setting at a time. For example, a low savings may result in a temperature setting of sixty-five degrees, a medium savings may result in a temperature setting of sixty-eight degrees, and a high savings level may result in a temperature setting of seventy-four degrees. Various combinations of values and display techniques can be used as needed or desired.

[00215] According to a further aspect, scheduling tool 1012 can include a seasonal schedule capable of allowing a user to schedule energy use based on a season (e.g. spring, summer, fall, winter). For example, a first site may be located in a hot climate and a second site may be located in a cold climate. As such, an air conditioner may be used more frequently during the summer months in a hot climate and can be associated with a schedule being displayed. A user can select between a seasonal schedule using scheduling tool 1012, and a schedule can be updated accordingly to display a winter schedule. Various other seasonal schedules can be added and removed as needed or desired. In other forms, scheduling tool 1012 can be used to access a current operating mode of an HVAC system and display a seasonal schedule in response to detecting an operating mode. For example, if an HVAC system may be operating in a heat mode, a winter schedule can be displayed. Other seasonal schedules can also be displayed within scheduling tool 1012 as needed or desired.

Ex. 1004.0511

[00216] According to a further aspect, scheduling tool 1012 can include a current inside and outside temperature display 1014, and a schedule selector 1016 capable of displaying a user schedule of a first user, a second user, a vacation schedule, or any combination of schedules. For example, a user may use scheduling tool 1012 to schedule energy use at multiple sites. As such, scheduling tool can display a second site associated with a specific user. Additional schedules can be added as needed or desired, and access privileges also can be set by a current user using user information profile such as user profile 902 illustrated in FIG. 9 or any other privileges or logic capable of setting access privileges.

[00217] According to a further aspect, scheduling tool 1012 can also include a weekly schedule display section 1018, and a time span display section 1020 configured within a schedule 1022. Weekly schedule display 1018 can also be configured to show current dates or a series of dates, and can further include forecasted weather conditions of each day. A user can navigate to another week by selecting tab 1024 configurable to enable a subsequent weekly schedule to be displayed as desired. According to further aspect, schedule 1022 includes a plurality of cells generally illustrated at scheduled events 1026 that can be modified as desired to schedule energy use. Schedule events 1026 can include a time interval and setting of a network device, such as a thermostat, being scheduled. A cell can also include an indicator, such as 'adapt?' indicator 1028 to indentify an auto-schedule suggestion detected by an energy management system operably associated with EMUI 1000. For example, when a user may be at a site, a user may desire to have a temperature decreased to seventy eight degrees on Saturday prior to nine (9) P.M. As such, an auto-schedule suggestion can be detected and an adapt? indicator 1028 can be displayed to enable a user to have a schedule adapted automatically. Adaption suggestions can be provided to users in other ways and need not be limited to being displaying within schedule 1022.

Ex. 1004.0512

[00218] According to a further aspect, EMUI 1000 can also provide access to view templates selector 1030 that can be used to schedule energy use. For example, view templates selector 1030 can be used to display predetermined schedules within scheduling tool 1012. A user can then modify portions of a selected template to their preference as needed or desired. In other forms, a series of questions can be asked to a user to determine a template to display. For example, scheduling tool 1012 can enable access to a short questionnaire to detect a user's day-to-day schedule. For example, a user can be an urban professional, a housewife, a single parent, a soccer mom, an empty nester, or various other demographics. As such, EMUI 1000 can be adapted to hide scheduling tool 1012 until a survey or series of questions is completed, and then display a resulting schedule within scheduling tool 1012.

[00219] According to a further aspect, EMUI 1000 can be adapted to display a list of selectable templates and can allow a user to select and display each template. Upon identifying a template, a user can then save an identified template as a user schedule. In some forms, a user's site location can be determined in advance and templates can be generated based on a location of a site (e.g. warm climate vs. cold climate). As such, view templates can be generated based on a site profile, a user profile, user characteristics, site data, or various other types of data capable of being used to generate a template that can be used by a user.

[00220] According to a further aspect, scheduling tool 1012 can also include an add addition time span selector 1034 configured to enable a user to add an additional time span within time span display section 1020. Scheduling tool 1012 can also include a view additional time slot selector 1032 configured to enable a user to scroll to additional time slots that may be output using scheduling tool 1012. For example, a user can select additional time slot selector 1032 and scheduling tool 1012 can be updated to display scheduled events of each day simultaneously. In this manner, a user can scroll additional time slots and days of the week as needed or desired.

Ex. 1004.0513

[00221] According to a further aspect, EMUI 1000 can also include a proximity detection selector 1036. For example, a user may enable proximity detection using proximity detection selector 1036, and energy use at a site may be altered based on a users distance to the site. A user's mobile device number can be associated with a site and can allow a user to enable and disable proximity detection selector 1036. In some forms, proximity detection selector 1036 can be hidden, displayed, selectable, or any combination thereof in response to a user having a mobile device capable of being detected when a user is at or away from a site.

[00222] According to another aspect, EMUI 1000 can a energy alert text message selector 1038 configured to enable a text message to be sent to a user's mobile device. For example, during a high energy use day, an energy action day may be identified and a utility company or other entity may publish a warning indicating that a high energy use day may be occurring. As such, a user can receive a text message indicating the situation. In some forms, a can respond to the text message and alter their energy use schedule. For example, a user can respond to a request to alter their energy savings setting from a medium to a high. As such, scheduling tool 1012 can be modified to initiate a high energy savings schedule at a user's site. In other forms, energy alert text message selector 1038 can be used to enable a user to receive demand response requests via a text message. For example, a demand response request can include a requested time interval, new temperature setting, estimated savings, other demand response data, or any combination thereof within a text message. A user can then respond to the text message to participate, not participate, partially participate, or any combination thereof. Upon responding, a user's schedule can be modified as needed or desired.

[00223] According to a further aspect, EMUI 1000 can also include a vacation mode settings 1040 to enable a user to initiate use of a vacation mode or schedule. For example, vacation mode settings 1040 can include a vacation mode selector 1042 to turn a vacation mode on or off. Vacation mode settings can also include a schedule leave date

Ex. 1004.0514

selector 1044 and a schedule return date selector 1046. A calendar (not expressly illustrated in FIG. 10) can be displayed to enable a user to select an interval of dates when they will be on vacation. As such, reduced energy use can be realized by altering a temperature setting. For example, a schedule can be increased to a high energy saving mode in association with the vacation mode being selected. In other forms, a user may have input or selected a vacation schedule to be used when vacation mode may be selected. Various combinations can be used as needed or desired.

[00224] During use, upon a user accessing EMUI 1000, EMUI 1000 can display a current date and time, and can further highlight a current cell within scheduling tool 1012 that corresponds to a current data and time. A user can select a thermostat to adjust using thermostat selector 1004, and a schedule of a selected thermostat can be displayed within scheduling tool 1012. A user can adjust a current set-point using thermostat controller 1006, and a corresponding temperature within a current cell can be adjusted accordingly. In another form, a user can select a cell to be modified. For example, a user may want to modify a temperature setting or scheduled event set for Tuesday, between eight (8) A.M and five (5) P.M. As such, a user can select the appropriate cell and further adjust a temperature up or down using thermostat controller 1006. A new setting can be displayed within the selected cell. According to a further aspect, a user can use savings selector 1008 to adjust a savings to be realized on a specific day. As such, a resulting temperature setting can be displayed within a selected cell.

[00225] In other forms, a user can select a time span cell to adjust. For example, a user can modify a current time span cell by selecting a specific cell. Upon selection of a specific cell, scheduling tool 1012 can highlight which cells may be affected by modifying a time interval. A user can then modify an interval accordingly as needed or desired.

[00226] According to a further aspect, a user can select a day of the week to modify. For example, a user can select 'MON' and a background color can be altered to indicated that each of the MON cells can be modified. In a form, a user can update each cell as

Ex. 1004.0515

desired, can alter one or more, or all MON cells using savings selector 1008 as needed or desired.

[00227] According to another aspect, EMUI 1000 can be used to activate a one or more schedules. For example, a first user schedule can be activated over a period of time and then a second user schedule can be activated over another period of time. A user can also activate a vacation schedule that include an scheduled events to optimize energy savings when nobody is present at a site. In other forms, a first user schedule can be compared to a second user schedule, and events at a site can be scheduled accordingly. For example, a first user schedule may be active during an evening time and may override a second user schedule. In other forms, a second user schedule may be activated in the morning to accommodate an individual that may remain at home during the day. As such, EMUI 1000 can be used to generate multiple schedules to automatically control energy use at a site as needed or desired.

[00228] According to an aspect, portions or all of EMUI 1000 can be provided as a hosted application that can allow a user to access site reports, historical consumption data, real-time consumption data, operating status of energy consuming devices, control interface to control energy consuming devices, a scheduling interface to schedule utilization and consumption of energy, an inventory tool that will show real-time and historic energy consumption of each energy consumption device within the home, or any combination thereof.

[00229] According to a further aspect, portions of all of EMUI 1000 can include a user interface that can report a current operating condition, and can further include control logic capable of providing a user access to a smart appliance or control system at a site. For example, if a demand response condition may be detected within an energy transmission system, EMUI 1000 can be used to output the condition to a user. A user can then alter an operating status of one or more energy consuming devices at a site.

Ex. 1004.0516

[00230] According to another aspect, a site can include multiple users that can access and control settings at a site using EMUI 1000. Additionally, a site can include multiple thermostats that can be managed remotely and controlled by a user. For example, a thermostat in the upper portion of a home can be displayed via a web browser or application on an mobile device such as a Blackberry®, I-Phone®, Android®, I-Pad® and the like. A user can select a thermostat using thermostat selector 1004, and adjust the thermostat to a first setting. In some forms, the thermostat settings may have a different effect on the actual temperature within various portions of the home. As such, a user may want to select the desired temperature within at a site, and EMUI 1000 can be used to calculate thermostat settings to achieve the desired temperature. In another form, EMUI 1000 can be used with an energy management system such as energy management system 600 in FIG. 6, or other systems. A thermal response of a zone, room, site, or any portion thereof can be determined and setting of one or more thermostats can be automatically determined to achieve a desired temperature.

[00231] In other forms, EMUI 1000 can be used in association with various types of EMI data. For example, various EMI data such as current and forecasted weather data, grid conditions, real-time pricing data, grid congestions conditions, forecasted demand, or any combination thereof of EMI data can be used to determine a setting recommendation that a user can select. In this manner, a user's lifestyle and preferences can be aligned with the real-time and forecasted conditions allowing a user to make informed energy consumption decisions.

[00232] FIG. 11 illustrates a diagram of a network device, illustrated generally as wireless thermostat 1100, according to an aspect of the disclosure. Wireless thermostat 1100 can be used in association with an energy management system, mobile device, energy management user interface, or various other devices, systems, or any combination thereof.

Ex. 1004.0517

[00233] Wireless thermostat 1100 can include a outside temperature display 1102, a weather forecast display 1104, and an inside temperature display 1106. Wireless thermostat 1100 can also include a thermostat setting display 1108, a temperature increase input 1110, and a temperature decrease input 1112. Various type of display technology having single color, multicolor, or any combination thereof can be used with wireless thermostat 1100, including, but not limited to LED displays, TFT displays, OLED displays, LCD displays, flexible lighting displays, or any combination thereof.

[00234] According to an aspect, wireless thermostat 1100 can also include a mode switch 1114 and indicators 1116 configured to identify a mode. For example, mode switch 1114 can be placed off, heat mode, air condition model, or fan mode. An associated indicator above each mode within setting display 1116 can be illuminated in connection with an operating mode setting. In other forms, indicators 1116 can be placed behind an associated text and illuminated to indicate a current mode. For example, wireless thermostat 1100 can include a thin material that can allow a backlight, such as LED lighting to illuminate and show text. In another form, mode switch 1114 can include a push button or toggle switch to enable a back light to display and select a mode. Various other input and display methods or combinations thereof can be used.

[00235] According to a further aspect, wireless thermostat 1100 can also include a smart thermostat settings 1118. Smart thermostat settings 1118 can be programmable settings that can display a proximity mode 1122, a vacation mode 1124, and a smart energy mode 1126. Smart thermostat settings 1118 can be displayed based on a capability of a site, a current operating mode of wireless thermostat 1100, a setting within a energy management user interface such as EMUI 1100 and the like, an operating mode of a mobile device, a location of a mobile device, an operating mode of another network device accessible to an energy network, or various other combinations of operating modes or settings accessible to wireless thermostat 1118. For example, a user may want to activate proximity detection to control wireless thermostat 1100 (and possible other network

Ex. 1004.0518

devices) using proximity mode 1122. As such, a user can activate proximity mode accordingly. In other forms, a user may be going on vacation and can activate vacation mode 1122. In another form, a user may activate a smart energy mode 1126, and an energy schedule provided by EMUI 1100, associated settings, and the like can be deployed.

[00236] According to another aspect, wireless thermostat 1100 can include a housing 1130 can having a material that can detect when a user touches wireless thermostat 1100. For example, housing 1130 can be operably coupled to a heat sensor, capacitive sensor, and the like configured to detect when a user touches a portion of housing 1130. Upon detecting a user contacting housing 1130, one or more displays or indicators of wireless thermostat 1100 may illuminate. In this manner, energy consumed by wireless thermostat 1100 can be realized by changing one or more displays from a sleep state to a display state. According to a further aspect, a portion or all of housing 1130 can include a material such as a concealing material that can include characteristics such as transparency, translucency, semi-transparency, semi-translucency, opaqueness, other types of light altering material, or any combination thereof capable of hiding one or more displays or indicators of wireless thermostat 1100. For example, a backlight or LED can illuminate at a surface of wireless thermostat 1100 giving an appearance of having the display at or near a front surface of housing 1130. As such, housing 1130 with a concealing material can be mounted on a wall or other location without having readings or settings persistently being displayed using a display or other indicators.

[00237] According to an aspect, temperature control mechanisms 1110 and 1112 can include a mechanism (not expressly illustrated in FIG. 11) that can allow housing 1130 to rock or shift left and right as a user contacts mechanisms 1110 or 1112. Other orientations can also be used. For example, wireless thermostat 1100 can mounted to a wall surface (not expressly illustrated in FIG. 11), and a user can contact a temperature increase mechanism 1110. Housing 1130 would rock slightly to the right. In another

Ex. 1004.0519

form, at least a portion of housing 1130 can include a switch mechanism similar to a mouse of a computer system that provides a clicking sound or a mechanical feedback when temperature control mechanisms 1110 or 1112 are engaged or touched. As such, a user can realize a visual change of display 1108, and can further be provided a mechanical feedback of a switching mechanism upon activation of a switching mechanism. Various other orientations to rotate housing (e.g. up/down, left/right, etc.) can be realized as needed or desired.

