

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ADEMCO INC.,

Petitioner,

v.

ECOFACITOR, INC.,

Patent Owner.

Case: IPR2023-00409

U.S. Patent No. 10,584,890

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §311-319 AND 37 C.F.R. §42**

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TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	REQUIREMENTS (37 C.F.R. §42.103 AND 104).....	2
III.	PROSECUTION HISTORY	2
IV.	CLAIM CONSTRUCTION.....	3
V.	THE CLAIMS ARE UNPATENTABLE	3
A.	Priority Date	3
B.	Prior Art.....	4
1.	Leen	4
2.	Trundle.....	4
3.	Imes.....	4
4.	Young.....	7
5.	Wedekind.....	7
6.	Ehlers	7
VI.	LEVEL OF ORDINARY SKILL IN THE ART	8
VII.	GROUND OF INVALIDITY	8
A.	Ground 1A: Leen, Trundle, and Ehlers	8
1.	Motivation to Combine.....	8
2.	Claim 1: [1Pre] A thermostat system comprising:	14
3.	Claim 2: The thermostat system of claim 1, wherein the one or more processors is further configured to determine whether the building is occupied or unoccupied.	37
4.	Claim 3: The thermostat system of claim 2, further comprising an interface configured to allow the user to input that the building is currently unoccupied.	39

5.	Claim 4: The thermostat system of claim 3, wherein the determination of whether the building is occupied or unoccupied by the one or more processors is based at least on a fourth data parameter received from a motion sensor.	41
6.	Claim 5: 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.	41
7.	Claim 6: The thermostat system of claim 5, wherein the third data parameter from the first sensor comprises a measurement of the humidity of the building.	42
8.	Claim 7: The thermostat system of claim 5, wherein the third data parameter from the first sensor comprises a measurement of sunlight.	42
9.	Claim 8: The thermostat system of claim 7, wherein the second data parameter from the network connected to the thermostat further comprises a measurement of the outdoor humidity....	43
B.	Ground 1B: Trundle, Leen, Wedekind, and/or Ehlers	43
1.	Motivation to Combine.....	43
2.	Claim 9: The thermostat system of claim 1, further comprising a memory configured to store historical values of the first data parameter and second data parameter.....	46
3.	Claim 10: 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, 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.....	47
4.	Claim 11: The thermostat system of claim 10, 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 determining a rate of change value necessary for the building to reach the first temperature value by the first time value.....	49
5.	Claim 12: The thermostat system of claim 11, wherein the automatic adjustment of the temperature setpoint is based at least in part on the rate of change value.	51
6.	Claim 13: The thermostat system of claim 10, 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.	52
7.	Claim 14: The thermostat system of claim 10, further comprising a memory configured to store historical values of the first data parameter and second data parameter; 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.	53
8.	Claim 15: The thermostat system of claim 14 wherein the one or more processors determines one or more intermediate temperature setpoints that have a temperature value between a current temperature of the building and the first temperature setpoint.....	55
9.	Claim 16: The thermostat system of claim 14, 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.	56
10.	Claim 17: 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.....	56
C.	Ground 2A: Imes, Young, and Ehlers	57
1.	Motivation to Combine.....	57
2.	Claim 1: [1Pre]	60
3.	Claim 2.....	71
4.	Claim 3.....	72
5.	Claim 4.....	72
6.	Claim 5.....	72
7.	Claim 6.....	72
8.	Claim 7.....	73
9.	Claim 8.....	73
D.	Ground 2B: Imes, Wedekind, Young, and Ehlers	73
1.	Motivation to Combine.....	73
2.	Claim 9.....	76
3.	Claim 10.....	76
4.	Claim 11.....	76
5.	Claim 12.....	76
6.	Claim 13.....	76
7.	Claim 14.....	76
8.	Claim 15.....	77
9.	Claim 16.....	77
10.	Claim 17.....	77

VIII. DISCRETIONARY ISSUES	78
A. The Petition Does Not Present the Same References.....	78
B. The Board Should Not Deny Institution Under <i>Fintiv</i>	80
C. The Board Should Not Deny Institution Under <i>General Plastic</i>	81
IX. MANDATORY NOTICES UNDER 37 C.F.R. §42.8.....	83
A. Real Party in Interest (37 C.F.R. §42.8(b)(1))	83
B. Related Matters (37 C.F.R. §42.8(b)(2))	83
C. Designation of Counsel (37 C.F.R. §42.8(b)(3))	83
D. Service Information (37 C.F.R. §42.8(b)(4))	84

TABLE OF AUTHORITIES

Page(s)

Cases

<i>Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.</i> , 800 F.3d 1375 (Fed. Cir. 2015)	5
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Statutes

35 U.S.C. §102	4, 5, 7
35 U.S.C. §103	2
35 U.S.C. §112(a)	2, 3
35 U.S.C. §119(e)	4
35 U.S.C. §282(b)	3

Other Authorities

37 C.F.R. §42.100(b)	3
37 C.F.R. §42.103	2
37 C.F.R. §42.104	2

TABLE OF EXHIBITS

Exhibit	Short Name	Description
EX. 1001	“’890 Patent”	U.S. Patent No. 10,584,890
EX. 1002	“Koch Decl.”	Declaration of Edward Koch
EX. 1003		C.V. of Edward Koch
EX. 1004	“’246 Application”	File History of U.S. Patent Application No. 16/374,246
EX. 1005	“’719 Application”	File History of U.S. Patent Application No. 15/616,719
EX. 1006	“’554 Application”	File History of U.S. Patent Application No. 14/491,554
EX. 1007	“2012 ’246 Application”	File History of U.S. Patent Application No. 12/788,246
EX. 1008	“Leen”	U.S. Patent Publication No. 2009/0140056
EX. 1009	“Trundle”	U.S. Patent Publication No. 2010/0289643
EX. 1010	“Ehlers”	U.S. Patent No. 6,216,956
EX. 1011	“Wedekind”	U.S. Patent No. 5,197,666
EX. 1012		’890 Patent Infringement Contentions, <i>EcoFactor, Inc. v. Resideo Techs., Inc.</i> , Civ. No. 6:22-cv-00069 (W.D. Tex.)
EX. 1013	“Rosenblatt”	U.S. Patent Publication No. 2010/0081375
EX. 1014	“Imes”	U.S. Patent No. 8,457,797
EX. 1015	“Imes Prov.”	Provisional Application No. 61/255,678
EX. 1016	“Young”	U.S. Patent No. 6,196,468
EX. 1017	“Gupta”	Gupta, M., Intille S., Larson, K., Adding GPS-Control to Traditional Thermostats: An Exploration of Potential Energy Savings and Design Challenges, International Conference on Pervasive Computing (2009)
EX. 1018	“Shah”	Shah, N., Tsai, C., Chao, K., Monitoring Appliances Sensor Data in Home Environment: Issues and Challenges,

Exhibit	Short Name	Description
		IEEE Conference on Commerce and Enterprise Computing (2009)
EX. 1019	“Leslie”	Leslie, P., et al., The Application of Smartphone Technology to Economic and Environmental Analysis of Building Energy Conservation Strategies, Intl J of Sustainable Energy (2011)
EX. 1020		Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation, Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office, Katherine Vidal (issued June 21, 2022).
EX. 1021		Claim Construction Order, Civ. No. 6:22-cv-00069-ADA, Dkt. 43 (W.D. Tex. Oct. 11, 2022)
EX. 1022		Reserved
EX. 1023		Reserved
EX. 1024		Reserved
EX. 1025		<i>EcoFactor, Inc. v. Resideo Techs., Inc.</i> , Civ. No. 6:22-cv-00069-ADA, Dkt. 29 (W.D. Tex. Aug. 1, 2022)

Ademco, Inc. (“Petitioner” or “Ademco”) petitions for *Inter Partes* Review (“IPR”) of Claims 1-17 (“the challenged claims”) of U.S. Patent No. 10,584,890 (the “’890 Patent”). Petitioner requests cancellation of the challenged claims.

I. INTRODUCTION

The ’890 Patent uses geographic position data to reduce energy consumption in a thermostat-controlled heating, ventilation, and cooling (HVAC) system. EX. 1001, 1:18-20. However, the challenged claims recite conventional control features common to thermostats and already in the public domain.

The ’890 Patent confirms that conventional thermostats had long been designed “to prevent the HVAC system from constantly and rapidly cycling on and off” in order to prevent harm to the HVAC system. *Id.* at 2:5-13. The ’890 Patent further confirmed that advances in mobile devices that allowed users to control their HVAC remotely were well-known. *Id.* at 3:21-32. Newer mobile devices were also known to facilitate location-based services using, for example, GPS- or triangulation-based geolocation systems that allow for the detection of a device or user’s location. *Id.* at 3:37-50.

As such, the challenged claims, which merely describe, at best, a conventional thermostat capable of changing parameters due to the location of a mobile device, are not patentable, and each limitation of each claim is described in many prior art references directed to identical systems intended to achieve the very same goal.

II. REQUIREMENTS (37 C.F.R. §42.103 AND 104)

Petitioners authorize Account 16-0605 to be charged for any fees (37 C.F.R. §42.103). Petitioner certifies that the '890 Patent is available for review and that Petitioner is not barred or estopped (37 C.F.R. §42.104(a)). Petitioner requests cancellation of the claims on the following grounds:

1A: Claims 1-8 are unpatentable under 35 U.S.C. §103 over Leen, Trundle, and Ehlers.

1B: Claims 9-17 are unpatentable under 35 U.S.C. §103 over Leen, Trundle, Ehlers, and Wedekind.

2A: Claims 1-8 are unpatentable under 35 U.S.C. §103 over Imes, Young, and Ehlers.

2B: Claims 9-17 are unpatentable under 35 U.S.C. §103 over Imes, Young, Wedekind, and Ehlers.

(§42.104(b)(1)-(2)). Constructions are provided in Section IV. (§42.104(b)(3)). The claims are unpatentable as provided in Section V. (§42.104(b)(4)). Exhibit numbers of the evidence relied upon to support the challenge and the relevance of the evidence to the challenge raised are included. (§42.104(b)(5)).

III. PROSECUTION HISTORY

Patent Owner filed 16/374,246 (the "'246 Application"), which resulted in the '890 Patent, on April 3, 2019. EX. 1002, ¶45. Although the Examiner initially rejected the claims of the '246 Application because the disclosure of the prior-filed applications failed to provide adequate support or enablement as required by 35

U.S.C. §112(a), Patent Owner provided a table purporting to show §112 support for the limitations. An Allowance was mailed on November 1, 2019. EX. 1004, 35; EX. 1002, ¶¶46-49; *see also* EX. 1002, ¶¶50-62.

IV. CLAIM CONSTRUCTION

The claims are construed herein “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. §282(b).” 37 C.F.R. §42.100(b) (Nov. 13, 2018). Unless otherwise specified, the terms discussed herein are to have their plain meaning.

Petitioner believes that the preamble of sole independent claim 1, “A thermostat system,” is limiting, and the Court adopted this position in the co-pending district court case. *See, e.g.*, EX. 1025, 5; EX. 1021, 2; EX. 1002, ¶¶63-64. However, for the purposes of this proceeding, the claims are unpatentable under either construction and, thus, the Board need not reach a decision on the preamble. No further constructions are necessary. EX. 1002, ¶¶63-64.

V. THE CLAIMS ARE UNPATENTABLE

A. Priority Date

The ’890 Patent claims the benefit of the ’246 Application by way of a series of continuation applications. For the purposes of this Petition and without waiving the opportunity to challenge priority in the co-pending district court case, Petitioner

assumes that the earliest possible priority date of the '890 Patent is May 26, 2010—the filing date of the '246 Application; EX. 1002, ¶¶44.

B. Prior Art

1. Leen

Publication No. 2009/0140056 A1 to Leen (“Leen”) was filed on November 25, 2008 and published on June 4, 2009. Leen is prior art under at least 35 U.S.C. §102(e) (pre-AIA). Leen was not cited and was not considered during prosecution. EX. 1002, ¶¶65-66.

2. Trundle

Publication No. 2010/0289643 A1 to Trundle et al. (“Trundle”) was filed on May 18, 2010, published on November 18, 2010, and claims priority to Provisional Application No. 61/179,224, filed on May 18, 2009. As of its filing date of May 18, 2010, Trundle is prior art under at least 35 U.S.C. §102(e) (pre-AIA). While Trundle was cited in the '890 Patent, it was not relied upon in an action and is used here in combination with references never before considered. EX. 1002, ¶¶67-70.

3. Imes

Patent No. 8,457,797 to Imes et al. (“Imes”) was filed on September 29, 2010 and claims priority under 35 U.S.C. §119(e) to provisional application Nos. 61/255,678 and 61/235,798, filed on October 28, 2009 and August 21, 2009, respectively. EX. 1002, ¶77.

To the extent Patent Owner is able to show the '890 Patent is entitled to a May 26, 2010 priority date, at least provisional application No. 61/255,678 ("Imes Prov.") (EX. 1015) was filed before May 26, 2010 and its teachings were carried forward into Imes. EX. 1014, 1:1-25. Imes is prior art under at least 35 U.S.C. §102(e) (pre-AIA). EX. 1002, ¶78

Imes Prov. provides support for at least one claim of Imes. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). For instance, support for all of the claimed limitations of claim 12 of Imes is found throughout both Imes and Imes Prov., as shown below. EX. 1002, ¶79.