[00238] FIG. 12 illustrates a block diagram of a network device, illustrated generally as a wireless thermostat 1200, according to another aspect of the disclosure. Wireless thermostat 1200 be used with wireless thermostat 1100 illustrated in FIG. 11 above or various other devices, systems, or any combination thereof described herein. Wireless thermostat 1200 can include a temperature and humidity sensors 1202, and one or more I/O devices 1204 to allow a user to provide an input to wireless thermostat 1200. For example, I/O device 1204 can enable a user can to select a mode (e.g. off, A/C, Heat, Fan, etc.), a smart energy mode (e.g. proximity, vacation, smart schedule, etc.), or various other features or combinations of features. Wireless thermostat 1200 can also include a power interface 1206, and a bus interface 1208. Wireless thermostat 1200 can also include a processor or controller 1210, and one or more control relays 1212 to control a remote unit such as an HVAC unit, heat pump, other appliances, or any combination thereof.

[00239] According to a further aspect, wireless thermostat 1200 can also include a one or more wireless devices 1214 capable of communicating with one or more associated wireless networks, a memory 1216, and a display interface 1218. Display interface 1218 can be configured to engage one or more LCD displays, touch screens, one or more LEDs, or various other display technologies illustrated generally as display 1222. Wireless thermostat 1200 can also include a precision measurement unit (PMU) 1220 configured to measure consumed by an associated network device, and a profile module 1224 that can

Ex. 1004.0520

include network protocol configuration data, user profile data, device data, seasonal profile data, or various other types of data that can be accessed during use of wireless thermostat 1200. According to an aspect, wireless thermostat 1200 is a non-programmable thermostat that does not include an enabled programmable thermostat scheduling feature accessible by a user engaging wireless thermostat 1200. As such, a limited amount of scheduling functionality is needed or desired within wireless thermostat 1200 and a user can use a scheduling tool such as EMUI 1000 or various other features provided herein to enable and disable use of wireless thermostat 1200.

[00240] FIG. 13 includes a block diagram of an energy management system, illustrated generally at 1300, according to a further aspect of the disclosure. Energy management system 1300 can be deployed at residential site 1302 and can include an energy management apparatus or controller 1302. Controller 1302 can include portions or all of controller 400 described in FIG. 4 or any other type of system, device, apparatus, or any combination thereof capable of deploying controller 1302.

[00241] According to an aspect, controller 1302 can include an application program interface 1306 operably coupled to a processor or logic (not expressly illustrated in FIG. 13) of controller 1302. Controller 1302 can include a communication interface 1306 a wireless device 1308 configured to access a first network 1314, a wireless device 1310 configured to access a second network 1318, and a wireless device 1312 configured to access a third network 1322. Controller 1302 can also include a network device 1330 such as an Ethernet or other wireline communication device capable of access an information network such as a LAN, WAN, the Internet, and the like.

[00242] According to a further aspect, first network 1314 can be communicatively coupled to a smart meter / AMI device 1316. According to another aspect, second network 1318 can be communicatively coupled to a wireless thermostat (TSTAT) 1320. According to a further aspect, third network 1322 can be coupled to a mobile device 1324. According to an aspect, mobile device 1324 can include a smart phone device such as a

Ex. 1004.0521

Blackberry®, I-Phone®, Android ® and the like, a laptop computer system, a Netbook, an IPad®, or any other type of mobile device.

[00243] During use, controller 1302 can be used to communicate information from various networks to a wireless energy network to manage one or more network device connected to a wireless energy network. For example, second network 1318 can be configured as a wireless energy network capable of enabling communication with a network device such as TSTAT 1320. Information can be received from information network 1332, and processed by controller 1302 and output to TSTAT 1320 using API 1306 and communication interface 1306. In other forms, information can be communicated from mobile device 1324 to controller 1302 using third network 1322 that may be different from second network 1318. Controller 1302 can detect information communicated from mobile device 1324 and output information to TSAT 1320 using second network 1318 to TSTAT 1320. As such, controller 1302 can provide a network bridge to enable information communicated between various different types of networks.

[00244] According to an aspect, controller 1302 can include application program interface 1306 configured to use at least a portion of an incoming message communicated from an information network, an information network, a utility network or any combination thereof. For example, an incoming message can include at least a portion of a user energy management schedule. Controller 1302 can initiate altering use of a resource in response to detecting a portion of the first user energy management schedule. For example, a schedule can include altering a thermostat, lights, smart appliances, etc. Communication interface 1306 can further be operably coupled to application program interface 1306 and configured to communicate information using a wireless device.

[00245] For example, communication interface 1306 can communicate with wireless device 1310 capable of accessing a second network 1318 operable as a wireless energy network. Although illustrated as a single communication interface, communication interface can be provided as multiple communication interfaces, a single communication

Ex. 1004.0522

interface, as a multi-network communications interface, or any combination thereof. As such, multiple networks can be accessed and communicated with as needed or desired. For example, wireless device 1312 can be configured to communicate using a WIFI enable communication protocol and wireless device 1310 can be configured to communicate using a Zigbee enabled communication protocol.

[00246] According to an aspect, controller 1302 can include wireless device 1312 configured as a WIFI enabled communication device operably coupled communication interface 1306 and third network 1322 operable as a WIFI network. Application program interface 1306 can be configured to receive an energy management schedule communicated using an incoming message received from third network 1322 as an incoming WIFI message. As such, an energy management schedule or other EMI data can be communicated from a WIFI enabled device, such as mobile device 1324 or other devices. Controller 1302 can then use application program interface 1306 to process the energy management schedule and initiate control actions to a network device accessible to an energy network.

[00247] According to another aspect, controller 1302 can recieve an first energy management schedule using a first network, and receive a second energy management schedule using a second network. For example, a first enrgy schedule can be received using network device 1330 and can include a first user energy schedule data. A second energy schedule can be received using third network 1322 operable as a WIFI network. For example, a user of mobile device 1324 can provide scheduling data, control data, or various other energy management scheduling data. Controller 1302 can then use portions of each schedule as needed or desired, and initiate control actions using second network 1318 operable as a wireless home energy network. For example, second network 1318 can be configured as a Zigbee enabled network. As such, multiple networks having scheduling information can be accessed and scheduling data of multiple users can be used to control network devices accessible to an energy network.

Ex. 1004.0523

[00248] According to an aspect, controller 1302 can include output control actions that have been received from more than one network to control a network device accessible to an energy network. For example, wireless device 1312 can be configured to receive control action data from third network 1322 operable as a WIFI enabled network. Control action data can be provided in association with a first user schedule using mobile device 1324. Controller 1302 can further receive a second control action data from associated with a second user schedule, such as a utility schedule. Second control action data or a second user energy management schedule can be communicated using first network 1314 configured as an AMI enabled network and smart meter / AMI interface 1316. Controller 1302 can then detect whether to use the second control action prior to the first control action.

[00249] According to another aspect, control action data of multiple user schedules can be communicated using communication interface 1306 provided as multiple communication interfaces. For example, wireless device 1312 can include a communication interface accessible to application program interface 1306. Additionally, wireless device 1310 can include a communication interface accessible to application program interface 1306. As such multiple communication interfaces can be deployed to communicate control action data of one or more user energy management schedule.

[00250] According to a further aspect, application program interface 1306 can be used to initiate use of a first control action of a first user energy management schedule prior to using a first control action of a second user energy management schedule prior to the first user energy management schedule. For example, a second user energy management schedule can include one or more control action that can have a higher priorty that a first user energy management schedule. As such, controller 1302 and application program interface 1306 can initiate a control action as needed or desired based on a priority.

[00251] According to a further aspect, controller 1302 can initiate a control action or energy management schedule in response to a distance an associated mobile device 1324 may be from site 1304. For example, a first user energy management schedule may be deployed as a first user having mobile device 1324 may be located at or near site 1302. As mobile device 1324 moves away from site 1302 (e.g. one mile, three miles, etc.), a second user energy management schedule can be initiated and used by controller 1302. In this manner, proximity detection of mobile device 1324 can be used to initiate a second user energy schedule.

[00252] According to another aspect, mobile device 1324 can output scheduling data, control action data, energy management data, and the like using third network 1322 configured as a WIFI enabled network. For example, mobile device 1324 can include a application or scheduling logic capable of initiating a user energy management schedule. Mobile device 1324 can encode or output control action data, and communicate the control action data, scheduling data, and the like using a WIFI protocol and messaging format.

[00253] According to an aspect, controller 1302 can include detect when mobile device 1324 may be connected to third network 1322 and modify operation of a network device accessible to controller 1302. For example, mobile device 1324 can be coupled to third network 1322 operable as a WIFI network, or other network capable of being deployed at site 1304. As mobile device 1324 moves away from site 1304 and a network connection to third network 1322 may be altered, controller 1302 can detect a change in connectivity (e.g. weak signal, signal is lost, connection switches to another hub, station, controller, and the like) to third network 1322, a connection status of wireless device 1312 can be output to communication interface 1306 and accessed by application program interface 1306. As such, controller 1302 can detect whether to alter use of a resource or network device accessible to controller 1302. For example, mobile device 1324 may be connected to third network 1322 using a WIFI connection. As a WIFI connection is

altered, controller 1302 can initiate altering an operating condition of a resources such as TSTAT 1320, one or more wireless devices 1308, 1310, 1312, or various other resources accessible to controller 1302. For example, if a second user may be located at site 1304, a second user energy management schedule that may be different from the fist user energy management schedule can be deployed. For example, a first portion of a second energy management schedule of a second user can be enabled in response to the operating status of the resource,

[00254] According to another aspect, wireless device 1312 that may have been configured to be coupled to third network 1322 can be placed in a reduced operating condition to save power consumed by controller 1302. In another form, proximity detection of mobile device 1324 can be initiated to detect a location of mobile device 1324 when a WIFI connection or other connection is altered. Additionally, mobile device 1324 may also alter an operating condition by disabling a WIFI connection to third network 1322. Mobile device 1324 can also initiate location reporting of mobile device 1324, and controller 1302 can alter an operating condition of a network device or resource in response to mobile device 1324 being at a distance from site 1304.

[00255] According to another aspect, mobile device 1324 may be configured to enable access to TSTAT 1320 using a network connection 1330 that can include one or more wireless communication protocols. For example, a network device such as TSAT 1320 can be coupled to mobile device 1324 using a WIFI connection, Bluetooth connection, or various other forms of wireless communication. Upon connecting to TSTAT 1320, mobile device 1324 can be used to alter and operating condition of TSTAT 1320. As such, mobile device 1324 having energy management capabilities can be used to alter an operating condition of TSTAT 1320, various other network devices at site 1304, or any combination thereof. For example, mobile device 1324 can include an energy management scheduling tool, such as portions or all of EMUI 1000 described in FIG. 10, to provide control inputs and scheduling data directly to TSTAT 1320. As such, controller

Ex. 1004.0526

1302 may not be available to output control actions (e.g. a network connection may be lost, etc.), or mobile device 1324 may have priority over controller 1302 to provide control inputs or energy managing scheduling information to TSTAT 1320.

[00256] According to a further aspect, TSTAT 1320 can receive an input and communicate status information, operating conditions, control actions, or any combination thereof to a network resource, controller 1302, mobile device 1423, smart meter / AMI 1316, or any other device, system, or apparatus, or any combination thereof. According to an aspect, TSTAT 1302 can detect is a user altered an operating condition (e.g. change mode, altered smart energy settings, etc.) and can communicate an operating status change. In another form, TSTAT 1320 can alter an operating status of another network device in response to an input to TSTAT 1320. For example, a user may place TSTAT 1320 in a vacation operating mode. As such, TSTAT 1320 can output an updated status to another network device, controller 1302, mobile device 1324, or other network devices. For example, a second TSTAT may be located at site 1304 (not expressly illustrated in FIG 13), and placed in a vacation operating mode using a signal output by TSTAT 1320. In other forms, controller 1302, mobile device 1324, or any combination thereof can be used to alter the operating condition of the second TSTAT as needed or desired.

[00257] FIG. 14 illustrates a collaborative demand response system (CDRS), illustrated generally at 1400, according to an aspect of the disclosure. CDRS 1400 can include a server 1402 operably coupled to an information source such as a database 1404. According to a further aspect, server 1402 can include portions or all of server 602 illustrated in FIG. 6, or any other server capable of being deployed with CDRS 1400. According to further aspect, database 1404 can include site data 1406, user profile data 140, performance data 1410, or various other types of EMI data that can be used in association with CDRS 1400 as needed or desired. According to another aspect, CDRS 1400 can also include access to one or more external data source 1412. CDRS 1400 can

Ex. 1004.0527

also interface with an energy buyer / auction 1414 capable of buying available capacity of CDRS 1400.

[00258] According to a further aspect, CDRS 1402 can include a monitor 1416, a client interface 1418, and a site interface 1420. According to an aspect, client interface 1418 can be coupled to a first mobile device 1422, a second mobile device 1424, a client system 1426, or any combination thereof. For example, client interface 1418 can be configured as a mobile client interface operable to communicate information using a mobile network. In other forms, client interface 1418 can be coupled to a client system 1426 using an information network such as the Internet.

[00259] According to another aspect, CDRS 1402 can include site interface 1420 configured to interface with multiple sites. For example, site interface 1420 can be operably associated with fist site 1428 and mobile device 1422. In other forms, site interface 1420 can be operably associated with second site 1430 and mobile device 1424. Site interface 1420 can also be operably associated with third site 1423 and client system 1426. Various other combinations can also be used with CDRS 1400.

[00260] During use, CDRS 1400 can be used to determine a desire by an owner of a site to participate in a demand response event. Server 1402 and monitor 1416 can detect a current or future demand response initiative to be deployed at a specific time. Server 1402 can detect an availability of capacity in a specific region, and initiate an inquiry with a site owner, user, administrator, etc. According to an aspect, a text message, email message or other form of electronic or wireless messaging can be initiated to detect a desire by a user to participate. Serve r1402 can access site data 106 associated with a specific site to detect if a user may have a default setting to participate. In other forms, a user a user may have set a preference to be contacted via email or text message. As such, server 1402 can initiate a message and detect a desire by one or more users to participate.

Ex. 1004.0528

[00261] According to a further aspect, server 1402 can access performance data of each site elected to participate in a demand response event. For example, historical site data of a site can be stored within database 1404, and performance of a participating site can be determined as performance data 1410. According to an aspect, other EMI data can be accessed from database 1404, external data source 1412, or any combination thereof and used to determine performance of a site. For example, current and future weather conditions can be used to determine performance of a site. Taking weather conditions into consideration, along with a thermal response or characteristic of a site, a capacity to reduce energy can be determined on a site by site basis. The overall or aggregate capacity and desire to participate can be sold to a third party, monetized by an owner of CDRS 1400, or any combination thereof.

[00262] FIG. 15 illustrates a demand scheduling system (DDS), illustrated generally at 1500, according to an aspect of the disclosure. DSS 1500 can include a server 1502 operably coupled to an information source such as a database 1504. According to a further aspect, server 1502 can include portions or all of server 602 illustrated in FIG. 6, or any other server capable of being deployed with DDS 1500. According to an aspect, database 1504 can include site data 1506, site schedule data 1508, performance data 1510, or various other types of EMI data that can be used in association with DSS 1500 as needed or desired. According to another aspect, DSS 1500 can also include access to one or more external data sources 1512. DSS 1500 can also interface with an utility company, COOP, retail energy provider, or various other energy providers, or any combination thereof, using one or more utility schedule interface 1514. According to an aspect, utility scheduling interface 1514 can be a standard interface however in other forms, utility scheduling interface 1514 can include a custom interface configurable to engage an existing energy company's information network, infrastructure, database, or various other components that can be used by an energy provider to access DDS 1500.

Ex. 1004.0529

[00263] According to a further aspect, DSS 1502 can include an aggregate demand module 1516, a client interface 1518, a site interface 1520, or any combination thereof. According to an aspect, client interface 1518 can be coupled to a first mobile device 1522, a second mobile device 1524, a client system 1526, or any combination thereof. For example, client interface 1518 can be configured as a mobile client interface operable to communicate information using a mobile network. In other forms, client interface 1518 can be coupled to a client system 1526 using an information network such as the Internet.

[00264] According to another aspect, DSS 1502 can include site interface 1520 configured to interface with multiple sites. For example, site interface 1520 can be operably associated with a fist site 1528 that can be associated with mobile device 1522. In other forms, site interface 1520 can be operably associated with a second site 1530 and mobile device 1524. Site interface 1520 can also be operably associated with third site 1532 and client system 1526. Various other combinations can also be used with DSS 1502.

[00265] During use, server 1502 can use EMI data to forecast energy use at sites 1528, 1530, and 1532. For example, each site can include site schedule data 1508 stored within database 1504. For example, EMUI 1000 or another scheduling tool can be used to schedule energy use at a site. Site 1508 schedule data can be used to determine what energy use may be on a site-by-site basis. An aggregate demand of a specific region, zip code, substation, grid location, etc. can also be detected. Aggregate demand module 1516 can then detect what an aggregate level of demand and scheduled demand can then be communicated to a utility company as needed or desired. In this manner, scheduling data that may not have been traditionally accessible on a site by site basis can be used to detect energy demand and schedule energy production. For example, residential sites traditionally use non-programmable and programmable thermostats that do not allow for determining schedules on a site by site basis. DSS 1500 can enable access to scheduling data of each residential site to determine an aggregate demand schedule.

Ex. 1004.0530

[00266] According to an aspect, server 1502 can access performance data of each site to determine scheduled energy demand. For example, historical site data of a site can be stored within database 1504, and performance of a participating site can be determined as performance data 1510. According to an aspect, other EMI data can be accessed from database 1504, external data source 1512, or any combination thereof and used to determine performance of a site. For example, current and future weather conditions can be used to determine performance of a site. Taking weather conditions into consideration, along with a thermal response or characteristic of a site, a capacity to reduce energy can be determined on a site by site basis. The overall or aggregate demand can be used by the owner of DSS 1500 or communicated to a third party on a contractual basis as needed or desired.

[00267] FIG 16 illustrates a method of managing energy at a site according to an aspect of the disclosure. Portions or all of the method of FIG. 16 can be used with portions or all of the energy management systems, devices, or apparatuses disclosed herein, or any other type of system, controller, device, module, processor, or any combination thereof, operable to employ all, or portions of, the method of FIG. 16. Additionally, the method can be embodied in various types of encoded logic including software, firmware, hardware, or other forms of digital storage mediums, computer readable mediums, or logic, or any combination thereof, operable to provide all, or portions, of the method of FIG. 16.

[00268] The method begins generally at block 1600. At block 1602, an acquisition interval to acquire network device data can be detected. For example, network device data can be acquired using a wireless energy network having one or more network devices accessible to the wireless energy network. For example, a wireless energy network can include various types of wireless networks configured to communicated information to manage energy use of a network devices accessible to the wireless network. For example, a wireless energy network can include one or more of any combination or portion of, IEEE

Ex. 1004.0531

802.15-based wireless communication, Zigbee communication, INSETEON communication, X10 communication protocol, Z-Wave communication, Bluetooth communication, WIFI communication, IEEE 802.11-based communication, WiMAX communication, IEEE 802.16-based communication, various proprietary wireless communications, or any combination thereof.

[00269] At decision block 1604, the method can detect whether an acquisition interval may be updated. For example, an acquisition interval can be set to a first interval (such as 1 minute, 2 minutes, 10 minutes etc.), and can then be altered to another interval. According to an aspect, an acquisition interval can be altered in response to a distance a mobile device may be from a site. For example, as a user moves away from a site, an acquisition interval can be increased (e.g. changed from 1 minute to 3 minutes). Similarly, as a mobile device move towards a site, an acquisition interval can be decreased (e.g. changed from 3 minutes to 1 minute). Various combinations of intervals can be used as needed or desired. If at decision block 1604 an acquisition interval has been updated, the method can proceed to block 1606 and an updated interval can be obtained. If at decision block 1604 an acquisition interval has not been changed, the method can proceed to block 1608.

[00270] According to an aspect, at block 1608, device data can be acquired. For example, device data can be obtained by sending a request to one or more network devices joined to a wireless energy network. For example, multiple devices can be accessed at an acquisition interval to obtain device data. Device data can be provided in various forms and types of information. According to an aspect, device data can include a device identifier, a network identifier, operation data, security data, various other types of data that can be used to manage energy use, or any combination thereof. According to a further aspect, device data can be formatted based on a wireless communication protocol (e.g. Zigbee, WIFI, WiMax, etc.) being deployed as the wireless energy network.

Ex. 1004.0532

[00271] According to another aspect, the method can be modified to detect an availability of one or more network devices. For example, a first network device may be accessible to a wireless energy network and may use a first device profile to communicate informaitonn using the wireless energy network. Addtionally, a second network device may be accessible to the wireless energy network and may use a second device profile that may be different from the first.

[00272] Upon acquiring device data from one or more network devices, the device data can be translated at step 1610. For example, the device data may be formatted using a device profile, communication protocol, or various other formats to communicate device data using a wireless energy network. At block 1610, device data can be translated into another format to use by another system, process, device, etc. other than the wireless energy network. For example, Zigbee formatted data can be translated into XML encoded data. According to another aspect, device data can be translated to an data object, such as a Java object and the like. Various other translations can also be used.

[00273] The method can then proceed to block 1612 and a report interval can be detected. According to an aspect, a report interval can include an interval that may be the same as the acquisition interval, greater than the acquisition interval, or less than the acquisition interval. According to a particular aspect, the report interval can be twice as long as the acquisition interval. As such, exact timing of when to acquire device data can be obviated as at least one data acquisition may be available to generate a report.

[00274] At decision block 1614, if a report interval should not be updated, the method can proceed to block 1618 as described below. If a report interval should be updated, the method can proceed to block 1616 and an updated report interval may be obtained. According to an aspect, a report interval can be provided using a data acquisition interval. For example, a report interval can be updated in association with an acquisition interval being updated. In other forms, a report interval can be provided and

Ex. 1004.0533

updated without an acquisition interval being updated. Various combinations of updating a report interval, acquisition interval, or any combination thereof can be used. Upon updating a report interval, the method can proceed to block 1618.

[00275] According to an aspect, at block 1618 report data can be generated. For example, report data can include data that can be provided within a site report and can be formatted in various ways. For example, report data can include a XML encoded data, Java objects, textual data or various combinations thereof. According to an aspect, network device data can be converted to a binary representation. For example, to reduce the amount of information to be communicated, a binary representation can include one or more binary bits within a data field that can represent portions or all of the network device data. According to a further aspect, report data can be stored on a device basis until a site report can be generated.

[00276] Upon generating report data, the method can proceed to block 1620 and generates a site report. For example, a site report can include data received from one or more network devices. In another form, site report data can include data from another source, device, network, or any combination thereof capable of providing data that can be used within a site report. For example, a home controller may include a data and time setting based on a current time zone. A network device may not have a current or updated date and time stamp provided with the network device data. As such, a current date and time stamp can be provided with the site report data. In other forms, data obtained from another source (e.g. WIFI network, AMI network, WiMax network, etc.) can be provided within a site report. For example, a site report can include network device data that includes a thermostat or HVAC system being placed in an 'on' condition. Additionally, an AMI network can be accessed to detect a current energy consumption level, rate, price, savings or various other types of information that can be provided using an AMI network. The AMI network data can be combined with the network device data within a site report. As such, subsequent processing of site reports can include additional information that can

Ex. 1004.0534

be processed into a rite report to manage and report energy use at a site. Other types and combinations of EMI data from various network locations can be included within a site report as needed or desired.

[00277] Upon generating a site report, the method can proceed to block 1622 and a network connection can be initiated. For example, a rested web services approach to making a network connection can be deployed to realize increased network security at a site. For example, a home controller can be used to initiate a network connection using a LAN, broadband network, wireless data network, WiMax network, WIFI network, or various other networks or combinations of networks. A specific network location can be accessed on a secure basis using SSL or other encryption methods. At decision block 1624, if a network may not be available, the method can proceed to block 1626 and store the site report until the network may become available. The method can then proceed to block 1608 as described herein. If at decision block 1624 a network location may be available, the method can proceed to block 1630 and initiates a transfer of a site report. According to an aspect, if multiple site reports are available, the method can initiate a transfer of the multiple site reports.

[00278] Upon initiating transfer of the site reports, the method can proceed to block 1632 and can initiate processing site report data at a network location. For example, a network location can include a server configured to process site report data and store site report data within a database. Additional processing of the data can be realized as needed or desired. For example, server 602 described in FIG. 6 includes several modules that can be used to process site report data.

[00279] Upon initiating processor of site report data, the method can processed to decision block 1634 to detect if a control action may be available. For example, a control action field or flag associated with a specific site and one or more network devices can be provided within a database or other storage location. In another form, one or more binary values can be used to indicate if control action data be available. If control action may be

Ex. 1004.0535

available, the method can proceed to block 1636 and a control action can be received. For example, a control action can be communicated during a session and can include one or more actions associated with a network device accessible at a site. According to an aspect, a control action can be encoded based on a profile,(e.g. Zigbee Profile, Smart Energy Profile, Home Automation, etc.). In other forms, a control action can be formatted as XML encoded data, HTML encoded data, proprietary data format, or any combination thereof.

[00280] Upon receiving a control action at block 1636, or if a control action may not be available, the method can proceed to decision block 1638 and detects if an interval should be updated. For example, a acquisition interval, report interval, or any combination thereof can be available. If an interval should be updated, the method can proceed to block 1640 and one or more intervals can be received and updated. According to an aspect, if an interval may be updated, an update flag can be set to indicate a new or updated interval can be used. In other forms, a current interval field can be updated with a new interval value. If at decision block 1638, an interval may not be updated, the method can proceed to decision block 1642 as described below.

[00281] According to an aspect, at decision block 1642 the method can detect if an update may be available. For example, an update can include one or more new or updated profiles that can be used at a site in association with an energy network. In another form, a software or firmware update can be available to update a network device, home controller, or various other systems, apparatuses, methods, devices, or any combination thereof that can be used at a site. If an update may be available, the method can proceed to block 1644 and a method can be received and processed at block 1646 as needed or desired. According to an aspect, an update may be available at another network location. As such, the method can be modified to include an update available flag or data, and another network location can be accessed to receive an update. If at decision block 1642

Ex. 1004.0536

an update may not be available, the method can proceed to block 1648 as needed or desired.

[00282] According to an aspect, at block 1648, the method can disconnect from a network location and proceed to block 1650. If a control action may have been received, the method can processor the control action data, and proceed to block 1652 to detect a control action within the control action data. According to an aspect, a control action can include various combinations of actions such as obtaining or reading an operating status or value of one or more network device attributes, altering an operating condition of network device, updating an operating schedule of a network device, or various other control actions as needed or desired. In another form, control action data can be stored within a memory and deployed based on a schedule. As such, a period of time (e.g. twelve hours, twenty four hours, etc.) can be stored and deployed in the event of a information network failure at a site.

[00283] Upon detecting control action data, the method can proceed to block 1654 and can process control action data. For example, if control action data should be stored, the method can store control action data and deploy at a later time. In another form, control action data can be processed into a format that can be used to output network device data. For example, control action data can be processed into one or more JAVA objects, XML files, or other formats to include a received control action data of a specific device. According to an aspect, a network device can include a specific profile to access features of a network device. As such, control action data can be processed based on a specific profile.

[00284] Upon processing control action data, the method can proceed to block 1656 and the processed control action data can be generated into network device data. For example, a network may be deployed to provide an energy network at a site. As such, a protocol to communicate device data as network device data can be deployed. In other forms, a communication device can be coupled to a USB port, UART port, SPI port, other

Ex. 1004.0537

buses, or combinations thereof. As such, control action data can be formatted into a format that can be communicated using a specific bus having a wireless network device or module coupled to a bus. For example, for example. At block 1656 network device data can be formatted to be communicated using a USB bus having Zigbee communication module coupled to the USB bus. In other forms, a network device, such as a wireless WIFI device can be coupled to a UART bus and accessed to output control action data. Upon generating network device data, the method can proceed to block 1658 and the network device data can be output to a communication module that can output the control action data to the network device. The method can then proceed to block 1660, and to block 1602 as needed or desired.

[00285] According to another aspect, the present disclosure and include an installation system and method configured to install a system at a site. For example, FIG. 6 described herein includes controller 626 and thermostat 628 installed at a site 604. Installation can include controller 626 including a serial number (not expressly illustrated in FIG. 6), or other unique identifier. Thermostat 628 can also include a serial number (not expressly illustrated in FIG. 6) or other unique identifier. Upon a user or agent installing controller 626, an identifier of controller 626, thermostat 628, or any combination thereof, can be communicated to server 602 to authenticate site 604 and enable energy management at site 604.

[00286] According to another aspect, an installation can include controller 626 requesting a list of valid identifiers of one or more network devices that can be installed at site 604. For example, controller 626 can receive a list of one or more valid network devices that may be installed at site 604, and can validate one or more installed devices. For example, controller 626 can detect a network device accessible using an energy network deployed at site 604. A network device can communicate an identifier and controller 626 can detect whether the communicated identifier may be within the list communicated by server 602. As such, an agent that may have an inventory of network

Ex. 1004.0538

devices, controllers, or any combination thereof can install a controller and a network device without having to determine a valid serial number.