Claim	Imes (EX. 1014)	Imes Prov. (EX. 1015)
12. A method comprising: detecting a network device at a first site;	4:65-5:13, 5:65-6:2, 6:48-50, 6:53-57, 7:66-8:4, 12:32-34, 39:4-15, 45:28-45, 45:46-57, 54:63-55:1	7, §1.2; 8-9, §1.4; 18-19, §2.1.17
detecting a first reporting device associated with the first site;	6:53-59, 7:40-52, 8:62-9:14, FIG. 2, 5A	7, §1.2; 7-8, §1.3; 8-9, §1.4; 18-19, §2.1.17
detecting a network device at a second site;	4:65-5:13, 5:65-6:2, 6:48-50, 12:32-34, 39:4-15, 45:28-45, 45:46-57, 54:63-55:1	7, §1.2; 8-9, §1.4; 18-19, §2.1.17
detecting a second reporting device associated with the second site;	7:40-52, 8:62-9:14, 54:63-55:4	7, §1.2; 7-8, §1.3; 8-9, §1.4; 18-19, §2.1.17
detecting a first relative location between the first location reporting device and the first site;	8:62-9:14, 12:35-58, 35:63-36:7	7, §1.2; 8-9, §1.4; 11-12, §2.1.6; 12-14, §2.1.7; 18-19, §2.1.17
detecting a second relative location between the second location reporting device and the second site;	8:62-9:14, 34:57-64, 35:63-36:7	7, §1.2; 8-9, §1.4; 11-12, §2.1.6; 12-14, §2.1.7; 18-19, §2.1.17
altering a first operating condition of the network device disposed at the first site in response to the first relative location of the first location reporting device; and	8:62-9:14, 12:35-58, 35:63-36:7	7, §1.2; 8-9, §1.4; 11-12, §2.1.6; 12-14, §2.1.7; 18-19, §2.1.17
altering a second operating condition of the network device disposed at the second site in response to the second relative location of the second location reporting device.	8:62-9:14, 34:57-64, 35:63-36:7	7, §1.2; 8-9, §1.4; 11-12, §2.1.6; 12-14, §2.1.7; 18-19, §2.1.17

EX. 1002, ¶79.

Imes was cited but not relied upon in an action and is used here in combination with references never before considered. Additionally, a relative of Imes, Imes '782, was cited in the file history of the '554 Application. Patent Owner did not dispute that Imes '782 was prior art. EX. 1006 at 454; EX. 1002, ¶¶80.

4. Young

Patent No. 6,196,468 to Young ("Young") was filed on July 23, 1999 and issued on March 6, 2001. Young is prior art under at least 35 U.S.C. §102(a), (b) (pre-AIA). Young was not cited and was not considered during prosecution. EX. 1002, ¶¶75-76.

5. Wedekind

Patent No. 5,197,666 to Wedekind ("Wedekind") was filed on January 2, 1992 and issued on March 30, 1993. Wedekind is prior art under at least 35 U.S.C. §102(a), (b) (pre-AIA). Wedekind was not cited or relied upon in an action and is used here in combination with references never before considered. See EX. 1004, 389; EX. 1002, ¶¶73-74.

6. Ehlers

Patent No. 6,216,956 to Ehlers et al. ("Ehlers") was filed on December 23, 1998 and issued on April 17, 2001. Ehlers is prior art under at least 35 U.S.C. §102(a), (b) (pre-AIA). While Ehlers was cited in an IDS, Ehlers was not relied upon

in an action and is used here in combination with references never before considered. EX. 1002, ¶¶71-72.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA at the time of the '890 Patent would have had at least (1) an undergraduate degree in electrical engineering, computer engineering, computer science, or a comparable field of study and (2) at least two years of experience with (i) process control, (ii) automation systems, (iii) or a comparable field of work. EX. 1002, ¶12. Individuals with different education and additional experience could still be of ordinary skill in the art if that additional experience compensates for a deficit in their education stated above. *Id.* Additional education might substitute for some experience, and vice versa. *Id.*

VII. GROUND OF INVALIDITY¹

A. Ground 1A: Leen, Trundle, and Ehlers

1. Motivation to Combine

Leen discloses a thermostat that allows a user to create and edit a cooling and heating schedule. EX. 1008, [0010], [0024], [0171], Figs. 18-26; EX. 1002,

¹ Patent Owner cannot dispute that thermostats prevented HVAC systems from constantly and rapidly cycling on and off (EX. 1001, 2:5-13), that remote control via

¶82. Leen also discloses a schedule that allows a user to set a temperature “when the user is away from the house,” and can change a thermostat’s operation when a sensor senses that the house is unoccupied. EX. 1008, [0092]-[0093], [0171]; EX. 1002, ¶83.

Trundle represents an advancement brought about by “smart” devices and “smart” phones with GPS capabilities. *See* EX. 1001, 3:37-50; EX. 1002, ¶84. Specifically, Trundle discloses a mobile device application for “controlling wake-up and turn-down schemes” such as “chang[ing] a thermostat setting to a day setting.” EX. 1009, [0072], [0116]; EX. 1002, ¶84. Trundle discloses techniques for remotely monitoring and controlling devices such as thermostats to increase user convenience and improve energy efficiency, such as by using a mobile device application’s specific geolocation or “location tracking to automatically set [a] thermostat.” EX. 1009, [0036], [0037], [0131]; EX. 1002, ¶85.

It would have been obvious to a POSITA to combine Leen with Trundle for several reasons. EX. 1002, ¶86. *First*, Leen teaches that there was a need for HVAC controllers that are more intuitive and user-friendly to program and operate.

mobile devices was well known (*Id.* at 3:21-32), and/or that location-based services (*Id.* at 3:37-50) were well known.

EX. 1008, [0003]-[0004]; EX. 1002, ¶87. A POSITA would have recognized that many users ignored automated schedules because they found programming them to be “difficult and/or confusing.” EX. 1008, [0003]; EX. 1002, ¶88. In fact, Leen even suggests a solution to “hasten[] the programming process” by transferring previously-created thermostat configurations and values of operating parameters to the HVAC controller. EX. 1008, [0028]; EX. 1002, ¶88. Leen also recognizes a need to automate and control HVAC systems in an energy-efficient manner, such as by using sensors to determine building occupancy. *See* EX. 1008, [0170]-[0171]; EX. 1002, ¶¶89-90.

Other than suggesting the ability to upload schedules and the use of automated occupancy detection, Leen does not provide any additional implementation details for occupancy detection. EX. 1002, ¶91. A POSITA would have been motivated to locate those details in other related literature and sought to incorporate location-based services given the ubiquitous nature of location-aware mobile devices at the time and the increased desire to optimize energy consumption. *See, e.g.*, EX. 1013, [0318], Figs. 71A-D; EX. 1017, 1; EX. 1018, 2; EX. 1019, 8; EX. 1002, ¶91.

A POSITA would have been motivated to implement the mobile device-based occupancy detection of Trundle to improve both user-friendliness and energy efficiency of programmable thermostats, such as Leen, at least because

Trundle teaches techniques that “provid[e] an enhanced level of convenience to users” that would reduce or eliminate well-known difficulties with respect to schedules. EX. 1009, [0036]; EX. 1002, ¶92. Indeed, Trundle would enable not only reliable occupancy detection but would also allow the system to pre-heat or pre-cool based on the detection of a returning user. *See, e.g.*, EX. 1009, [0133]-[0136]; EX. 1002, ¶¶93-95.

Trundle provides phone-based occupancy detection and its associated benefits, thus eliminating the need for complicated schedules and/or expensive sensors, such as occupancy sensors. *See, e.g.*, EX. 1009, [0037]; EX. 1002, ¶93. The resultant system becomes significantly more energy efficient because it reduces (or even turns off) heating/cooling when the user is not occupying the property. EX. 1002, ¶93. Moreover, Trundle enhances convenience and energy efficiency by using a user’s location and a desired setpoint to determine when to start heating/cooling. *See, e.g.*, EX. 1009, [0101]-[0103], [0133]-[0136], [0144]; EX. 1002, ¶¶94-95. A POSITA would have been motivated to rely on automated, location-based systems to also ensure that a home will be heated or cooled to a comfort level prior to a user’s arrival. *See* EX. 1009, [0101], [0131]; EX. 1002, ¶96.

In addition to location-based services and occupancy, a POSITA would have understood the benefits of leveraging user interfaces on existing “smart” devices

for the remote control of thermostats, such as those disclosed in Trundle, instead of having a complex user interface on every controlled device. EX. 1002, ¶97. A POSITA would have also been motivated to rely on wireless networks configured to facilitate communications between a monitoring system control unit and one or more mobile devices, as taught by Trundle, to further provide enhanced convenience to users in the form of remote device control. EX. 1009, [0036], [0043], [0114]; EX. 1002, ¶98.

The POSITA would have had a reasonable expectation of success in the combination of Leen and Trundle because both references rely on occupancy-dependent protocols to control heating and cooling devices. EX. 1002, ¶99.

For similar reasons, a POSITA would have been motivated to combine the teachings of Leen and Trundle with those of Ehlers. EX. 1002, ¶100. Trundle teaches the importance of automated temperature control systems, and the enhanced convenience of having a property ready at a time when the user arrives home, but it does not provide specific implementation details regarding calculating the specific time needed for a property to be pre-heated or -cooled. EX. 1009, [0144]; EX. 1002, ¶100.

In a similar field, Ehlers teaches an environmental control system that “controls internal environmental conditions to optimize comfort and minimize energy consumption” through ramping and preheating (or precooling) a premise.

EX. 1010, 1:11-14, 12:55-56; 19:27-34, 19:40-43, 29:1-2, 29:25-36; EX. 1002, ¶101. Ramping rates may be set based on a rate of temperature change, or based on learning modes that measure the premise's natural thermal rate of change. EX. 1010, 29:2-10; EX. 1002, ¶¶101-102.

A POSITA would have been further motivated to combine the teachings of Trundle with those of Ehlers, because Ehlers provides specific implementation details regarding automatic environmental condition control based on sensed external environmental conditions. EX. 1010, 2:14-18, 2:35-39, 22:23-46; EX. 1002, ¶103. A POSITA would have further been motivated to rely on the use of historical data to automatically determine the optimum settings for the thermostat system. EX. 1010, 17:56-64; EX. 1002, ¶104.

Additionally, while Leen discloses a thermostat, Leen does not specifically disclose what a POSITA would have readily understood to be well known and necessary elements of a thermostat, such as relays (or contacts). EX. 1002, ¶105. A POSITA would have been motivated to turn to an analogous reference, such as Ehlers, for further implementation details. *Id.*

Indeed, Ehlers describes controlling an HVAC in the same way as Leen and Trundle and explicitly discloses the use of electrical contacts to control the HVAC system. *See* EX. 1010, 30:37-44; EX. 1002, ¶106. The POSITA would have had a

reasonable expectation of success in the combination given that each of the references disclose thermostats to control HVAC devices. EX. 1002, ¶¶106-107.

2. Claim 1: [1Pre] A thermostat system comprising:

Leen discloses an HVAC controller 10 (*thermostat system*), such as a thermostat, that may control “one or more components of an HVAC system.” EX. 1008, [0025], Fig. 1; EX. 1002, ¶108.

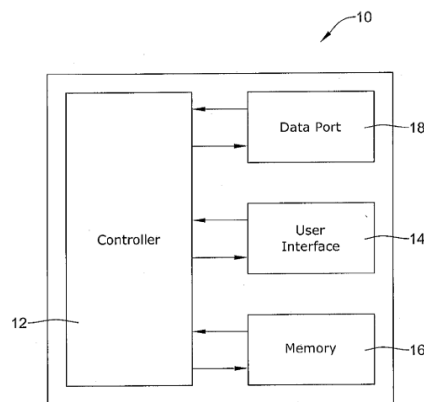


Figure 1

EX. 1008, Fig. 1.

a) [1A]: a housing;

Leen discloses an HVAC controller that “includes a display 22 that is disposed within a housing 24” (*housing*). EX. 1008, [0030]; EX. 1002, ¶109.

- b) **[1B]: 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 POSITA would have understood that Leen inherently discloses relays because it discloses that the HVAC controller operates the HVAC equipment and electrical contacts are the standard and necessary mechanism for connecting a thermostat to the HVAC equipment. EX. 1002, ¶¶111-112; EX. 1008, [0057].

Regardless, Ehlers explicitly discloses “electrical contacts.” Ehlers discloses a control system “contained within a thermostat-like unit” that may contain contact closures (*electrical contacts*) for controlling the operation of the HVAC unit. EX. 1010, 14:12-13, 30:37-46; EX. 1002, ¶113. As depicted below in Figure 2 (annotated), “[d]ry contact closures 51” are rated for “controlling relays and low voltage circuits. The contacts may, for example, control the external load devices for energy consumption management and environmental condition control” (*connect the thermostat with wires that allow for at least two electrical connections from a building's HVAC system to the contacts*). EX. 1010, 14:42-47; EX. 1002, ¶114.