[00287] According to a further aspect, an installation can include using a mobile device including installation logic, one or more applications, settings, or any combination thereof. For example, mobile device 632 illustrated in FIG. 6 or other mobile devices or systems can be used to install portions or all of an energy management system at site 604. For example, a user can deploy an energy management application on mobile device 632 and can input a serial number or other identifier to into an energy management application. In this manner, a user may modify network devices installed at site 604 by for example, adding new devices, updating new devices, deleting current devices, receiving software updates using a serial number of an installed device, or various combinations thereof. According to a further aspect, an installation, settings, and the like can include prompting a user to use a GPS location in connection with an installation and site 604. As such, a user need not type in an address and can just select a current location to associate mobile device 632 and site 604.

[00288] According to another aspect, an installation can include using RFID, bar code, network scan, or various other hands-free identification processes. For example, mobile device 632 can include an energy management application that can include an installation or set-up that includes reading a bar code label of controller 626, TSTAT 628, various other network devices, or any combination thereof. For example, a user can scan a barcode that can include a unique identifier of controller 626, TSTAT 628, or any combinations thereof. According to an aspect, a bar code label can be affixed to a portion of a housing (not expressly illustrated in FIG. 6). In other forms, a bar code can be accessed using a display, such as a display of TSAT 626 or other network devices or systems that can display one or more bar codes (e.g. outputting multiple at a single system, network device, installation sheet or stickers, etc.). Upon a user scanning a bar code label, the installation process can use a network connection, such as WIFI or other wireless data

Ex. 1004.0539

networks to communicate unique data and authenticate a system. An server, such as server 602 can authenticate the data and activate a user's account. According to an aspect, a user can also set a location using a current GPS location of mobile device 632 at site 604. In this manner, and installation process that can include authenticating or activating software on a mobile device, a home controller, a network device, and a server account can be coordinated in an efficient manner thereby reducing the need to have an installation technician or other third party activate an account. Various combinations of associating devices, systems, controllers, mobile devices, etc. can be used to activate portions or all of an energy network using hands-free RF, optical scanning devices, or any combination thereof. According to a further aspect, an installation can be modified to allow a third party technician install a system and can include scanning one or more bar codes that may be affixed to a network device, controller, etc. In other forms, a third party technician can scan bar code labels or other devices and affix the labels to a device, controller, system, etc. in association with an installation. As such, inventory management can also be maintained in association with installing a controller, network device, system, etc.

[00289] Note that not all of the activities described above in the general description or the examples are required, that a portion of a specific activity may not be required, and that one or more further activities may be performed in addition to those described. Still further, the order in which activities are listed are not necessarily the order in which they are performed.

[00290] The specification and illustrations of the embodiments described herein are intended to provide a general understanding of the structure of the various embodiments. The specification and illustrations are not intended to serve as an exhaustive and comprehensive description of all of the elements and features of apparatus and systems that use the structures or methods described herein. Many other embodiments may be apparent to those of skill in the art upon reviewing the disclosure. Other embodiments may be used and derived from the disclosure, such that a structural substitution, logical

Ex. 1004.0540

substitution, or another change may be made without departing from the scope of the disclosure. Accordingly, the disclosure is to be regarded as illustrative rather than restrictive.

[00291] Certain features are, for clarity, described herein in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features that are, for brevity, described in the context of a single embodiment, may also be provided separately or in any sub combination. Further, reference to values stated in ranges includes each and every value within that range.

[00292] Benefits, other advantages, and solutions to problems have been described above with regard to specific embodiments. However, the benefits, advantages, solutions to problems, and any feature(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential feature of any or all the claims.

[00293] The above-disclosed subject matter is to be considered illustrative, and not restrictive, and the appended claims are intended to cover any and all such modifications, enhancements, and other embodiments that fall within the scope of the present invention. Thus, to the maximum extent allowed by law, the scope of the present invention is to be determined by the broadest permissible interpretation of the following claims and their equivalents, and shall not be restricted or limited by the foregoing detailed description.

[00294] Although only a few exemplary embodiments have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of the embodiments of the present disclosure. Accordingly, all such modifications are intended to be included within the scope of the embodiments of the present disclosure as defined in the following claims. In the claims, means-plus-function

clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents, but also equivalent structures.

Ex. 1004.0542

WHAT IS CLAIMED IS:

1. An energy management system comprising:

a database configured to store site report data received from a plurality of residential sites using a wireless home energy network at each site, wherein each residential site includes a thermostat accessible to the wireless home energy network;

a processor operably coupled to the database and configured to access the site report data and:

detect a current temperature set-point of the thermostat at a first residential site;

detect a first seasonal profile of the thermostat;

detect a current operating mode of a HVAC system operably coupled to the thermostat; and

determine a thermostat schedule of the thermostat using the first seasonal profile and the current operating mode of the HVAC system.

2. The energy management system of claim 1, wherein:

the processor is further configured to detect a second seasonal profile of the thermostat;

the first seasonal profile includes at least a minimum seasonal setting;

the second seasonal profile includes at least a maximum seasonal setting;

the processor is further configured to initiate generation of a control action report to communicate to the first residential site, wherein the control action report is generated using one or more of:

an updated temperature set-point having a value between the current temperature set-point and the minimum seasonal set-point in response to the current operating mode of the HVAC being in a heating mode;

Ex. 1004.0543

an updated temperature set-point having a value between the current temperature set-point and the maximum seasonal set-point in response to the current operating mode of the HVAC being in a cooling mode;

an efficiency rating of the first residential site;

an estimated time period to generate an updated temperature reading an updated temperature set-point;

a current energy price; and

a future energy price.

3. The energy management system of claim 1, wherein the processor is further configured to:

detect a distance between a location reporting device and the first residential site;

detect a current zone from a plurality of zones operably associated with the first residential site using the distance; and

initiate generation of a control action report to be communicated to the first residential site using the current zone.

4. The energy management system of claim 3, further comprising the processor configured to:

detect an efficiency rating of the first residential site;

detect an external temperature at the first residential site;

determine a real-time travel time between the location reporting device and the residential site; and

modify a distance range of the plurality of zones using one or more of:

the efficiency rating;

the external temperature; and

the real-time travel time.

5. The energy management system of claim 3, wherein the processor is further configured to:

detect the location reporting device moving away from the first residential site;

detect a percentage change value associated with the current zone;

detect a base set-point of the wireless thermostat of the first residential site;

determine a difference between the base set-point and a minimum seasonal set-point in response to the current operating mode of the HVAC being in a heating mode;

determine a difference between the base set-point and a maximum seasonal set-point in response to the current operating mode of the HVAC being in a cooling mode;

determine an updated thermostat set-point as a percent change based on the determined difference and the current operating mode of the HVAC; and

output the updated thermostat set-point to be used within the control action report.

6. The energy management system of claim 3, wherein the processor is further configured to:

detect the location reporting device moving toward the first residential site;

detect the current zone and a percentage change value associated with the current zone;

determine a difference between the base set-point and a minimum seasonal set-point in response to the current operating mode of the HVAC being in a heating mode;

determine a difference between the base set-point and a maximum seasonal set-point in response to the current operating mode of the HVAC being in a cooling mode; and

determine an updated thermostat set-point as a percent change based on the difference and the current operating mode of the HVAC; and

Ex. 1004.0545

output the updated thermostat set-point to be used within the control action report.

7. The energy management system of claim 1, wherein the processor is further configured to:

identify a group of residential sites within a specified region;

access thermostat schedules of each of the residential sites within the group;

aggregate scheduling data using the thermostat schedules; and

initiate an outputting of the aggregated scheduling data.

8. The energy management system of claim 1, further comprising a web services enabled scheduling tool configured to provide a user access to schedule energy use at a first residential site using a web based graphical user interface, wherein the scheduling tool includes:

a thermostat selector configurable to enable selection of one or more wireless thermostats located at the first residential site;

an event scheduler operably associated with the thermostat selector and configurable to enable the user to graphically select a utilization schedule of the one or more wireless thermostats;

wherein the utilization schedule includes a time of day and temperature setting capabilities to control the one or more wireless thermostats; and

an energy savings preference selector configured to graphically modify the utilization schedule and display a resulting energy savings.

9. The energy management system of claim 8, wherein the processor is further configured to:

detect a user interaction with the wireless thermostat;

suggest a modification of the utilization schedule to the user during a user access to the scheduling tool; and

modify the utilization schedule to include the suggestion in response to the user validating the modification.

10. The energy management system of claim 8, wherein the scheduling tool further comprises:

a proximity control selector configured to enable and disable proximity control of the first residential site;

a demand response selector configured to enable and disable participation in demand response event; and

an auto update selector configured to enable an automatic update of the utilization schedule in response to a detection of a user interaction with the one or more wireless thermostats.

11. The energy management system of claim 8, further comprising a demand response selector operable to be displayed with the scheduling tool, wherein the demand response selector includes:

an always participate selection configured to always enable a curtailment of the HVAC system at the first residential site in response to a demand response event;

a never participate selection configured to not allow a curtailment of the HVAC system at the first residential site in response to a demand response event; and

a request participation selection configured to initiate a communication to the user to request participation in a demand response event.

12. The energy management system of claim 8, further comprising:

a plurality of energy templates accessible using the scheduling tool, wherein each template includes a predetermined utilization schedule selectable by the user based on a user's scheduling profile;

wherein the predetermined utilization schedule is modifiable by the user with the scheduling tool; and

an energy personality detection module configured to:

detect an interaction of the user with the wireless thermostat;

display of an energy personality indicia in response to the interaction; and

enable the user to display the energy personality indicia within a social network.

13. The energy management system of claim 1, further comprising the processor configured to:

determine a random sample size of residential sites in connection with estimating an energy consumption of a specific region;

accessing a plurality of thermostat schedules within the specified region based on the random sample size; and

output thermostat scheduling data of the plurality of thermostat schedules in connection with forecasting production.

14. The energy management system of claim 1, further comprising the processor configured to:

detect an enabled demand response setting of the first residential site;

detect a demand response event condition; and

enable a curtailment action of a corresponding HVAC system at the first residential site.

15. The energy management system of claim 1, further comprising the processor configured to:

initiate a demand response event request communication to the users of the plurality of residences;

detect a user response level to participate in a demand response event; and

enable a curtailment of a corresponding HVAC system at the residential sites of the users electing to participate in the demand response event.

Ex. 1004.0548

16. The energy management system of claim 1, further comprising the processor configured to:

identify a group of residences within the plurality of residences;

determine an energy reduction capacity of each of the residences within the group using an efficiency rating of each of the residences within the group; and

estimate an aggregate energy reduction capacity based on the energy reduction capacity of each of the residences within the group.

17. The energy management system of claim 16, further comprising the processor configured to:

initiate an auction process to sell the aggregate energy reduction capacity to a third party;

detect a sale of the aggregate energy reduction capacity in connection with the auction process; and

initiate a curtailment of the HVAC system at each of the residences within the group.

18. The energy management system of claim 1, further comprising a mobile client module configured to be operably coupled to a mobile device associated with the first residential site, wherein the mobile client module is configured to:

receive a site readings request of the first residential site from the first mobile device;

access the database to retrieve site report data of the first residential site;

format the accessed site report data as mobile device data;

output the mobile device data to the first mobile device using a mobile device network;

receive a request from the mobile device to modify a current temperature set-point of the HVAC system at the first residential site;

Ex. 1004.0549

initiate generation of a control report including an updated temperature set-point input using the mobile device; and

output a confirmation of the updated temperature set-point.

19. The energy management system of claim 18, wherein the mobile client module is further configured to:

enable access to a proximity setting of the first residential site;

detect multiple control zones at the first residential site;

detect a corresponding wireless thermostat of each of the multiple control zones;

output mobile device data to the mobile device indicating a current reading within each zone;

wherein the current reading is acquired from the site data;

enable access to the corresponding wireless thermostat of each zone; and

enable the mobile device control of the corresponding wireless thermostat.

20. The energy management system of claim 18, further comprising the processor further configured to:

detect a manual input condition to the wireless thermostat at the first residential site;

identify a mobile device associated with the first residential site;

initiate a text message indicating the manual input condition; and

enable a user to alter the manual input condition using the mobile device.

Ex. 1004.0550

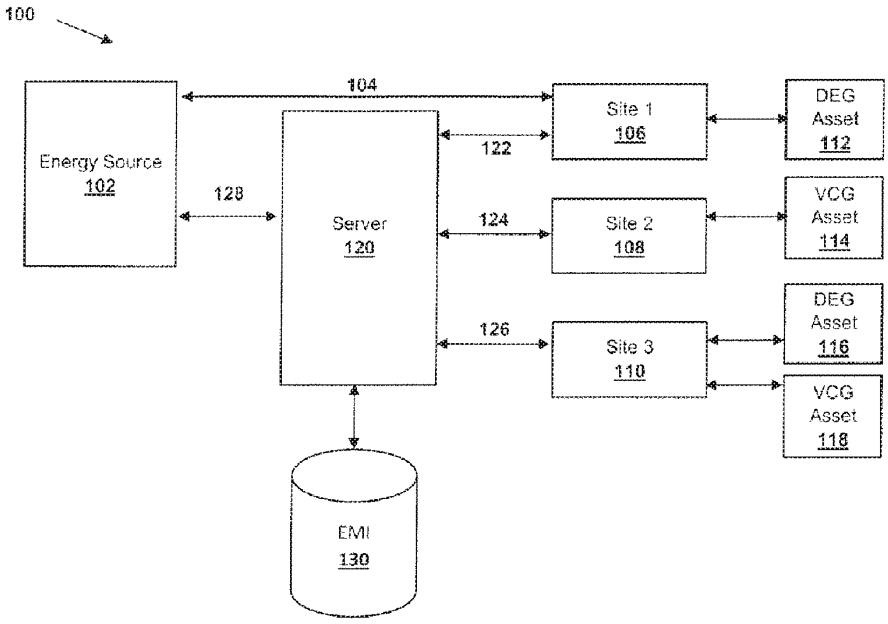

100
Energy Source
102
104
128
Server
120
122
124
126
Site 1
106
Site 2
108
Site 3
110
DEG
Asset
112
VCG
Asset
114
DEG
Asset
116
VCG
Asset
118
EMI
130