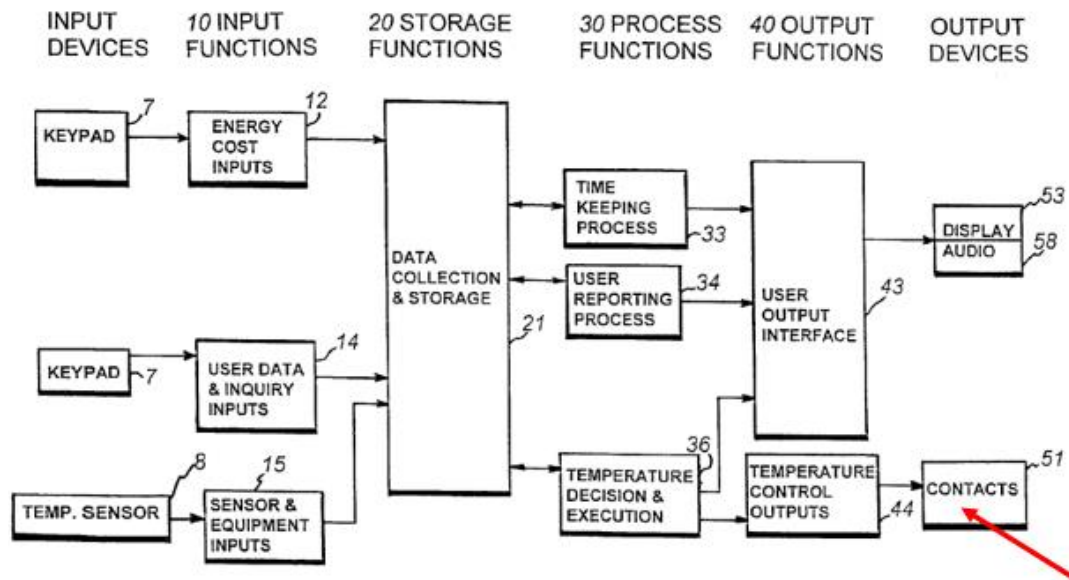


Fig. 2

EX. 1010, Fig. 2 (annotated).

- c) **[1C]: a display configured to present information to a user;**

Leen discloses a user interface (Figure 3) that may be “any suitable interface that permits controller 12 to display and/or solicit information” to a user (*display configured to present information to a user*). EX. 1008, [0026]; EX. 1002, ¶116.

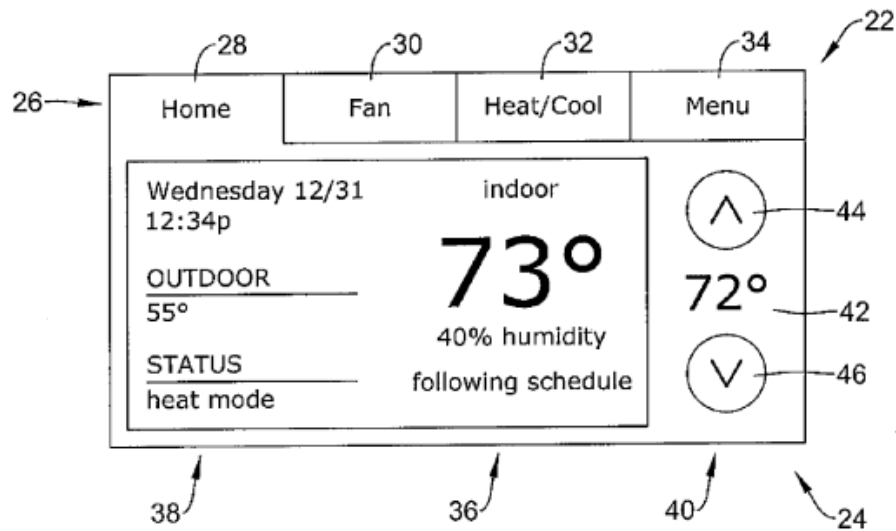


Figure 3

EX. 1008, Fig. 3.

- d) **[1D]: a wireless radio compatible with a wireless radio frequency protocol and configured to communicate bi-directionally with a location-aware mobile device;**

Leen discloses a data port (wireless or wired) configured to communicate with controller 12 to exchange thermostat configurations and values of operating parameters with the HVAC controller. EX. 1008, [0028]; EX. 1002, ¶117. Leen, however, does not explicitly disclose communication with “a location-aware mobile device.” EX. 1002, ¶117.

According to the Patent Owner’s interpretation of this limitation², it is not necessary for the mobile device to communicate directly with the thermostat system using the wireless radio frequency protocol. Thus, according to Patent Owner’s interpretation, either a mobile device communicating with the thermostat ***directly*** via wireless radio frequency protocol or ***indirectly*** through a network satisfies this limitation. EX. 1002, ¶119. Regardless, Trundle discloses both. EX. 1009, [0059]; EX. 1002, ¶120.

Trundle discloses a network 205 that may “facilitate[] communications between the monitoring system control unit 210, ***the one or more mobile devices 240, 250***...and the monitoring application server 260,” and may include one or more of a “Local Area Network[]” (LAN); “wireless telephone networks;” “radio;” and “any other delivery or tunneling mechanism for carrying data.” EX. 1009, [0043]-[0044], [0051]; EX. 1002, ¶120.

Trundle discloses that its “system leverages GPS information from the one or more mobile devices 240, 250,” e.g., smart phones (*location-aware mobile device*), which send and “receive data ***directly*** from” module 230, a thermostat.

² Patent Owner asserted that this limitation may be met by a location-aware mobile device that communicates indirectly through a network to include one or more servers. EX. 1012, 25-33; EX. 1002, ¶118.

EX. 1009, [0054], [0056], [0060]-[0061], Fig. 2 (annotated); EX. 1002, ¶121. The mobile devices “may communicate directly with...devices controlled by the monitoring system control unit 210,” such as thermostat 230. EX. 1009, [0056]; EX. 1002, ¶122. The mobile devices may use local wireless protocols and “communicate with and receive monitoring system data from the monitoring system control unit 210 using the communication link 238” (*communicate bi-directionally*) to “connect the one or more mobile devices 240, 250 to local security and automation equipment” (*a wireless radio compatible with a wireless radio frequency protocol*). EX. 1009, [0055]-[0056]; EX. 1002, ¶123.

Thus, Trundle discloses this claim element. EX. 1002, ¶¶124-125.

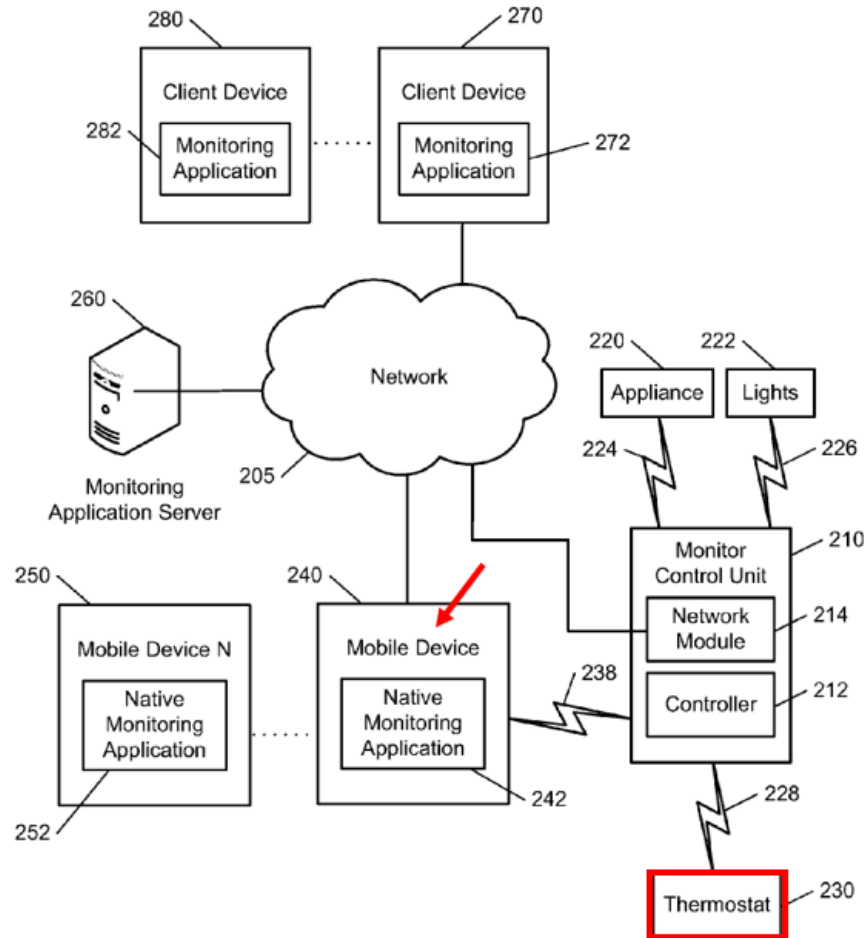


FIG. 2

EX. 1009, Fig. 2 (annotated).

e) [1E]: a temperature sensor;

Leen discloses a controller that uses an “internal thermal sensor” to sense ambient temperature (*temperature sensor*). EX. 1008, [0041]-[0042]; EX. 1002, ¶126.

f) [1F]: one or more processors configured with electronic circuitry to;

Leen discloses an HVAC controller 10 which includes “a processor or controller 12” (*one or more processors configured with electronic circuitry*). EX. 1008, [0025]; EX. 1002, ¶127. Similarly, Trundle discloses “one or more processors included in one or more electronic devices.” EX. 1009, [0078]; EX. 1002, ¶128.

g) [1G]: receive HVAC data parameters, including a first data parameter from the temperature sensor comprising an interior temperature inside the building; and

Leen teaches an HVAC controller that receives HVAC data parameters, such as “ambient temperature at HVAC controller 20 using an internal thermal sensor” (*first data parameter from the temperature sensor comprising an interior temperature*). EX. 1008, [0025], [0041]-[0042]; EX. 1002, ¶¶129-30. Leen illustrates the first data parameter:

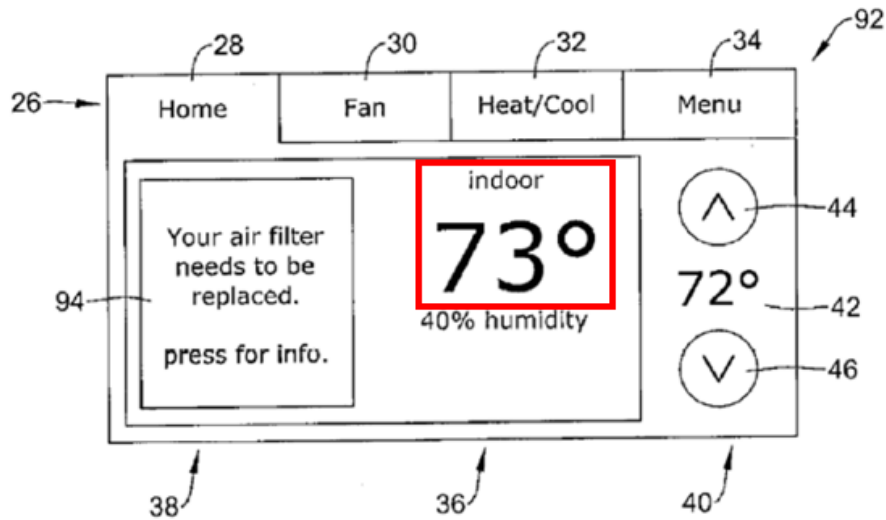


Figure 10

EX. 1008, Fig. 10 (annotated).

- h) [1H]: 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;**

Leen teaches that “[w]ireless devices” such as “exterior temperature sensors” and “exterior humidity sensors” may provide outside weather conditions.

EX. 1008, [0173], [0176]; EX. 1002, ¶¶131-32. Such exterior measurements would have been collected from an internal network and from a network source external to the building. EX. 1002, ¶132. Leen specifies that information received by the data port 18 could be received from a Bluetooth network connection, or in the alternative a wired network connection. EX. 1008, [0029].

And Ehlers teaches an “[i]nput function 13 [that] provides weather information,” which can be provided by “decoding DTMF from a phone input or

through a communications link,” i.e., a network. EX. 1010 at 9:50-58, *see also* 35:13-17; EX. 1002, ¶¶131, 268; EX. 1010, Fig. 4 (annotated). Ehlers also discloses the Ethernet as one type of network connection (i.e., a computer network) that supports Ehlers’ weather data input function 13. EX. 1010, 14:48-59. A POSITA would have appreciated receiving weather data from a network because it saves the cost and time associated with installing outdoor temperature sensors at the monitored property, which is sometimes difficult or impossible to do, and improves upon the sensors’ accuracy. *See* EX. 1002, ¶¶131, 268.

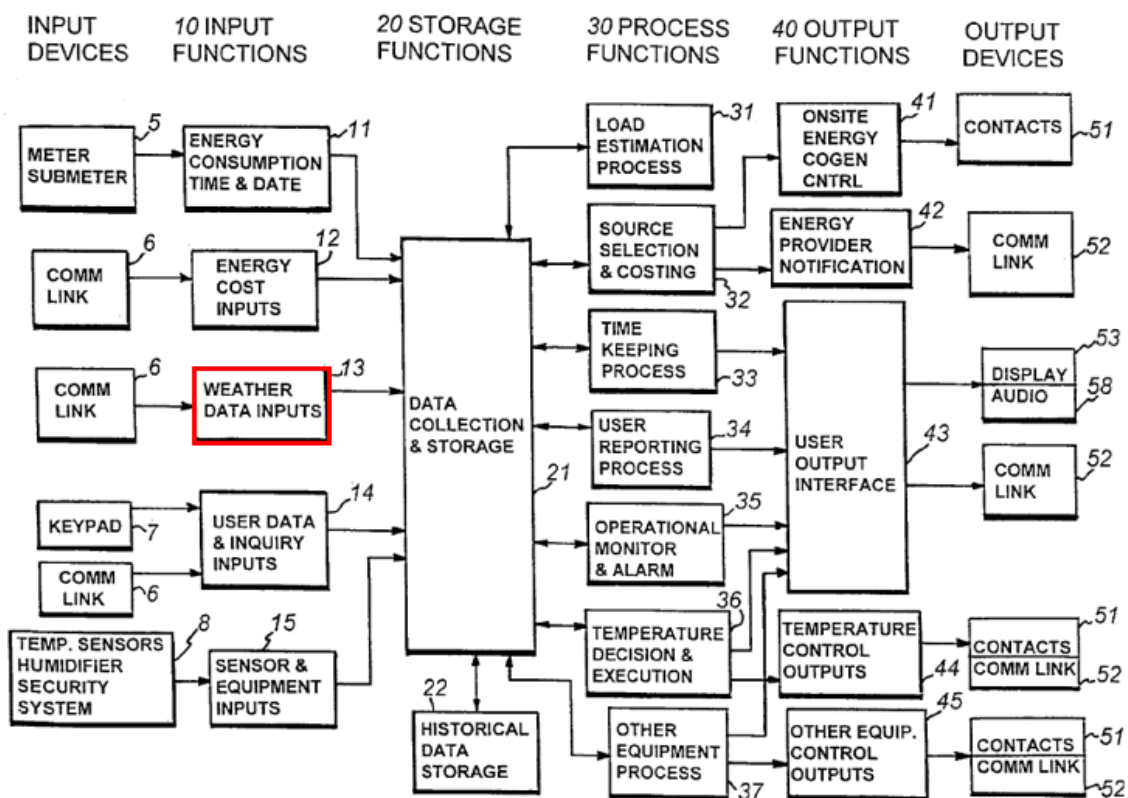


Fig. 4

EX. 101, Fig. 4 (annotated).

Additionally, Trundle discloses a system that “receives current weather data from...a weather broadcasting system” (*second data parameter from a network connected to the thermostat...comprises an outside weather condition*). EX. 1009, [0119], [0090]; EX. 1002, ¶¶133-35.

- i) **[1I]: 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;**

Leen allows a user to set “time and/or temperature set point information” such as “heating and cooling temperature set points” for Wake, Leave, Return, and sleep periods for weekdays. EX. 1008, [0062]; EX. 1002, ¶136.³

³ Patent Owner asserted that this limitation may be met by setpoint schedules. EX. 1012, 46-50; EX. 1002, ¶136.

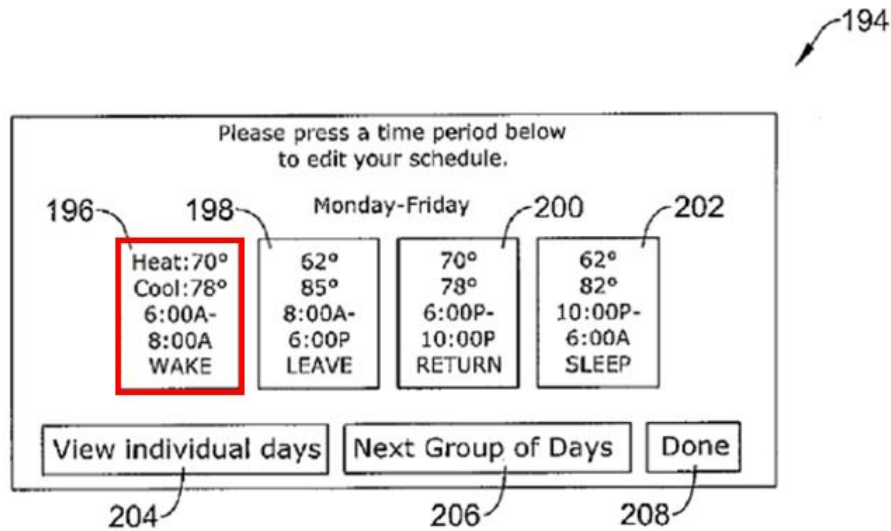


Figure 19

EX. 1008, Fig. 19 (annotated). As is shown in Figure 19, Leen discloses a first heat setpoint of 70 degrees and a cool setpoint of 78 degrees at 6:00A (*first temperature setpoint data parameter...includes a first temperature value and a first time value*). EX. 1002, ¶137. To the extent that Patent Owner argues that this limitation requires a determination by the thermostat without user involvement, Leen discloses that setpoints may be changed based on a sensor-based determination of occupancy. See EX. 1008, [0171]; EX. 1002, ¶137.

Trundle also discloses different setpoints for different schedules set by the user, EX. 1009, [0116], Figs. 16B, 17, and determining setpoints without user involvement, *see id.* at [0152]; EX. 1002, ¶137. Trundle describes a learning thermostat that manages energy consumption based on an energy management profile. EX. 1009, [0206], [0168-170], [0171]-[0176], [0204]; EX. 1002, ¶137.

- j) **[1J]: 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;**

For the same reasons as [1I], Leen and Trundle disclose multiple scheduled setpoints, and Trundle contemplates an ongoing analysis of energy consumption and changing setpoints. *See, e.g.*, EX. 1009, [0116], [0152], [0206], [0168]-[0170], [0171]-[0176], EX. 1002, ¶¶137-39.

- k) **[1K]: receive radio frequency signals from the location-aware mobile device;**

For the same reasons as described in limitation [1D], Trundle discloses [1K]. Additionally, Trundle discloses that “the system leverages GPS information from the one or more mobile devices 240, 250” (*location-aware mobile device*) to determine, based on their distance, whether to use the “direct local pathway” or “the pathway over network 205”. EX. 1009, [0061]; EX. 1002, ¶140-41.

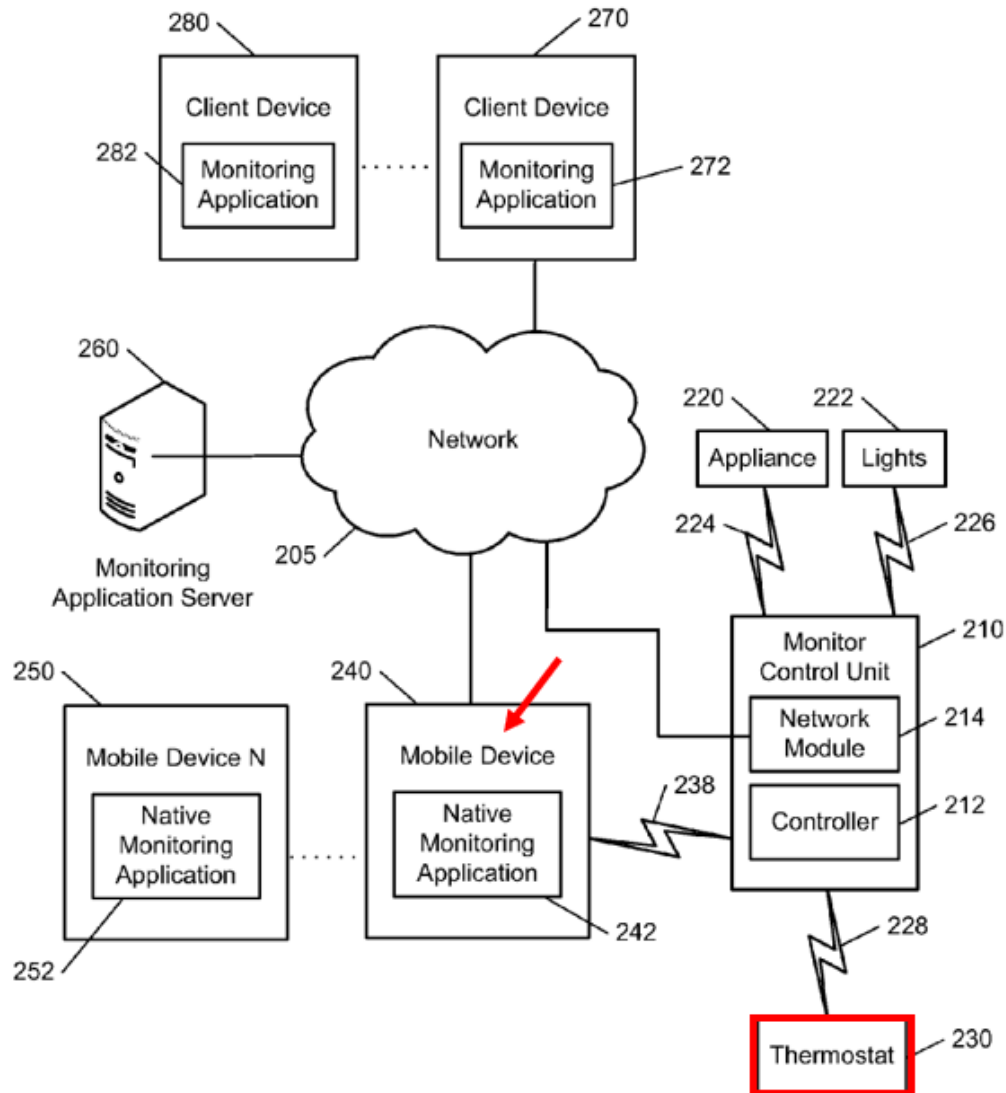


FIG. 2

EX. 1009, Fig. 2 (annotated).

Trundle mobile devices “may connect locally to the monitoring system and its sensors and other devices” and communicate directly with “devices controlled by the monitoring system control unit 210,” such as thermostat 230. EX. 1009, [0055]-[0056]; EX. 1002, ¶¶142-43.

- l) **[1L]: 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;**

As described with respect to [1K], the combination of Leen and Trundle discloses receiving radio frequency signals from the location-aware mobile device. Further, Trundle discloses the control of devices in a property based on a user's proximity. EX. 1009, [0031]; EX. 1002, ¶144.

For example, as illustrated in Figure 11 below, the control system may receive geographic location by using "GPS data" and "cell tower triangulation" (*receive geo-positioning data*) to "infer[] future occupancy" of the user and "determine[] an operation related to controlling the one or more energy consuming devices" such as "automatically setting a thermostat to an energy conserve mode" (*automatically adjust a temperature value based on the geo-positioning data*). EX. 1009, [0131], [0133], [0136], [0138]; EX. 1002, ¶145. A POSITA would have understood that a building is unoccupied when the user (and its phone) is not in the same geographic location as the monitored building (and the system would be required to "infer future occupancy"). EX. 1002, ¶145.

1100

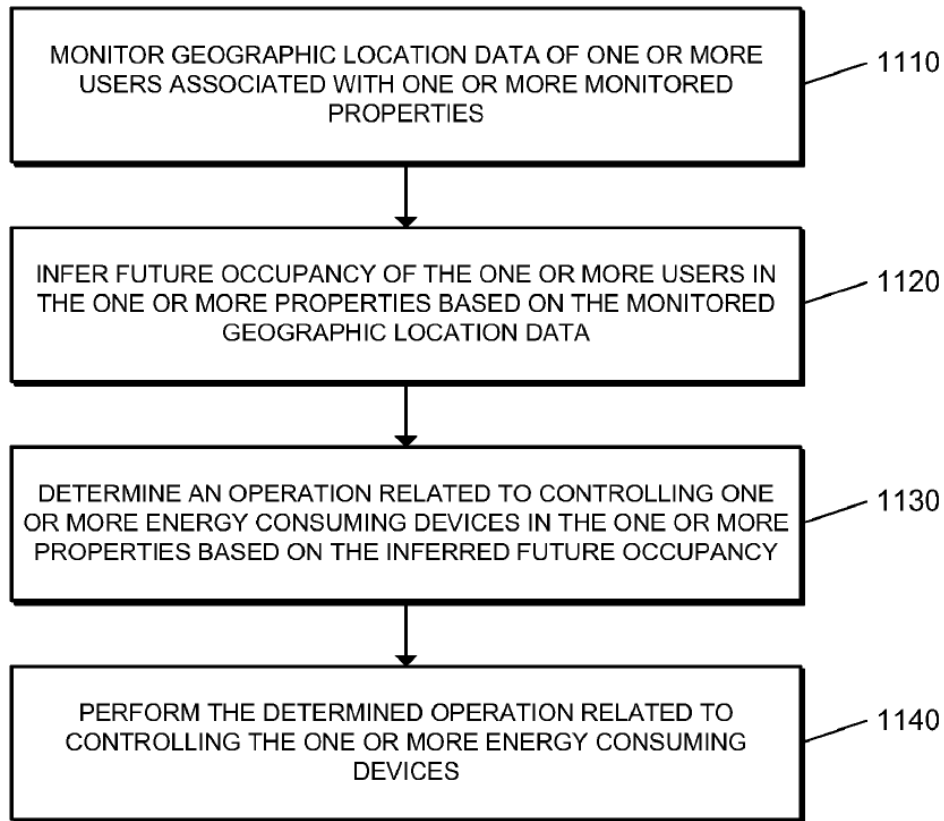


FIG. 11

EX. 1009, Fig. 11.