FIG. 1

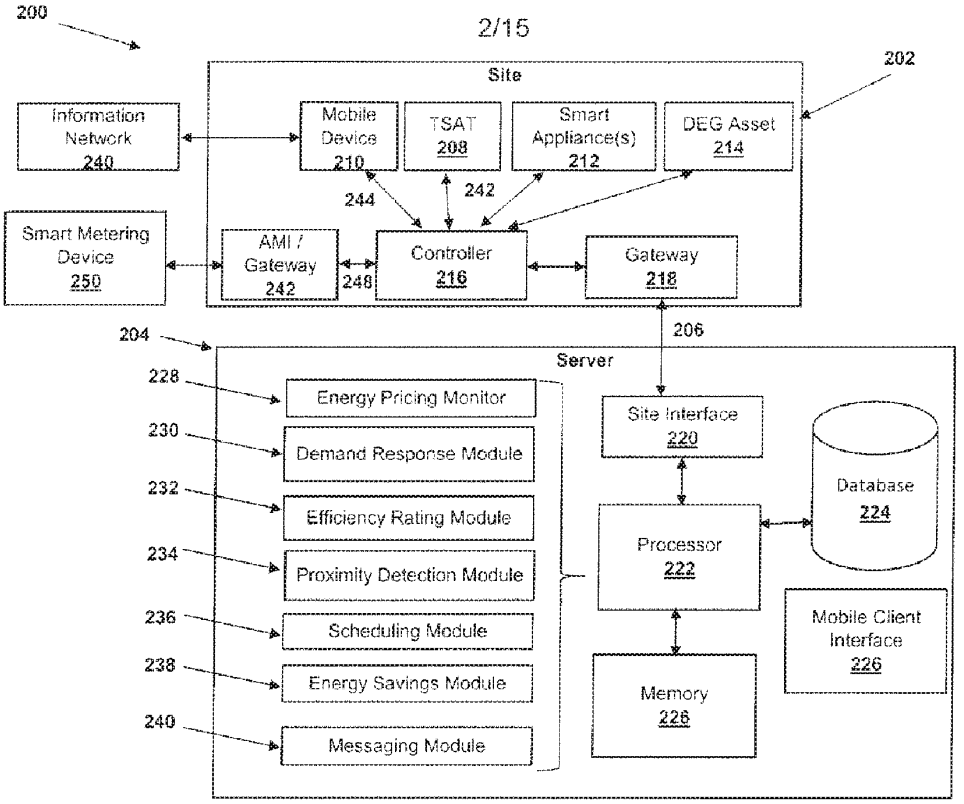
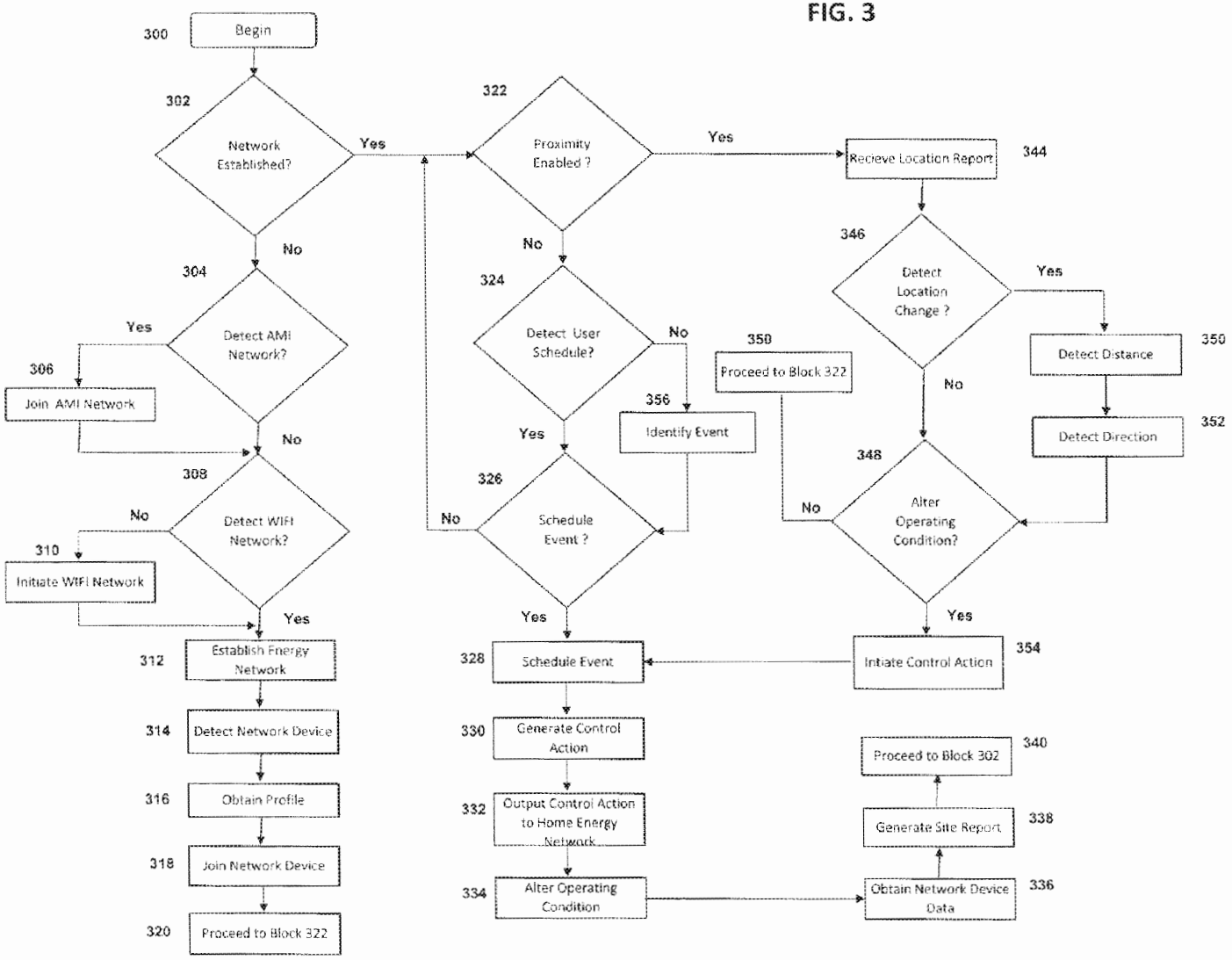

200
Site
202
Information Network 240
Mobile Device 210
TSAT 208
Smart Appliance(s) 212
DEG Asset 214
244
242
Smart Metering Device 250
AMI / Gateway 242
248
Controller 216
Gateway 218
206
204
Server
228
Energy Pricing Monitor
230
Demand Response Module
232
Efficiency Rating Module
234
Proximity Detection Module
236
Scheduling Module
238
Energy Savings Module
240
Messaging Module
Site Interface 220
Database 224
Processor 222
Mobile Client Interface 226
Memory 226

FIG. 2

FIG. 3


300
Begin
302
Network Established?
Yes
No
304
Detect AMI Network?
Yes
306
Join AMI Network
No
308
Detect WIFI Network?
No
310
Initiate WIFI Network
Yes
312
Establish Energy Network
314
Detect Network Device
316
Obtain Profile
318
Join Network Device
320
Proceed to Block 322
322
Proximity Enabled ?
Yes
No
324
Detect User Schedule?
No
356
Identify Event
Yes
326
Schedule Event ?
No
Yes
328
Schedule Event
330
Generate Control Action
332
Output Control Action to Home Energy Network
334
Alter Operating Condition
344
Recieve Location Report
346
Detect Location Change ?
Yes
350
Detect Distance
352
Detect Direction
No
348
Alter Operating Condition?
No
350
Proceed to Block 322
Yes
354
Intiate Control Action
336
Obtain Network Device Data
338
Generate Site Report
340
Proceed to Block 302

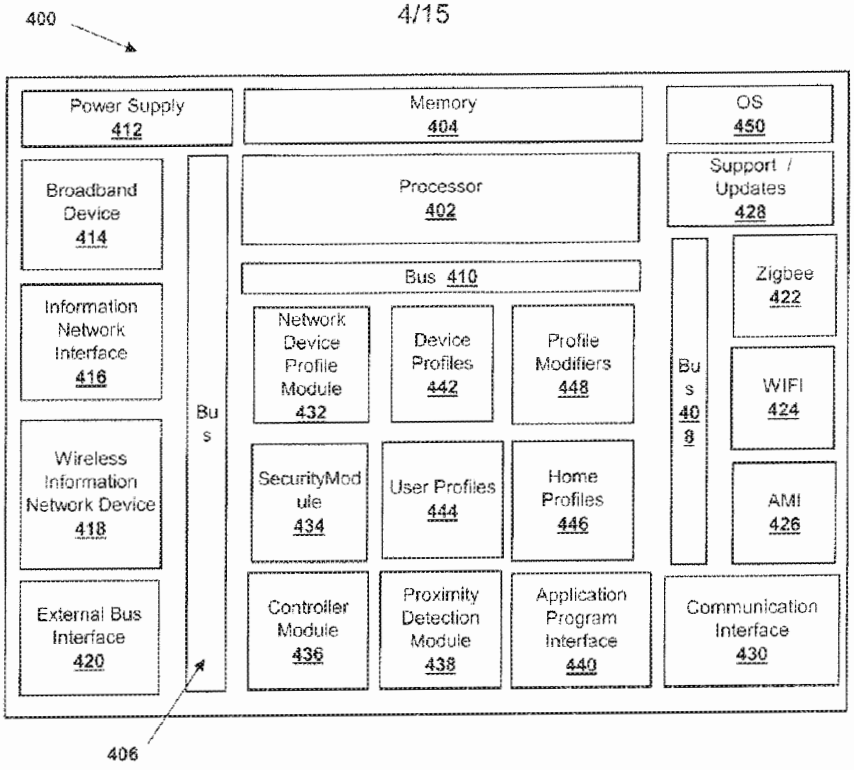

400
Power Supply 412
Memory 404
OS 450
Broadband Device 414
Processor 402
Support / Updates 428
Information Network Interface 416
Bus 410
Zigbee 422
Network Device Profile Module 432
Device Profiles 442
Profile Modifiers 448
Bus 408
WIFI 424
Wireless Information Network Device 418
Bus
SecurityModule 434
User Profiles 444
Home Profiles 446
AMI 426
External Bus Interface 420
Controller Module 436
Proximity Detection Module 438
Application Program Interface 440
Communication Interface 430
406

FIG. 4

FIG. 5A

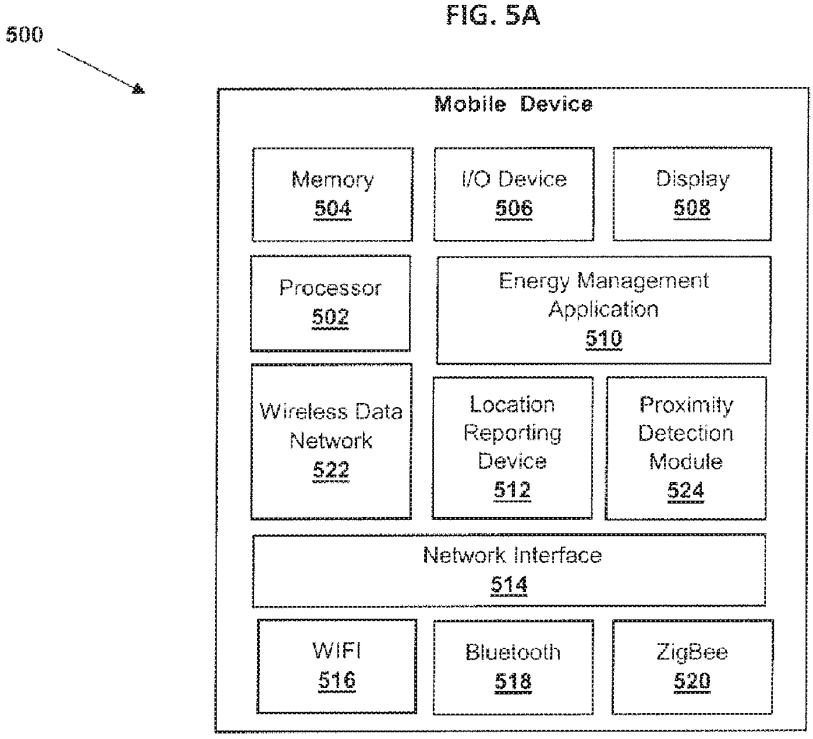

500
Mobile Device
Memory
504
I/O Device
506
Display
508
Processor
502
Energy Management
Application
510
Wireless Data
Network
522
Location
Reporting
Device
512
Proximity
Detection
Module
524
Network Interface
514
WIFI
516
Bluetooth
518
ZigBee
520

FIG. 5B

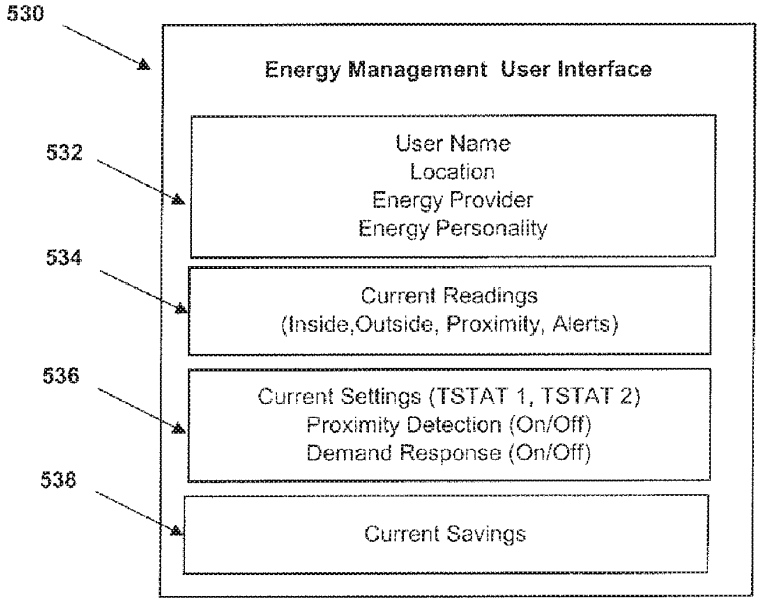
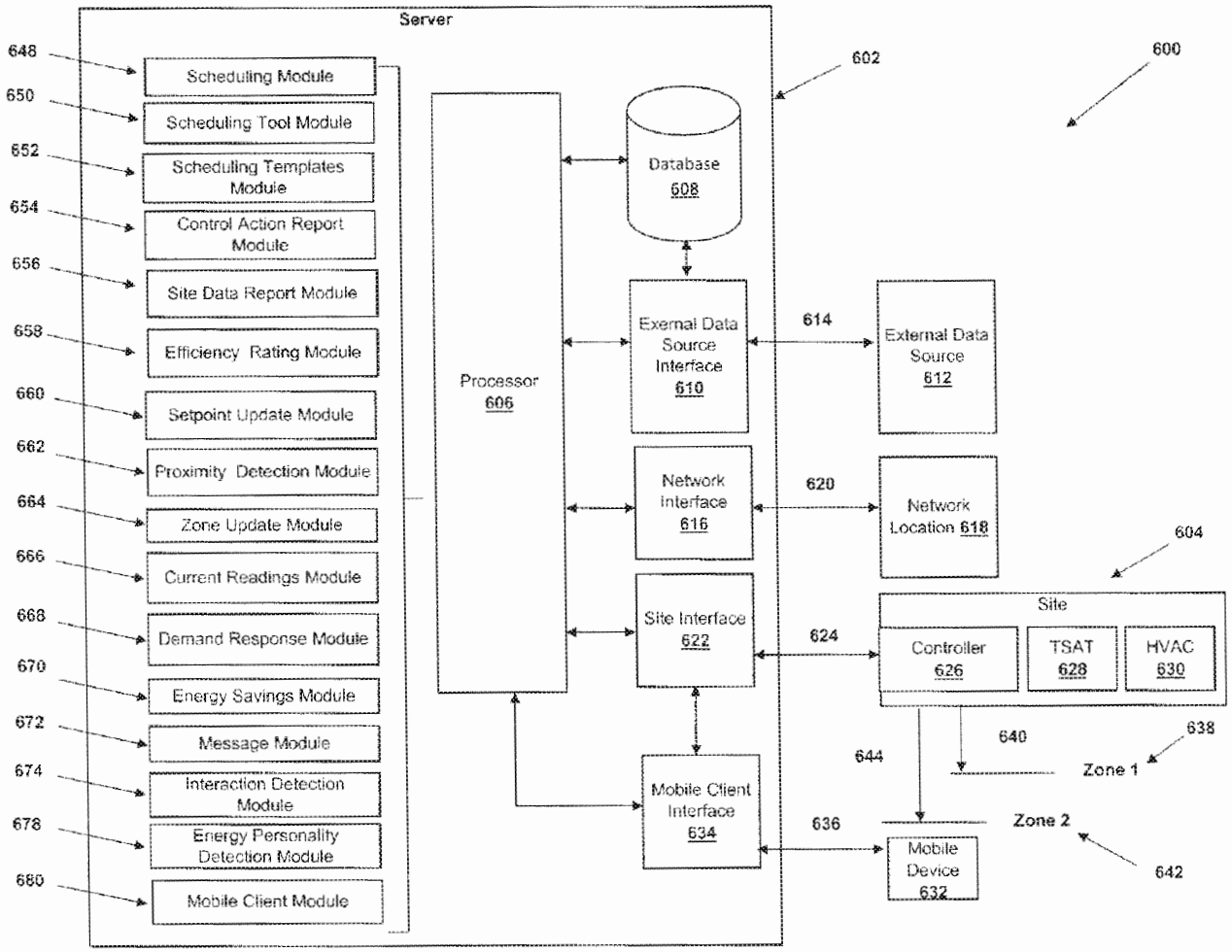