The native monitoring application also may switch between the operating modes (e.g., home or away) based on “location of the mobile device” (*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).⁴ EX.

1009, [0073], [0141]; EX. 1002, ¶¶146-47.

⁴ Patent Owner interprets switching to Away temperatures as satisfying “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.” EX. 1012, 69.

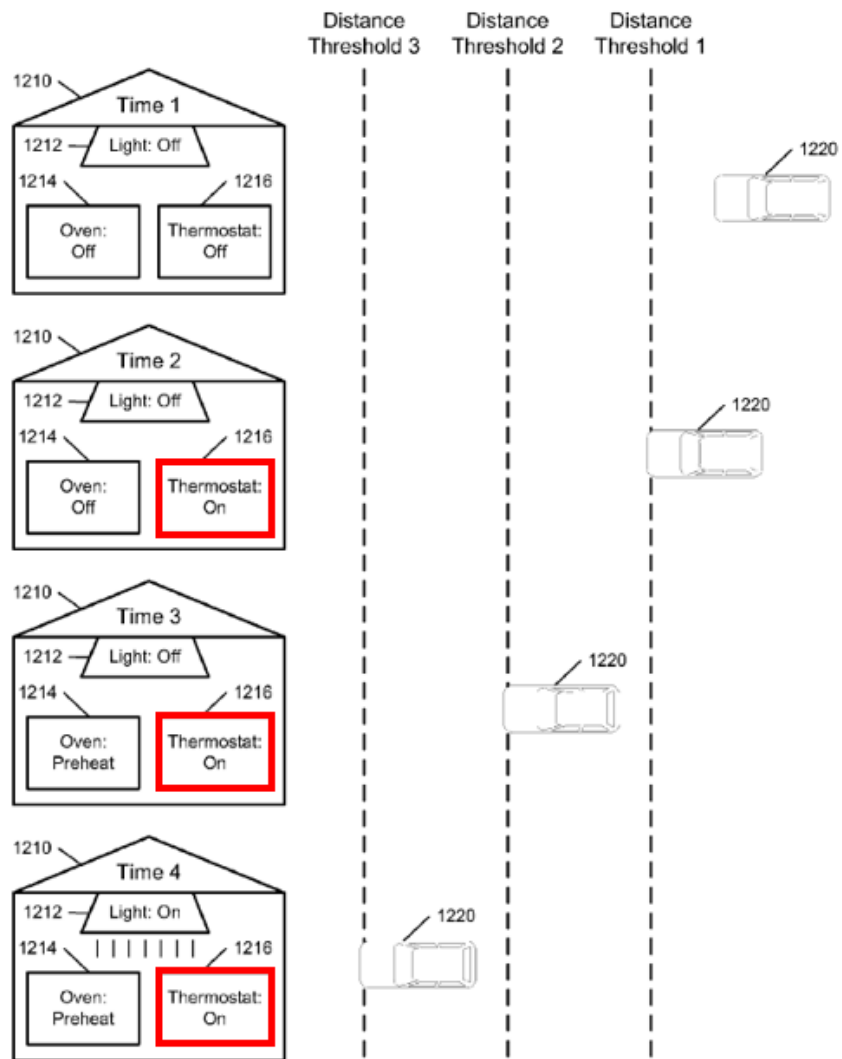


FIG. 12

EX. 1009, Fig. 12 (annotated).

- m) [1M]: electronic circuitry configured to allow the user to adjust a desired temperature for the HVAC system;

As illustrated in Figure 4 (annotated) below, Leen discloses that the heating and cooling temperature may be adjusted with buttons⁵ (*allow the user to adjust a desired temperature for the HVAC system*). EX. 1008, [0036]; EX. 1002, ¶148.

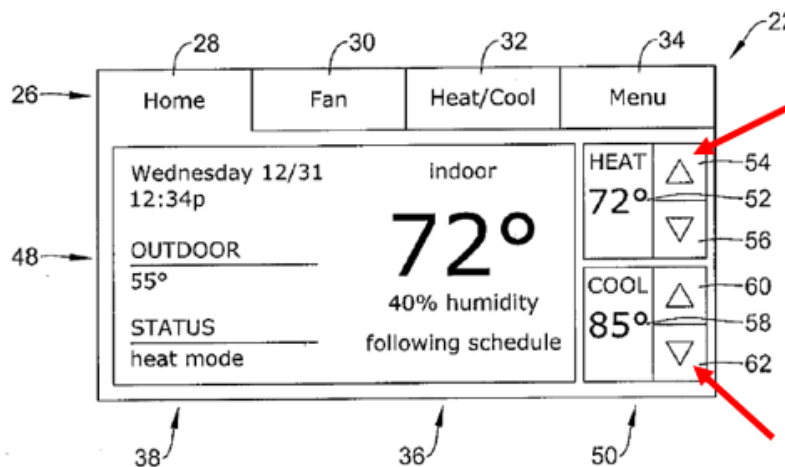


Figure 4

EX. 1008, Fig. 4 (annotated).

⁵ The claims suggest that “electronic circuitry” in limitations [1M] – [1O] is different circuitry than the processor. But Patent Owner appears to be relying on the processor as being the same as the claimed electronic circuitry in its infringement contentions. EX. 1012, 70-84. Thus, for the purposes of this IPR only, Petitioner has adopted this position.

To the extent Patent Owner argues that the electronic circuitry is referring to a mobile device (*see, e.g.*, EX. 1012, 70-81.), Trundle describes “us[ing] native monitoring application 242, 252 to control the thermostat(s) in the user’s home.” EX. 1009, [0064], [0200]; EX. 1002, ¶149-51.

- n) **[1N]: 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**

Patent Owner appears to interpret “data parameters specific to the user” as encompassing data parameters specific to a ***monitored property***. *See* EX. 1012, 81-83 (showing home energy usage reports). Petitioner relies on Patent Owner’s interpretation for the purposes of this IPR. EX. 1002, ¶152. For example, Trundle discloses a system that “monitors energy usage” at a property. EX. 1009, [0173]; EX. 1002, ¶¶154, 150

Regardless, Ehlers and Trundle disclose analyzing data parameters ***specific to the user***. Ehlers teaches that a storage function may store data types including “user preferences and limits,” and “consumption profiles.” EX. 1010, 10:43-62. “Other optional data includes the HVAC consumption.” *Id.* at 28:24-29; EX. 1002, ¶157.

Another aspect of Trundle’s system “uses [] one or more energy management goals or rules to define ***a profile for the user***, which is used to control energy management at one or more properties associated with the user”

(analyze...at least one data parameter relating to usage of the HVAC system at various times). EX. 1009, [0171], [0173]; EX. 1002, ¶154. Trundle also teaches user-specific operation “based on...the determined user identity.” EX. 1009, [0091], [0152], [0153]; EX. 1002, ¶¶155-56.

o) **[10]: electronic circuitry configured to generate and communicate usage metrics pertaining to the HVAC system over time; and**

Trundle discloses that “[t]he system 200 analyzes the monitored energy usage,” “analyze[s] *patterns of the energy usage*,” and “send[s] alerts or display suggested changes to a user based on the analysis of the monitored *energy usage*” (*generate and communicate usage metrics pertaining to the HVAC system over time*). EX. 1009, [0176]-[0178]; EX. 1002, ¶158.

At a user-specific level, Trundle discloses “providing energy usage suggestions based on determined energy usage profiles for efficient energy users.” EX. 1009, [0035]; EX. 1002, ¶158. As shown below in Figure 20, Trundle’s system may monitor energy consumption levels to determine a user’s energy profile, and suggests to inefficient users “the efficient energy usage profile determined for” a more efficient user. EX. 1009, [0196], [0199]; EX. 1002, ¶158.

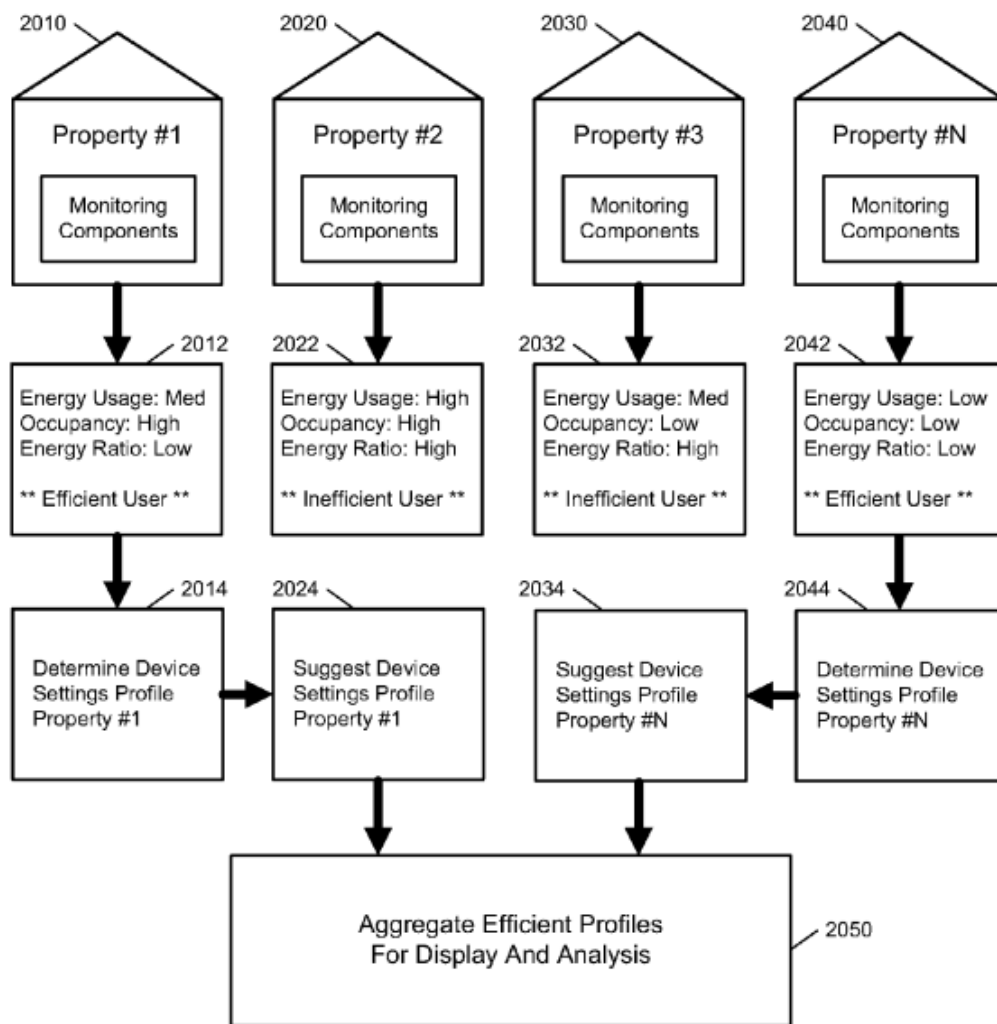


FIG. 20

EX. 1009, Fig. 20.

Ehlers also discloses generating and communicating usage metrics pertaining to the HVAC system including “user preferences and limits,” and “consumption profiles.” EX. 1010, 10:43-62, 28:24-29; 36:17-22 (“With sufficient historical data collected, function 31 can provide historical consumption analysis

by *providing graphs and summary data* of the average consumption of a premise as a function of time, temperature, or user set point changes”); EX. 1002, ¶158.

p) [1P]: 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.

Compressor delay circuits are well known. Ex. 1001 at 2:5-13. For example, Leen teaches that a compressor may be programmed to remain off for a user-determined minimum time period, as illustrated below in Figure 161 (annotated)⁶. Specifically, Leen teaches that “[a] second setup parameter may be a compressor minimum off time” (*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. 1008, [0317]; EX. 1002, ¶161. A POSITA would have understood that a minimum compressor off time would delay the start of a compressor to protect it from rapid cycling. EX. 1002, ¶¶159-62.

⁶ Patent Owner appears to interpret the compressor delay circuit as software capable of keeping the compressor off before restarting. See EX. 1012, 85. Petitioner will rely on Patent Owner’s interpretation for the purposes of this IPR. EX. 1002, ¶159.

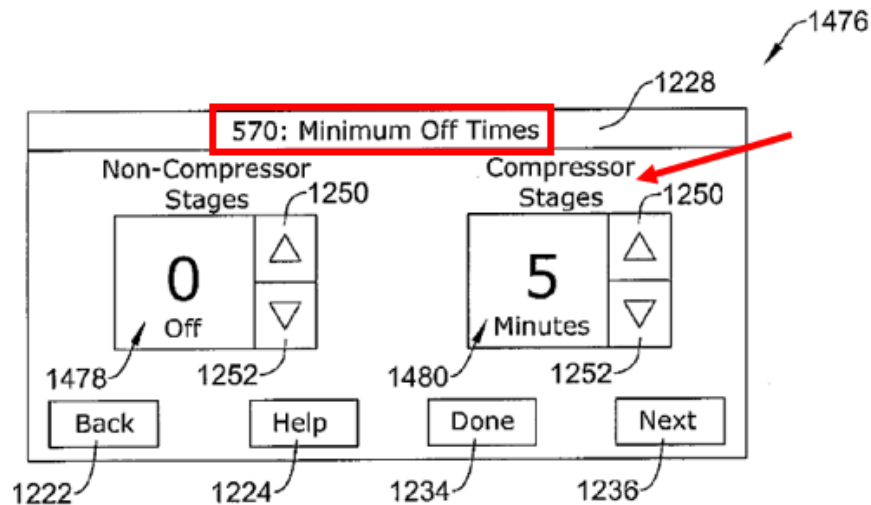


Figure 161

EX. 1008, Fig. 161 (annotated).

3. **Claim 2: The thermostat system of claim 1, wherein the one or more processors is further configured to determine whether the building is occupied or unoccupied.**

Leen discloses an HVAC controller “in communication with one or more sensors that register whether someone is in the house” (*determine whether the building is occupied or unoccupied*). EX. 1008, [0171]; EX. 1002, ¶163.

Trundle teaches that the detection of the “presence (or lack thereof)” of a user as detected by, e.g., a motion sensor, or the geographic location of a mobile

device, “impacts evaluation of a rule,” as illustrated below in Figure 4 (annotated).

EX. 1009, [0087]; EX. 1002, ¶¶165-66; *see also* limitation [1L].⁷

	401	402	403	404	405	406	407	408	409	410
	Presence Area #1	Presence Area #2	Window	Door	Weather	User	Temp	Energy Measure	Geographic Location	Action
411	No	No	Any	Any	Any	Any	Any	Any	Any	Turn off all lights; set all thermostats to conserve
412	No	Yes	Any	Any	Any	Any	Any	Any	Any	Turn off lights in Area #1; set thermostat for Area #1 to conserve
413	Yes	No	Any	Any	Any	Any	Any	Any	Any	Turn off lights in Area #2; set thermostat for Area #2 to conserve
414	Any	Any	Open	Any	Any	Any	Any	Any	Any	Send alert when thermostat is set to cooling or heating mode
415	Any	Any	Any	Open	Any	Any	Any	Any	Any	Stop thermostat from cooling or heating while door is open
416	Any	Any	Any	Any	Any	Any	> 85°	Any	Any	Control thermostat to cool mode
417	Any	Any	Any	Any	Any	Any	< 45°	Any	Any	Control thermostat to heat mode
418	No	No	Any	Any	Any	Any	Any	Any	< 1 Mile	Suggest light and appliance control
419	No	No	Any	Any	Any	Any	Any	Any	< 5 Miles	Control thermostat to scheduled heating or cooling mode
420	No	No	Any	Any	Any	Any	Any	Any	> 5 Miles	Control thermostat to conserve
421	Yes	No	Any	Any	Any	User1	Any	Any	Any	Set User1 control for Area #1
422	Yes	No	Any	Any	Any	User2	Any	Any	Any	Set User2 control for Area #1
423	Yes	Yes	Any	Any	50 to 80°	Any	Any	Low	Any	Control thermostat and lighting to scheduled mode
424	Yes	Yes	Any	Any	50 to 80°	Any	Any	High	Any	Control thermostat and lighting to conserve
425	Any	Any	Open	Open	Rain	Any	Any	Any	Any	Send alert to close window/door due to anticipated weather
426	Yes	Yes	Closed	Closed	> 90°	Pet	Off	High	> 20 Miles	Send alert to set thermostat to cool mode for pet

FIG. 4

EX. 1009, Fig. 4 (annotated).

⁷ Patent Owner accused products that utilize geo-fence technology, or “location-based temperature control” that “use[s] your smartphone’s location” as meeting this claim limitation. EX. 1012, 93. Petitioner will rely on Patent Owner’s interpretation for the purposes of this IPR. EX. 1002, ¶164.

4. Claim 3: The thermostat system of claim 2, further comprising an interface configured to allow the user to input that the building is currently unoccupied.

As described with respect to Claim 1, both Leen and Trundle disclose determining occupancy and a user interface. EX. 1002, ¶167.

Leen teaches that an HVAC controller may allow the user to enter vacation times or when a house will be vacant (*interface configured to allow the user to input that the building is currently unoccupied*). EX. 1008, [0105]-[0111], [0171], [0184]; EX. 1002, ¶¶168-69. A POSITA would have understood that by inputting this information, such as illustrated in Figure 28 (annotated), that user is inputting that the building is unoccupied. EX. 1002, ¶¶169-70.

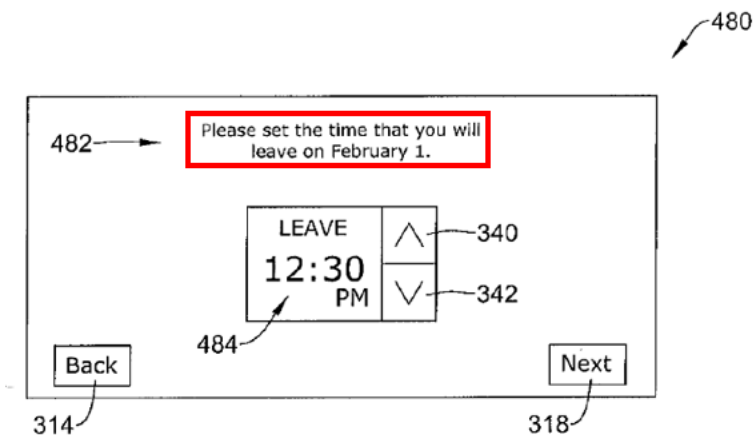


Figure 48

EX. 1008, Fig. 48 (annotated).

Trundle discloses a native monitoring application on mobile devices that may operate in “***user defined modes*** that control temperature,” including an Away-Work Mode and an Away-Vacation mode. EX. 1009, [0073]; EX. 1002, ¶171.⁸

Additionally, Ehlers discloses the use of “[a]n equipment interface” to access a Security System, which, when armed, “it is assumed the premise will be unoccupied and the temperature Set point will be changed to a user-defined or default level.” EX. 1009, [0073]; EX. 1002, ¶172. Ehlers discloses that “[t]o maximize energy efficiency while the premise is not occupied or is vacant...the system would support a minimum requirements function...which would be ***enabled by the premise owner, occupant or bill payer*** when conditions warrant.” EX. 1010, 20:4-10.

⁸ Patent Owner accused products that “connect to the internet via Wi-Fi and allows a mobile application to view data and adjust settings” as meeting this claim limitation. EX. 1012, 100. Petitioner will rely on Patent Owner’s interpretation for the purposes of this IPR.

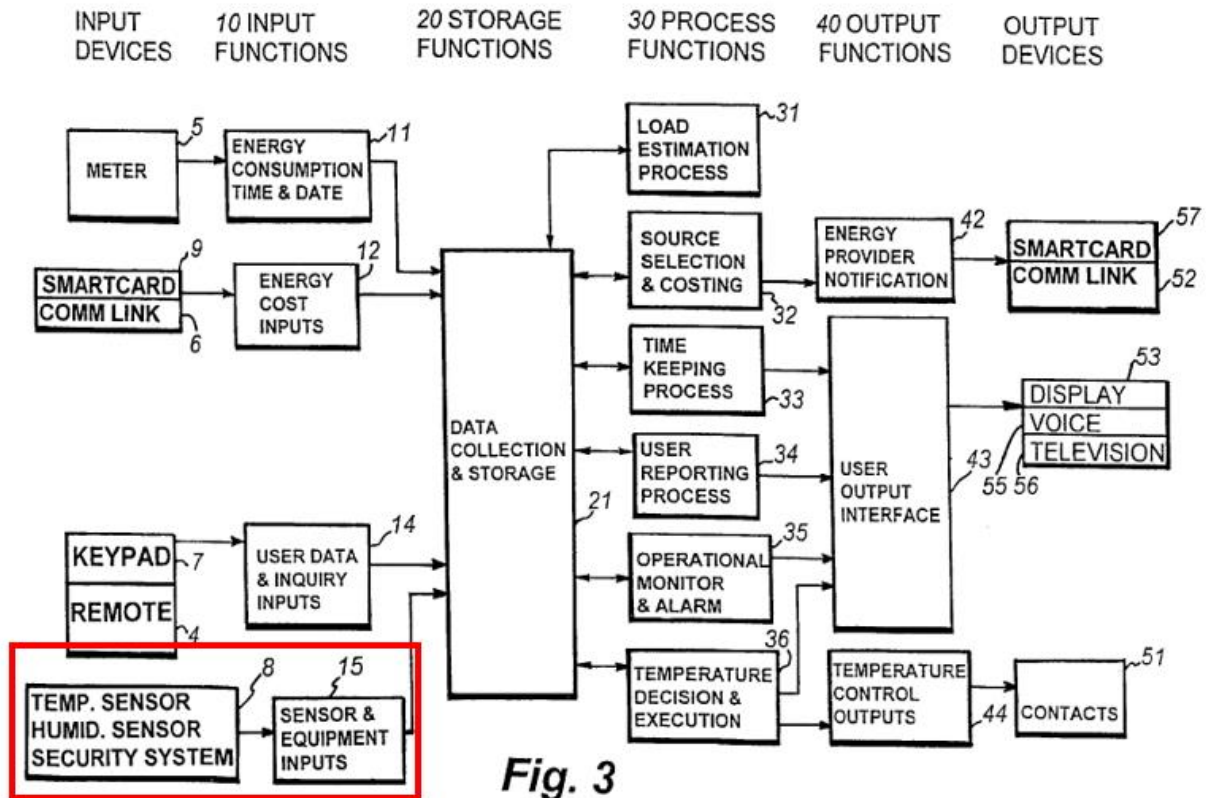
5. Claim 4: The thermostat system of claim 3, wherein the determination of whether the building is occupied or unoccupied by the one or more processors is based at least on a fourth data parameter received from a motion sensor.

As described above under Claim 2, Leen and Trundle teach a system wherein the determination of building occupancy is based on a motion sensor (*fourth data parameter received from a motion sensor*). EX. 1002, ¶173.

6. Claim 5: 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.

Leen discloses an HVAC controller that communicates with “[w]ireless devices” such as “interior humidity sensors” (*third data parameter from the first sensor includes a measurement of at least one characteristic of a building*). EX. 1008, [0173]; EX. 1002, ¶174. A POSITA would have understood that humidity is a characteristic of a building within which the thermostat is located. EX. 1002, ¶174.

Ehlers further discloses that its system communicates with sensors that “sense internal and external environmental conditions including temperature and humidity,” and further including “UV intensity,” which a POSITA would have understood to be one way to measure the sunlight. EX. 1010, 2:52-57, 10:14-19, 34:32-44, 35:52-58, 37:64-38:13; EX. 1002, ¶¶175-77.



EX. 1010, Fig. 3 (annotated).

7. Claim 6: The thermostat system of claim 5, wherein the third data parameter from the first sensor comprises a measurement of the humidity of the building.

As described above in Claim 5, Leen discloses Claim 6. EX. 1002, ¶178.

8. Claim 7: The thermostat system of claim 5, wherein the third data parameter from the first sensor comprises a measurement of sunlight.

As described above in Claim 5, Ehlers discloses Claim 7. EX. 1002, ¶¶179-

82.

9. Claim 8: The thermostat system of claim 7, wherein the second data parameter from the network connected to the thermostat further comprises a measurement of the outdoor humidity.

Leen discloses that “[w]ireless devices that may communicate with HVAC controller 20 include, for example...exterior humidity sensors” (*wherein the second data parameter from the network connected to the thermostat further comprises a measurement of the outdoor humidity*). EX. 1008, [0173]; EX. 1002, ¶183.

Additionally, Ehlers discloses that weather information such as “humidity could [] be received over the communication link.” EX. 1010, 9:50-58, 21:37-41; EX. 1002, ¶184.

B. Ground 1B: Trundle, Leen, Wedekind, and/or Ehlers

1. Motivation to Combine

As was described in Ground 1A, the POSITA would have been motivated to combine Leen, Trundle, and Ehlers. The POSITA would have been motivated to combine the teachings of Wedekind with those of Leen, Trundle, and Ehlers for at least the following several reasons. EX. 1002, ¶185.

Trundle teaches the importance of automated temperature control, and the enhanced convenience of having a property ready for the user upon the user’s arrival. EX. 1009, [0144]; EX. 1002, ¶186. While Trundle discloses setting threshold distances for location-based control, and using a “calculated R value to more efficiently control the thermostat to minimize usage and maximize efficiency on

behalf of the consumer,” Trundle does not provide specific implementation details regarding calculating the time needed for a property to be pre-heated or -cooled for arriving users. EX. 1009, [102], [0202]; EX. 1002, ¶186. Wedekind discloses additional details regarding a time needed to reach a desired heating or cooling setpoint. EX. 1002, ¶¶187-188; EX. 1011, 2:45-63.

A POSITA would have been motivated to combine the teachings of Trundle with those of Wedekind, because Wedekind discloses the use of inputs such as indoor and outdoor air temperatures to “more accurately achieve predetermined temperatures at predetermined times...while optimizing energy consumption.” EX. 1011, 2:45-63, 1:36-41; EX. 1002, ¶188. Indeed, Wedekind discloses specific formulas that describe a thermodynamic model. EX. 1011, 17:53-63; EX. 1002, ¶188. Thus, a POSITA would have been motivated to combine the teachings of Trundle with that of Wedekind to more accurately determine the proper start-up times of a heating or cooling system to have an enclosure reach a desired set-point temperature upon a user’s return. EX. 1011, 2:21-26; EX. 1002, ¶188.