530
Energy Management User Interface
532
User Name
Location
Energy Provider
Energy Personality
534
Current Readings
(Inside,Outside, Proximity, Alerts)
536
Current Settings (TSTAT 1, TSTAT 2)
Proximity Detection (On/Off)
Demand Response (On/Off)
538
Current Savings

FIG. 6


Server
602
600
648
Scheduling Module
650
Scheduling Tool Module
652
Scheduling Templates Module
654
Control Action Report Module
656
Site Data Report Module
658
Efficiency Rating Module
660
Setpoint Update Module
662
Proximity Detection Module
664
Zone Update Module
666
Current Readings Module
668
Demand Response Module
670
Energy Savings Module
672
Message Module
674
Interaction Detection Module
678
Energy Personality Detection Module
680
Mobile Client Module
Processor 606
Database 608
External Data Source Interface 610
614
External Data Source 612
Network Interface 616
620
Network Location 618
Site Interface 622
624
604
Site
Controller 626
TSAT 628
HVAC 630
640
638
644
Zone 1
Zone 2
642
Mobile Client Interface 634
636
Mobile Device 632

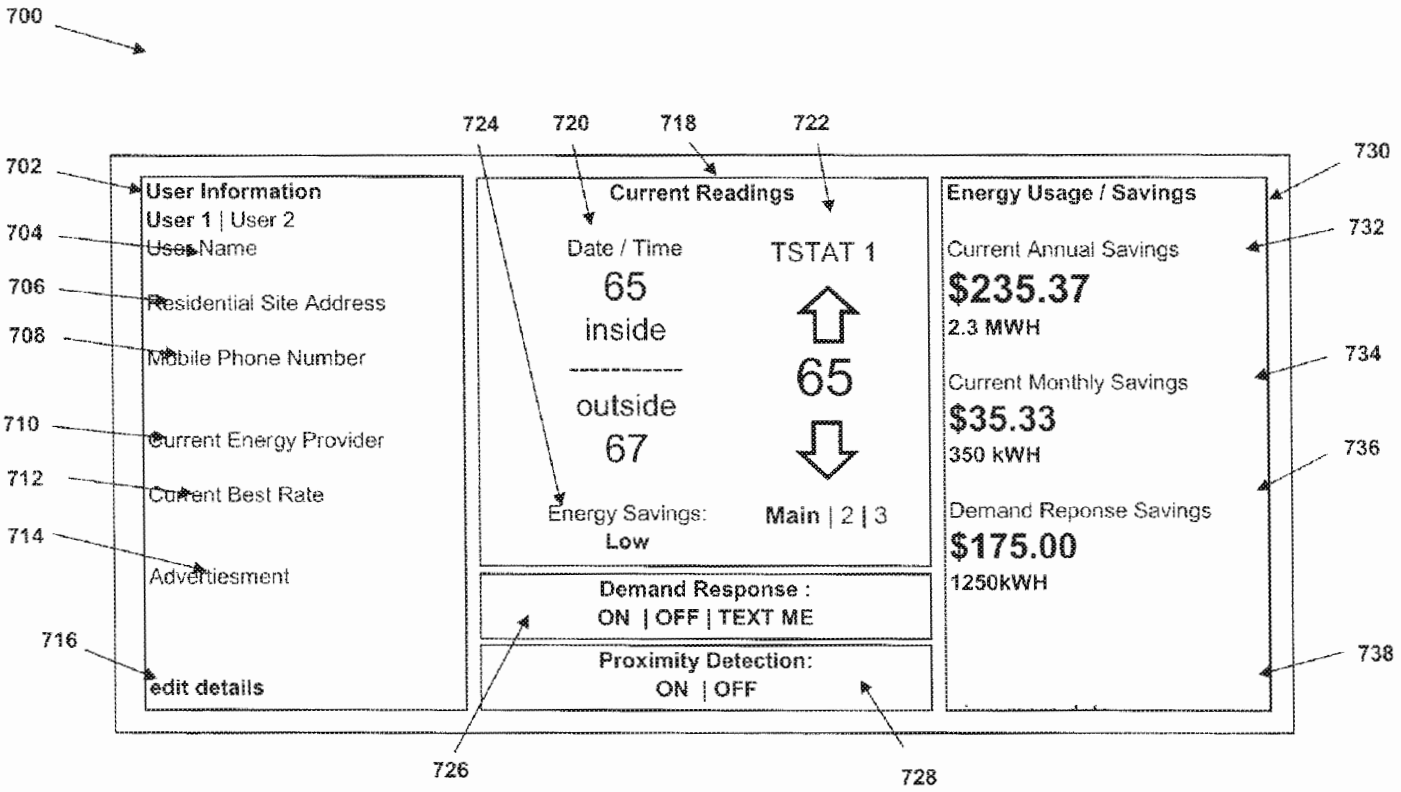

700
724
720
718
722
730
702
User Information
User 1 | User 2
704
User Name
732
Current Readings
Energy Usage / Savings
706
Residential Site Address
Date / Time
TSTAT 1
Current Annual Savings
$235.37
2.3 MWH
708
Mobile Phone Number
65
inside
65
734
Current Monthly Savings
$35.33
350 kWH
outside
67
710
Current Energy Provider
736
712
Current Best Rate
Energy Savings:
Low
Main | 2 | 3
Demand Reponse Savings
$175.00
1250kWH
714
Advertiesment
Demand Response :
ON | OFF | TEXT ME
716
Proximity Detection:
ON | OFF
738
edit details
726
728

FIG. 7

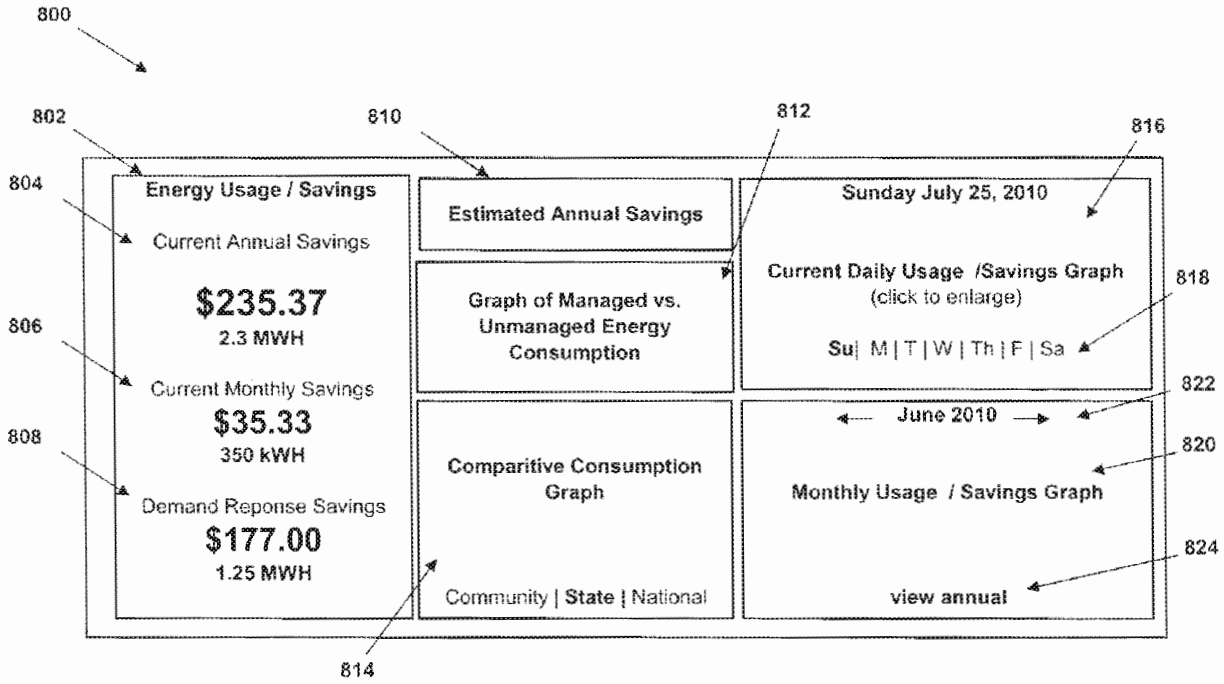

800
802
804
806
808
810
812
814
816
818
820
822
824
Energy Usage / Savings
Current Annual Savings
$235.37
2.3 MWH
Current Monthly Savings
$35.33
350 kWH
Demand Reponse Savings
$177.00
1.25 MWH
Estimated Annual Savings
Graph of Managed vs. Unmanaged Energy Consumption
Comparitive Consumption Graph
Community | State | National
Sunday July 25, 2010
Current Daily Usage /Savings Graph
(click to enlarge)
Su| M | T | W | Th | F | Sa
June 2010
Monthly Usage / Savings Graph
view annual

FIG. 8

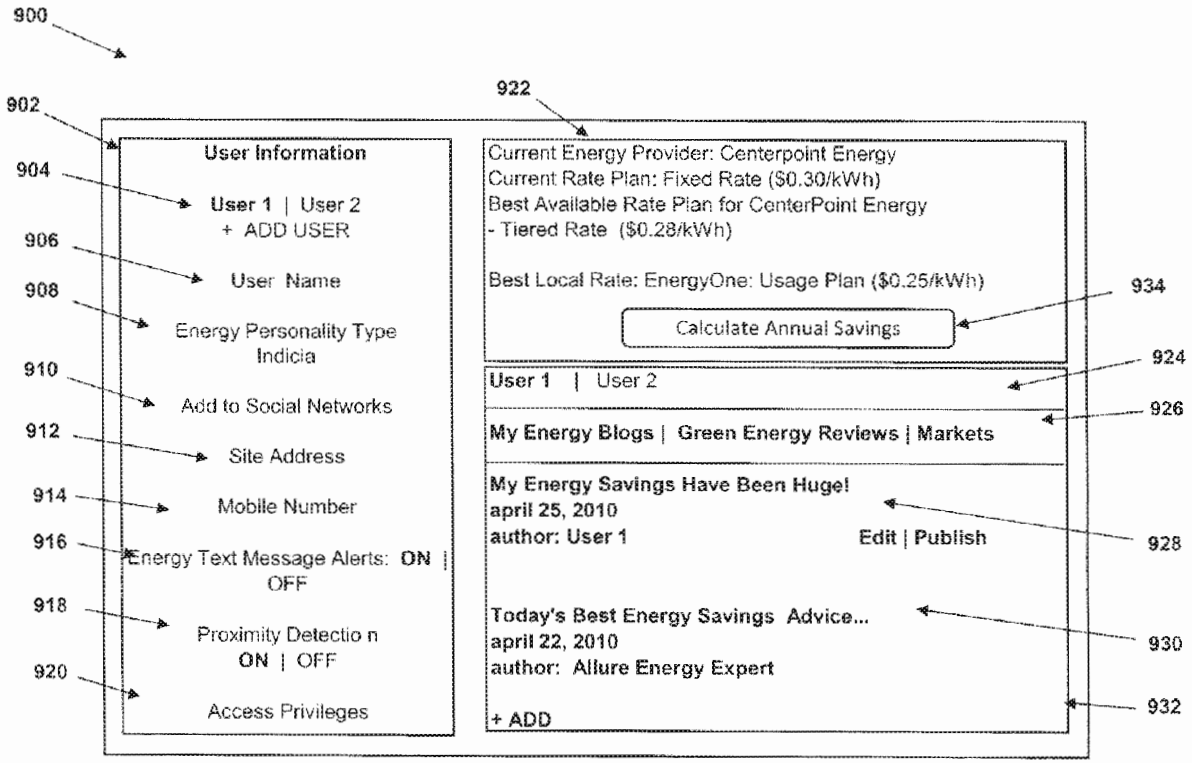

900
902
922
904
906
908
910
912
914
916
918
920
924
926
928
930
932
934
User Information
User 1 | User 2
+ ADD USER
User Name
Energy Personality Type Indicia
Add to Social Networks
Site Address
Mobile Number
Energy Text Message Alerts: ON | OFF
Proximity Detectio n
ON | OFF
Access Privileges
Current Energy Provider: Centerpoint Energy
Current Rate Plan: Fixed Rate ($0.30/kWh)
Best Available Rate Plan for CenterPoint Energy
- Tiered Rate ($0.28/kWh)
Best Local Rate: EnergyOne: Usage Plan ($0.25/kWh)
Calculate Annual Savings
User 1 | User 2
My Energy Blogs | Green Energy Reviews | Markets
My Energy Savings Have Been Huge!
april 25, 2010
author: User 1
Edit | Publish
Today's Best Energy Savings Advice...
april 22, 2010
author: Allure Energy Expert
+ ADD