A POSITA would have been similarly motivated to combine the teachings of Ehlers with those of Wedekind. EX. 1002, ¶189. Ehlers emphasizes that the prior art does not “provide automatic environmental condition control based on sensed external environmental conditions, which external conditions may greatly effect [sic] internal conditions.” EX. 1010, 2:14-18; EX. 1002, ¶189. Ehlers also aims to

“optimize comfort and minimize energy consumption and/or energy cost, based on user-defined parameters.” EX. 1010, 2:35-39; EX. 1002, ¶189. A POSITA would have turned to analogous art, Wedekind, for additional details to address the need for environmental condition control based on “external environmental conditions.” See EX. 1010, 2:14-18; EX. 1002, ¶189.

Specifically, Wedekind determines “the optimum thermostat setback schedule 80 which, while maintaining the user-specified occupancy comfort schedule 39, minimizes the input energy consumption of the climate control system 18.” EX. 1011, 17:53-67; EX. 1002, ¶190. Wedekind further teaches a processing means that will “automatically change the setback temperature if it computes, using the non-linear efficiency model a more energy efficient setback temperature exists for the existing outside air temperature and occupancy comfort schedule 39.” EX. 1011, 6:44-48; EX. 1002, ¶190.

A POSITA would also have been motivated to combine the teachings of Wedekind with those of Leen. EX. 1002, ¶191. While Leen suggests that there is a need in the art to control HVAC systems in an energy-efficient manner (see EX. 1008, [0170]) and does so via adaptive intelligent recovery, it provides no further implementation details. EX. 1002, ¶191. As described above, a POSITA would have turned to related literature to identify further implementation details, such as the energy prediction methodology and automatic setback change for greater energy

efficiency as taught in Wedekind. *See, e.g.*, EX. 1011, 17:53-67, 6:44-48; EX. 1002, ¶191.

The POSITA would have had a reasonable expectation of success in the combination given that each of the references disclose thermostats to control heating and cooling devices as well as specific mechanisms for controlling when to activate an HVAC system to achieve a particular setpoint. EX. 1002, ¶¶192-93.

2. Claim 9: The thermostat system of claim 1, further comprising a memory configured to store historical values of the first data parameter and second data parameter.

As discussed in [1N], Leen, Ehlers and Trundle disclose monitoring and storing HVAC usage metrics. EX. 1009, [0177]; EX. 1002, ¶194. Ehlers further discloses that storing such data was well known in the art as it discloses a system that, “after being installed for a period of time, will have sufficient history data in its memory to provide the average consumption analysis data such as energy units used and cost of the energy units as a function of time, temperature, occupant changes in the set point and weather related factors for normalization.” EX1010 at 17:56-64. As another example, the system can analyze other parameters including by “tracking [] set point changes by the occupant in relationship to the outside weather conditions.” *Id.* at 28:24-29.

Wedekind specifically discloses a thermostat system that “receives the temperatures of the inside and outside air,” and stores said data in a memory (*store*

historical values of the first data parameter and second data parameter). EX. 1011, 4:45-47, 4:55-63, *see also* 2:37-39, 6:61-62, Figs. 3 and 5; EX. 1002, ¶195. Storing such “history data” was well known. EX. 1010, 17:56-64; EX. 1002, ¶196.

3. Claim 10: 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, 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.

Leen discloses that “Adaptive Recovery may implement a control algorithm that initiates the HVAC equipment at an appropriate time...such that the temperature in the building reaches the new set point at or about the time that the temperature change is set to take place.” EX. 1008, [0169]; EX. 1002, ¶197.

Trundle provides additional details regarding how this is achieved by disclosing setting a threshold distance for starting the heating or cooling process based at least on “how close the current temperature is to the desired temperature” (*the first data parameter...and the first temperature setpoint data parameter*), and “how long it typically takes the system to adjust the temperature from the current temperature to the desired temperature” (*time necessary for the HVAC system to operate*). EX. 1009, [0102]; EX. 1002, ¶198.

In addition, Trundle discloses that its system may be a “learning system” that, “given a certain expected outdoor weather condition,” “runs experiments” on

heating or cooling a property and uses the learned information to control future heating or cooling scenarios. EX. 1009, [0204]; EX. 1002, ¶199.

Wedekind provides explicit detail with respect to reliance on outdoor temperature. For example, Wedekind teaches a predictor system that incorporates “***the current outside air temperature 36,***” to predict the ***recovery time t_r*** necessary to return the inside air from the setback temperature, T_i (*the first data parameter*), to the occupancy comfort temperature T_f “enough time in advance so that the ***air temperature*** reaches the ***comfort temperature T_f*** , at the beginning of the ***specified comfort time domain, t_4*** ” (*predict, based at least on the first data parameter, the second data parameter, and the first temperature setpoint data parameter, the time necessary...*). EX. 1011, 4:39-47, 7:19-30, 7:41-50, 17:68–18:3, 19:59-20:2; 5:57-60; EX. 1002, ¶¶200-201. The specified comfort time domain, t_4 , is the “first time value” claimed. Moreover, Wedekind explicitly describes that its system “us[es] the continuous measurement of various air temperatures.” EX. 1011, Abstract; EX. 1002, ¶¶200-201. Additionally, Wedekind calculates t_r based on inside temperature (T) and its derivatives, and outside temperature (T_0), such as by Equation 21. EX. 1011, 17:68–18:3.

Further, Ehlers confirms that it was well known that weather parameters may be used as “a load variable which would modify the ***estimate*** of the amount of energy required, [and] ***time***...to heat or cool the premise from ***a specific temperature*** [(first

data parameter)] to **a new set point** [(first temperature setpoint)],” or “as a predictor for user-desired temperature set point changes.” EX. 1009, 35:17-28, 39:44-51; EX. 1002, ¶¶202-204.

4. Claim 11: The thermostat system of claim 10, 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 determining a rate of change value necessary for the building to reach the first temperature value by the first time value.

As in Claim 10, Leen renders this claim unpatentable. EX. 1008, [0169]; EX. 1002, ¶205.

Additionally, Trundle discloses that it relies on an “R Value Rating for a monitored property,” EX. 1009, [0202], which reflects “the work of the heating and cooling system (e.g., the HVAC system) to raise/lower temperatures.” EX. 1009, [0102], [0202]-[0203]; EX. 1002, ¶206. A POSITA would have understood that the R Value Rating reflects a rate of change. EX. 1002, ¶206. Trundle’s “Home R Value Rating” is “[b]ased on the determined inside temperature...and the outside weather information.” EX. 1009, [0202]; EX. 1002, ¶206.

Trundle further discloses a “learning system.” EX. 1009, [0204]; EX. 1002, ¶207. The system “learns how gradually or intensively to proceed with cooling the property to best achieve efficient operation,” which a POSITA would have understood inherently takes into account a rate of change value for the HVAC system to operate to achieve a desired temperature. EX. 1009, [0204]; EX. 1002, ¶¶207-209.

Additionally, both Wedekind and Ehlers disclose the elements of this claim. For example, Wedekind, and in addition to what was addressed above in Claim 10, teaches a non-linear efficiency model consisting of a series of three differential equations representing the major physical mechanisms governing the thermal and thermodynamic processes involved. EX. 1011, 17:63-67; EX. 1002, ¶210-211. One of the three differential equations, (23), “govern[s] the ***rate at which energy is delivered to (heating) or removed from (cooling) the conditioned space***, Es, by the climate control system 18.” EX. 1011, 18:26-35; EX. 1002, ¶211. These three differential equations ((21), (22), and (23)) can be solved “using classic mathematical solution techniques for the five different time domains 40, 42 of the typical occupancy comfort 39 and thermostat setback 80 schedules depicted in FIG. 2.” EX. 1011, 18:65-19:4; EX. 1002, ¶211. A POSITA would have understood that solving these three differential equations involves calculating the derivative, or rate of change value. EX. 1002, ¶211.

Likewise, Ehlers teaches a system that uses preconditioning (with or without ramping) to pre-cool or pre-heat a premise by a number of user-selected degrees prior to a rate increase. EX. 1010, 19:14-19, 29:25-27; EX. 1002, ¶212. The starting time for preconditioning is determined by multiplying the rate of change for cooling or heating (i.e., “the time it takes to cool the premise one full degree”) by the number of user-selected degrees (*prediction of the time necessary for the HVAC system to*

operate...based on determining a rate of change ...). EX. 1010, 29:28-32; EX. 1002, ¶212. Then, if ramping is in use, the system disclosed in Ehlers “will use this lower temperature to calculate the rate of change for its operation which lowers the overall temperature during the higher rate period.” EX. 1010, 26:53-55, 29:33-36; EX. 1002, ¶¶212-213.

5. Claim 12: The thermostat system of claim 11, wherein the automatic adjustment of the temperature setpoint is based at least in part on the rate of change value.

As in Claim 10, Leen renders this claim unpatentable. EX. 1008, [0169]; *see also* EX. 1002, ¶¶214-15. And as described in Claim 10, Trundle, Wedekind, and Ehlers disclose a rate of change value. *See, e.g.*, EX. 1002, ¶218.

In addition, Trundle discloses “control[ing] future heating or cooling scenarios in a more efficient manner.” EX. 1009, [0204]; EX. 1002, ¶216. And Wedekind, in addition to what was addressed above in Claim 10, discloses that “the processing means 44 will ***automatically change the setback temperature*** if it computes, ***using the non-linear efficiency model*** a more energy efficient setback temperature exists for the existing outside air temperature and occupancy comfort schedule 39” (*automatic adjustment of the temperature setpoint is based at least in part on the rate of change value*). EX. 1011, 6:41-48; EX. 1002, ¶217.

6. Claim 13: The thermostat system of claim 10, 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.

As in Claim 10, Leen renders this claim unpatentable. EX. 1008, [0169]; EX. 1002, ¶219. Leen, Trundle, and Wedekind also disclose a prediction of time necessary for the HVAC system to operate in order to reach the first temperature value by the first time value. *See e.g.*, Claims 10-12.

Trundle discloses “automatically start[ing] a heating or cooling process” with enough time in advance to reach a suitable level upon the user’s arrival. EX. 1009, [0101]-[0102]; EX. 1002, ¶220. Wedekind discloses sending to the thermostat the predicted time necessary to raise the temperature to the comfort temperature (or setpoint) at the “beginning of the specificized comfort time domain” (*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*). EX. 1011, 7:19-30; EX. 1002, ¶221-22.

7. Claim 14: The thermostat system of claim 10, further comprising a memory configured to store historical values of the first data parameter and second data parameter; 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.

A memory configured to store historical values of the first data parameter and second data parameter is disclosed for at least the reasons as Claim 9. EX. 1002, ¶223.

Regardless, Trundle discloses a “learning system” that experiments with cooling/heating intensity and “measures the work required to create a certain amount of temperature change.” EX. 1009, [0204]. The system may use its “archive of information” to learn and “control future heating or cooling scenarios.” EX. 1009, [0206]; EX. 1002, ¶¶224-225.

Additionally, Ehlers teaches two artificial intelligence systems that disclose the limitations of this claim. EX. 1002, ¶226. In one system, the system tracks “set point changes by the occupant in relationship to the outside weather conditions” (*store historical values of the first data parameter and second data parameter*) so it can “automatically adjust the internal environmental conditions” to “maintain the indoor air...to achieve the desired comfort conditions of the occupant” (*prediction of the time necessary for the HVAC system to operate...based on historical values of the first data parameter and second data parameter*). EX. 1010, 22:23-28, 22:35-

43; EX. 1002, ¶227. A POSITA would have understood that the system of Ehlers is able to necessarily adjust operation to maintain the indoor temperature by tracking the historical values of the first data parameter. EX. 1002, ¶227. Moreover, the weather parameters can be used “as a load variable which would modify the estimate of the amount of energy required, time and cost to heat or cool the premise from a specific temperature to a new set point and as a predictor for user-desired temperature set point changes.” EX. 1010, 35:23-28; EX. 1002, ¶227.

Moreover, Wedekind, in addition to what was addressed above in Claim 10, teaches “direct temperature measurements of the *inside air 34... as a function of time*” for use in its parameter estimation methodology that “determine[s] the various thermal and thermodynamic parameters...required by the non-linear efficient model to currently determine the most efficient way to maintain the occupancy comfort schedule 39 which was input by the operator.” EX. 1011, 12:43-53, 13:23-25; EX. 1002, ¶228. Additionally, Wedekind’s system also requires a “direct measurement” of “the *outdoor air temperature as a function of time, $T_o(t)$* .” EX. 1011, 14:60-62; EX. 1002, ¶228.

8. Claim 15: The thermostat system of claim 14 wherein the one or more processors determines one or more intermediate temperature setpoints that have a temperature value between a current temperature of the building and the first temperature setpoint.

As in Claim 10, Leen and Wedekind render this claim unpatentable. EX. 1008, [0169]; EX. 1002, ¶229.