FIG. 9

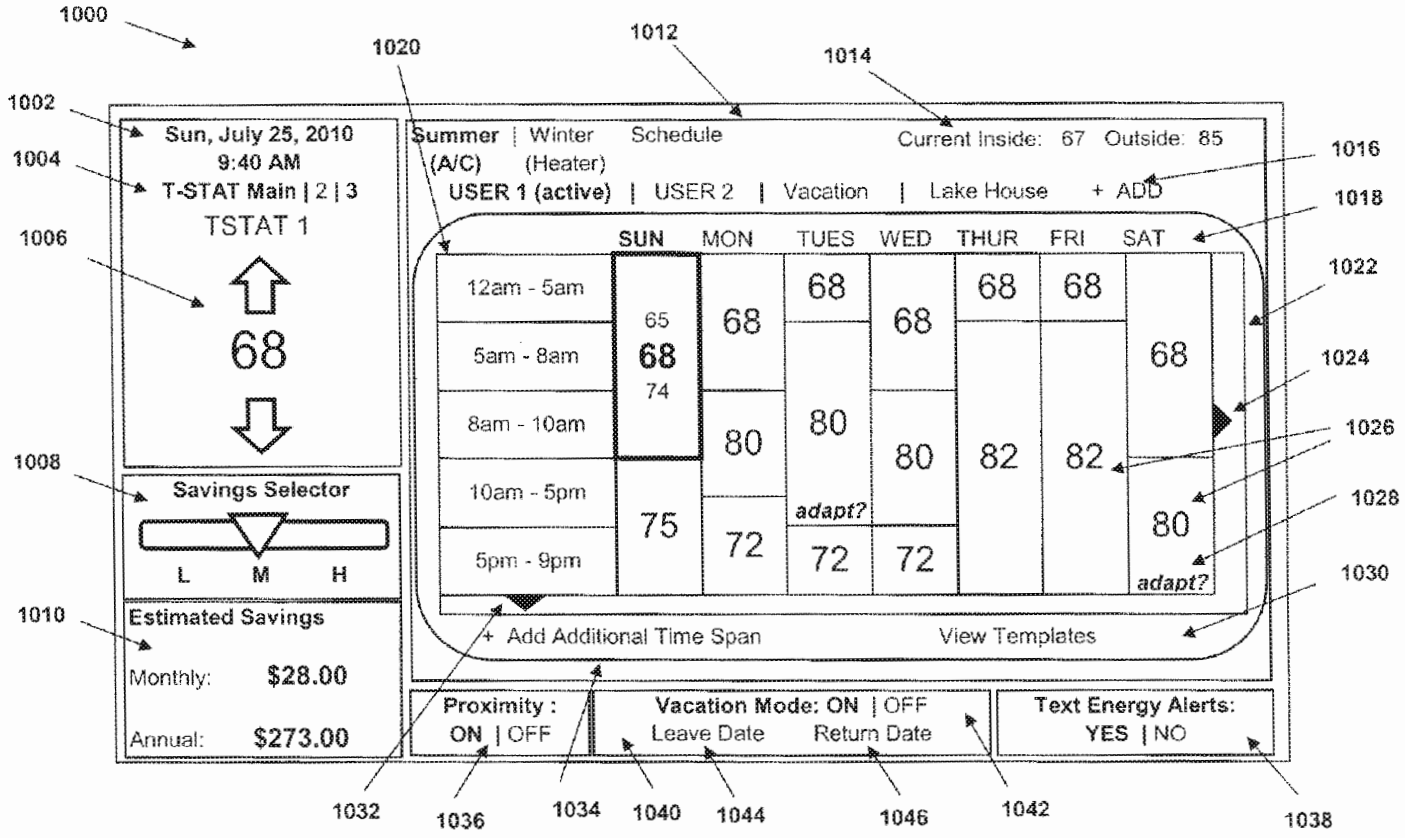

1000
1002
1004
1006
1008
1010
1012
1014
1016
1018
1020
1022
1024
1026
1028
1030
1032
1034
1036
1038
1040
1042
1044
1046
Sun, July 25, 2010
9:40 AM
T-STAT Main | 2 | 3
TSTAT 1
68
Savings Selector
L M H
Estimated Savings
Monthly: $28.00
Annual: $273.00
Summer | Winter Schedule
(A/C) (Heater)
Current Inside: 67 Outside: 85
USER 1 (active) | USER 2 | Vacation | Lake House + ADD
SUN MON TUES WED THUR FRI SAT
12am - 5am
5am - 8am
8am - 10am
10am - 5pm
5pm - 9pm
65
68
74
75
68
80
72
68
80
adapt?
72
68
68
80
72
68
68
82
82
68
80
adapt?
+ Add Additional Time Span
View Templates
Proximity :
ON | OFF
Vacation Mode: ON | OFF
Leave Date Return Date
Text Energy Alerts:
YES | NO

FIG. 10

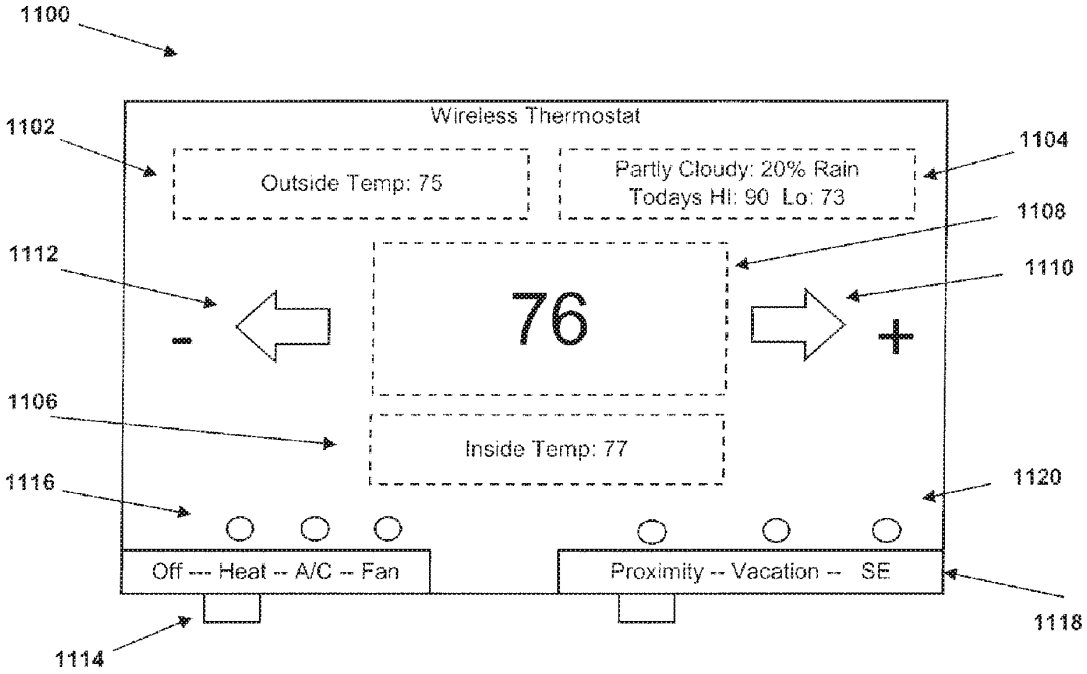

1100
Wireless Thermostat
1102
Outside Temp: 75
Partly Cloudy: 20% Rain
Todays Hi: 90 Lo: 73
1104
1108
1112
1110
76
-
+
1106
Inside Temp: 77
1116
1120
Off --- Heat -- A/C -- Fan
Proximity -- Vacation -- SE
1118
1114

FIG. 11

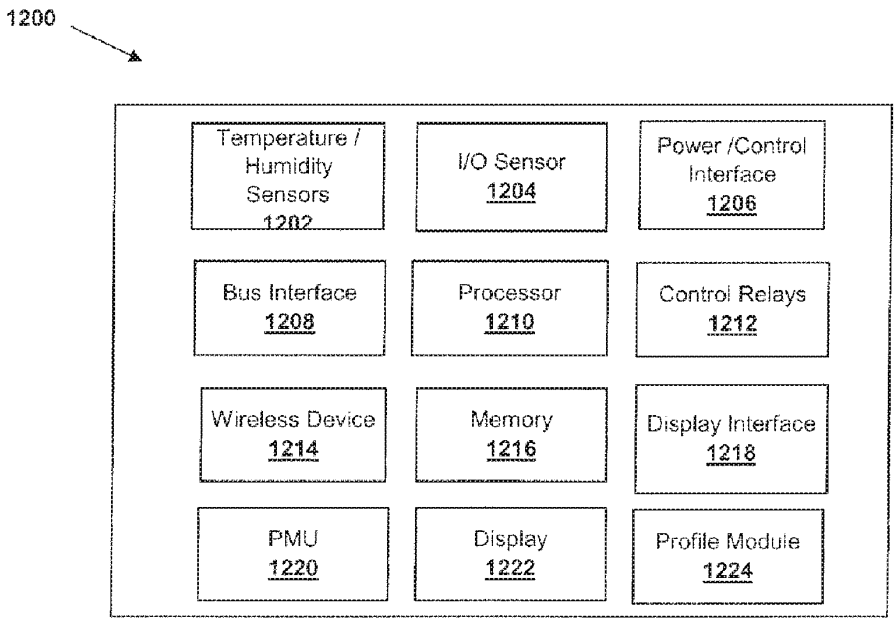

1200
Temperature / Humidity Sensors 1202
I/O Sensor 1204
Power /Control Interface 1206
Bus Interface 1208
Processor 1210
Control Relays 1212
Wireless Device 1214
Memory 1216
Display Interface 1218
PMU 1220
Display 1222
Profile Module 1224

FIG. 12

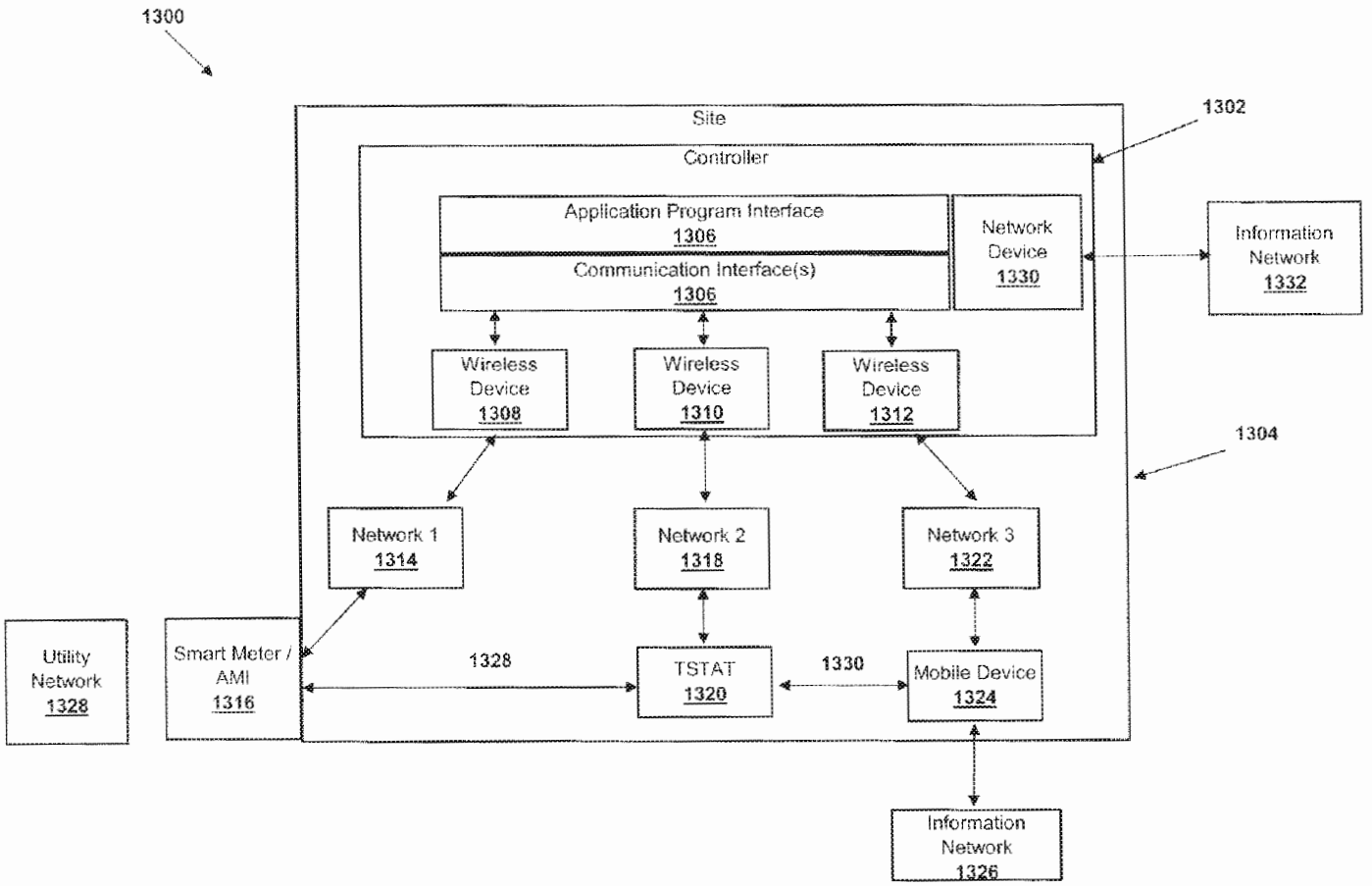

1300
Site
1302
Controller
Application Program Interface
1306
Communication Interface(s)
1306
Network Device
1330
Information Network
1332
Wireless Device
1308
Wireless Device
1310
Wireless Device
1312
1304
Network 1
1314
Network 2
1318
Network 3
1322
Utility Network
1328
Smart Meter / AMI
1316
1328
TSTAT
1320
1330
Mobile Device
1324
Information Network
1326

FIG. 13

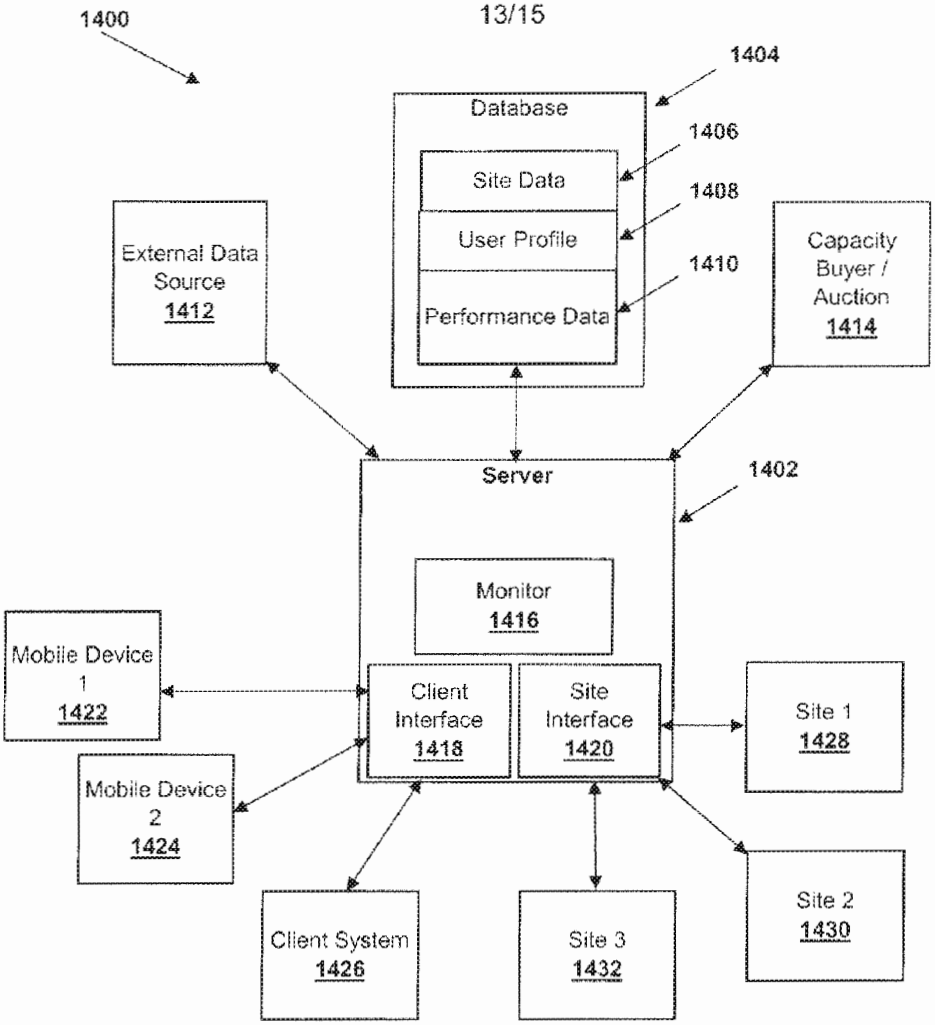

1400
1404
Database
1406
Site Data
1408
User Profile
1410
Performance Data
External Data Source 1412
Capacity Buyer / Auction 1414
Server
1402
Monitor 1416
Mobile Device 1 1422
Client Interface 1418
Site Interface 1420
Site 1 1428
Mobile Device 2 1424
Site 2 1430
Client System 1426
Site 3 1432

FIG. 14

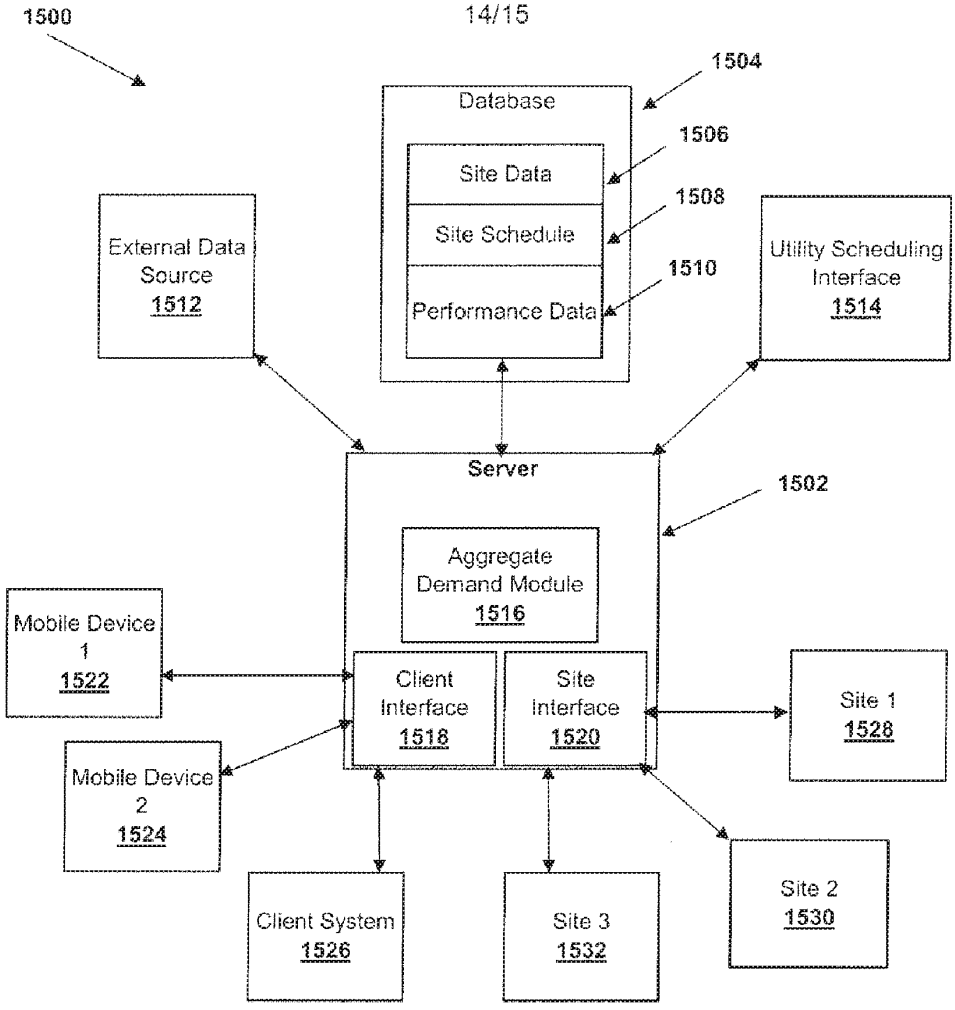

1500
1504
Database
1506
Site Data
1508
Site Schedule
1510
Performance Data
External Data Source 1512
Utility Scheduling Interface 1514
Server
1502
Aggregate Demand Module 1516
Mobile Device 1 1522
Client Interface 1518
Site Interface 1520
Site 1 1528
Mobile Device 2 1524
Client System 1526
Site 3 1532
Site 2 1530

FIG. 15

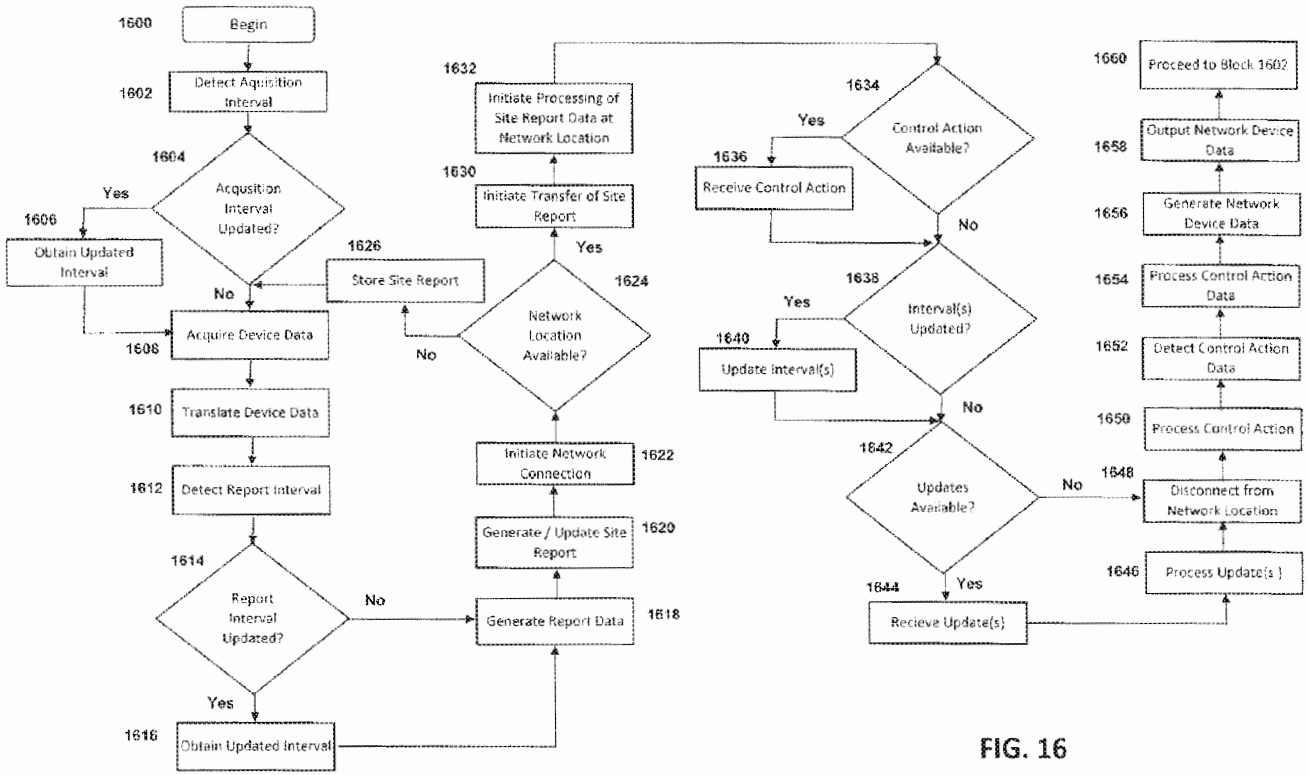

1600
Begin
1602
Detect Aquisition Interval
1604
Acqusition Interval Updated?
Yes
1606
Obtain Updated Interval
No
1608
Acquire Device Data
1610
Translate Device Data
1612
Detect Report Interval
1614
Report Interval Updated?
No
Yes
1616
Obtain Updated Interval
1618
Generate Report Data
1620
Generate / Update Site Report
1622
Initiate Network Connection
1624
Network Location Available?
No
Yes
1626
Store Site Report
1630
Initiate Transfer of Site Report
1632
Initiate Processing of Site Report Data at Network Location
1634
Control Action Available?
Yes
1636
Receive Control Action
No
1638
Interval(s) Updated?
Yes
1640
Update Interval(s)
No
1642
Updates Available?
No
1644
Yes
Recieve Update(s)
1646
Process Update(s)
1648
Disconnect from Network Location
1650
Process Control Action
1652
Detect Control Action Data
1654
Process Control Action Data
1656
Generate Network Device Data
1658
Output Network Device Data
1660
Proceed to Block 1602

FIG. 16

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2010/042589

A. CLASSIFICATION OF SUBJECT MATTER
INV. G05D23/19 H02J3/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G05D H02J H04L G05B F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2007/043477 A1 (EHLERS GREGORY A [US] ET AL) 22 February 2007 (2007-02-22) paragraphs [0002], [0057] - [0164], [0223] - [0358]; figures 1, 3, 4, 5	1,2,7-20 3-6
Y	WO 2009/034720 A1 (MITSUBISHI ELECTRIC CORP [JP]) 19 March 2009 (2009-03-19) paragraphs [0038] - [0041]; figure 7 & EP 2 189 803 A1 (MITSUBISHI ELECTRIC CORP [JP]) 26 May 2010 (2010-05-26) paragraphs [0038] - [0041]; figure 7	3-6
X Y A	US 2004/034484 A1 (SOLOMITA MICHAEL V [US] ET AL) 19 February 2004 (2004-02-19) paragraphs [0037] - [0049], [0055], [0056], [0063]; figures 1,2,6,11	1 3-6 2,7-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 November 2010	22/11/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax. (+31-70) 340-3016	Vañó Gea, Joaquín

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/042589

Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)

A home energy management system includes a database configured to store site report data received from a plurality of residential sites using a wireless home energy network at each site. Each residential site includes a thermostat accessible to the wireless home energy network. A processor is operably coupled to the database and configured to access the site report data and detect a current temperature set-point of the thermostat at a first residential site; detect a first seasonal profile of the thermostat; detect a current operating mode of a HVAC system operably coupled to the thermostat; and determine a thermostat schedule of the thermostat using the first seasonal profile and the current operating mode of the HVAC system.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2010/042589

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007043477 A1	22-02-2007	NONE	
WO 2009034720 A1	19-03-2009	CN 101802642 A	11-08-2010
		EP 2189803 A1	26-05-2010
		US 2010225540 A1	09-09-2010
US 2004034484 A1	19-02-2004	NONE	

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Unknown
Filing Date	Herewith
First Named Inventor	John Douglas Steinberg
Title	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Art Unit	Unknown
Examiner Name	Unknown
Attorney Docket Number	EFACT.012C5

SIGNATURE of Applicant or Patent Practitioner

Signature	/John R. King/	Date (Optional)	
Name	John R. King	Registration Number	34,362
Title (if Applicant is a juristic entity)	Attorney of record		
Applicant Name (if Applicant is a juristic entity)	EcoFactor, Inc.		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 3 minutes 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. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 20995

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

EcoFactor, Inc.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	11/7/13
Name	John Douglas Steinberg		
Title	EVP of Business Development		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 3 minutes 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. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

INFORMATION DISCLOSURE STATEMENT

First Inventor	:	John Douglas Steinberg
App. No.	:	Unknown
Filed	:	Herewith
For	:	SYSTEM AND METHOD FOR USING A MOBILE ELECTRONIC DEVICE TO OPTIMIZE AN ENERGY MANAGEMENT SYSTEM
Examiner	:	Unknown
Art Unit	:	Unknown
Conf. No.	:	Unknown

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Pursuant to 37 CFR 1.56, an Information Disclosure Statement listing references is provided herewith. References numbered 1-297, 301-307, 311-313, 315-344, 346, and 348-352 are of record in U.S. Patent Application No. 15/616,719 , filed June 7, 2017, which is relied upon for an earlier filing date under 35 USC 120. Accordingly, copies of references numbered 1-297, 301-307, 311-313, 315-344, 346, and 348-352 are not submitted pursuant to 37 CFR 1.98(d).

No Disclaimers

To the extent that anything in the Information Disclosure Statement or the listed references could be construed as a disclaimer of any subject matter supported by the present application, Applicant hereby rescinds and retracts such disclaimer.

Application No.: Unknown
Filing Date: Herewith

Timing of Disclosure

This Information Disclosure Statement is being filed within three months of the filing date, and no fee is believed to be required.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: April 3, 2019

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