A POSITA would have known that if a specific trajectory or profile of temperature changes is desired, such as ramping the temperature over time, then the thermostat must calculate a series of intermediate setpoints along the desired temperature trajectory. EX. 1002, ¶¶230-32. For example, Ehlers discloses the concept of temperature ramping, which “will cause the system to gradually ramp the temperature up or down over a period of time (i.e. 1 degree/30 min or 1 degree/1 hour...) in response to energy price changes.” EX. 1010, 19:27-34; EX. 1002, ¶232-33. Conversely, if prices drop, the ramping algorithm “uses a reverse recovery ramp” to ramp back to a narrower dead-band (*one or more intermediate temperature setpoints that have a temperature value between a current temperature of the building and the first temperature setpoint*). EX. 1010, 19:43-45; EX. 1002, ¶232-33.

9. Claim 16: The thermostat system of claim 14, 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.

Claim 16 is rendered obvious for at least the same reasons as explained for Claim 13. EX. 1002, ¶234.

10. Claim 17: 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.

Leen discloses that a data port may be used to upload or download information from a controller such as “values of operating parameters.” EX. 1008, [0028]; EX. 1002, ¶235.

Further, Trundle discloses that its thermostat system analyzes performance characteristics such as “patterns of the energy usage” and “the efficiency of a heating and cooling system (e.g., an HVAC system) at a property” (*receive a fifth data parameter...includes at least one performance characteristic of the HVAC system*). EX. 1008, [0177], [0202]-[0203]; EX. 1002, ¶¶236-37.

Wedekind, and in addition to what was addressed above in Claim 10, similarly discloses that its “predictor system” involves a mathematical model that utilizes performance characteristics such as “the measured thermal and thermodynamic parameters determined and stored in the registers 45 or database 45,” and efficiency

of the system. EX. 1011, Abstract, 7:50-61, 17:53-57; EX. 1002, ¶238. Further, Wedekind's predictor system determines the climate control efficiency η_s by "measuring the variables associated with the thermal energy consumption of the enclosure 30, i.e., inside temperature, outside temperature, flow rates, input energy rate, etc." EX. 1011, 12:10-26, EX. 1002, ¶238.

Further, Ehlers discloses a monitoring function that "entails extracting performance data from the collected data, [and] tracking it over time." EX. 1010, 37:20-24; EX. 1002, ¶239. One such performance data is "***the time to*** cool the premise one degree with known temperature and weather conditions" tracked over time. The system then can calculate a trend in operation and determine if the cooling unit is operating at the same level. EX. 1010, 37:24-28; EX. 1002, ¶239.

C. Ground 2A: Imes, Young, and Ehlers

1. Motivation to Combine

Ehlers describes a standard thermostat, including components such as electrical contacts. *See generally* Sections VII.A.2(a)-(j); EX. 1002, ¶240. Ehlers further discloses energy management systems that "provide automatic environmental condition control based on sensed external environmental conditions" and "optimize[s] comfort and minimize[s] energy consumption." EX. 1010, 2:10-18, 2:35-39; EX. 1002, ¶241. One such input could include an occupancy sensor that saves energy. EX. 1010, 21:41-47; EX. 1002, ¶241.

Imes represents an advancement brought about by mobile devices with location-detection capabilities: it discloses an energy management system that uses a proximity detection module to automatically control the operation of an HVAC system. EX. 1014, 11:10-21; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 11-12, §2.1.6; 13, §2.1.7; 28; EX. 1002, ¶242.

It would have been obvious to a POSITA to combine Ehlers with Imes because Ehlers teaches that there is a need for automatic control of HVAC systems that both “minimize[s] energy consumption” and “optimize[s] comfort.” EX. 1010, 2:35-39; EX. 1002, ¶243. Indeed, in the early 2000s, as GPS technology in mobile devices became more ubiquitous, the POSITA would have looked for ways to incorporate GPS-based location into thermostats to automate and/or more precisely control devices. EX. 1002, ¶243. Imes disclosed one such example. *Id.*

A POSITA would have been motivated to combine the teachings of Ehlers with those of Imes because Imes teaches techniques such as automatically controlling a site “on a zone by zone basis” based on mobile device location that eliminates the need for manual control of thermostats and minimizes energy consumption. EX. 1014, 35:63-36:7, 36:4-7; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 11-12, §2.1.6; 13, §2.1.7; 28; EX. 1002, ¶244-45. The resultant system becomes significantly more energy efficient by only heating/cooling when a user is

occupying or within a predefined distance of the property and, importantly, reduces (or even turns off) heating/cooling when the user is not. EX. 1002, ¶245.

Moreover, a POSITA would have recognized that the complexity of programming thermostats prevented many users from obtaining their benefits. EX. 1002, ¶246. Users of energy management systems often “lack energy awareness,” and passive displays of energy prices “leav[e] it up to the consumer to manually curtail their use.” EX. 1014, 1:35-46; EX. 1002, ¶246. Thus, the location-based control of thermostats reduces the need for manual control, and thus increases energy efficiency. EX. 1002, ¶246.

The POSITA would be further motivated to combine Imes with Ehlers because the same location-based occupancy detection taught in Imes also optimizes a user’s comfort. EX. 1002, ¶247. For example, Imes teaches “detect[ing] when mobile device 632 may be moving away from site 604” and adjusting a percentage change in the thermostat setting, and vice versa. EX. 1014, 36:25-36; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 11-12, §2.1.6; 13, §2.1.7; 28; EX. 1002, ¶247. A POSITA would have understood that altering a temperature setpoint based on user occupancy enhances user comfort by ensuring that the building is comfortable on arrival. EX. 1002, ¶247.

The POSITA would have had a reasonable expectation of success in the combination of Ehlers and Imes given that both references rely on occupancy-dependent protocols to control HVAC equipment. EX. 1002, ¶248.

A POSITA would have been motivated to combine the teachings of Ehlers and Imes with those of Young. Young also discloses a motion sensor or “occupancy sensor...to sense the presence of occupants in the room.” EX. 1016, 3:29-43; EX. 1002, ¶248. A POSITA would have been further motivated to combine the teachings of Ehlers and Imes with those of Young, because Young minimizes wear and tear on HVAC equipment. EX. 1016, 2:43-3:22; EX. 1002, ¶249. Specifically, Young teaches a compressor timer that prevents a compressor from reactivating in certain instances. EX. 1016, 3:12-22; EX. 1002, ¶249. A POSITA would have understood the importance of minimizing maintenance of an HVAC system. EX. 1002, ¶249.

The POSITA would have had a reasonable expectation of success in the combination of Ehlers, Imes, and Young given that all references rely on thermostats and particular well known implementation details of the same, including the use of sensors to detect a room’s occupancy. EX. 1002, ¶¶250-51.

2. Claim 1: [1Pre]

Ehlers describes thermostat systems as devices that sense interior temperatures and “activate a heating and/or cooling system or systems to maintain

the temperature at [a user-defined] setting” (*thermostat system*). EX. 1010, 1:17-24; EX. 1002, ¶252.

a) [1A]

Ehlers discloses an HVAC control unit that “may be contained within a case similar to thermostats presently available” (*housing*). EX. 1010, 27:36-38; EX. 1002, ¶253.

b) [1B]

For the same reasons as described in Ground 1A, [1B], Ehlers discloses [1B]. EX. 1010, 30:37-44; EX. 1002, ¶¶254-256.

c) [1C]

Ehlers further discloses a user interface which may include a “display device, which displays information to a user.” EX. 1010, 7:37-44; EX. 1002, ¶257.

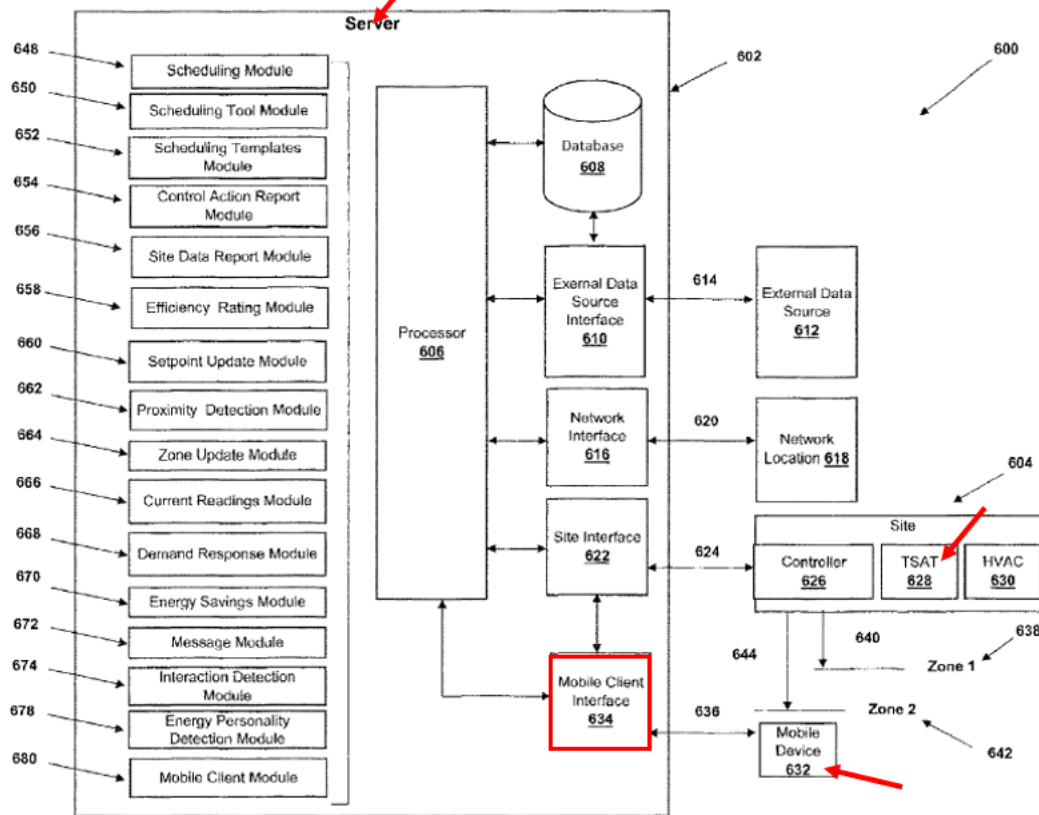
d) [1D]

Imes discloses that its mobile devices can communicate indirectly with one or more components.⁹ For example, as illustrated below in Figure 6 (annotated), Imes can include a mobile client interface 634 “coupled to mobile device 632 associated with site 604.” EX. 1014, 39:59-64; EX. 1015, 7-8, §1.3; 8-9, §1.4; 11,

⁹ Similar to Ground 1A, [1D], Petitioner relies on Patent Owner’s interpretation only for the purposes of this IPR. EX. 1002, ¶¶258-59.

§2.1.4; 28; 30; 33-35; 43-45; EX. 1002, ¶260. The mobile client interface 634 can include “a WAP gateway or other mobile client gateway to enable server 602 access to mobile device 632.” EX. 1014, 39:61-67; EX. 1015, 7-8, §1.3; 8-9, §1.4; 11, §2.1.4; 28; 30; 33-35; 43-45; EX. 1002, ¶260. After receiving a request from the mobile device to modify a current set-point of the HVAC, the mobile client interface communicates the control action to the site using site interface 622; and when the set-point has been updated, the mobile client interface receives confirmation communicated from the home controller 626 (*configured to communicate bi-directionally with a location-aware mobile device*). EX. 1014, 30:19-40; EX. 1015, 7-8, §1.3; 8-9, §1.4; 10, §2.1.1; 11, §2.1.4; 19, §2.1.9; 16, §§2.1.12, 2.1.14; 28; 30; 33-35; 43-45; *see also* EX. 1014, 12:32-34; EX. 1002, ¶260.

FIG. 6



EX. 1014, Fig. 6 (annotated).

Imes discloses that its mobile devices can also communicate directly. For example, the controller 216, which is capable of connecting to both the mobile device 210 and TSTAT 208, “can establish a wireless energy network 242 using a wireless communication described herein,” and “mobile device 210 can communicate with controller 216 using a WIFI or 802.11 based communication, Bluetooth communication, [or] Zigbee communication” (*a wireless radio compatible with a wireless radio frequency protocol*). EX. 1014, 6:63-67; EX. 1015, 8, §1.3; 30; 33-35; 43; 44; EX. 1002, ¶¶261-62.

e) [1E]

Ehlers discloses “sensors and equipment” such as those that “sense internal and external environmental conditions including temperature” (*temperature sensor*). EX. 1010, 10:14-19; EX. 1002, ¶263.

f) [1F]

Ehlers discloses “**a processor 30**” (*one or more processors configured with electronic circuitry*). EX. 1010, 6:66-7:3 (emphasis added); EX. 1002, ¶264.

g) [1G]

Ehlers discloses that its system “sense[s] an indoor temperature,” which “sensed conditions and inputs are processed by a processor of the system” (*receive HVAC data parameters, including a first data parameter from the temperature sensor comprising an interior temperature inside the building*). EX. 1010, 2:52-65, 10:14-19, 32:31-37; EX. 1002, ¶¶265-66.

h) [1H]

For the same reasons as those outlined in Ground 1A, Limitation [1H], Ehlers discloses the recitations of this claim. EX. 1002, ¶¶267-69.

Moreover, Imes discloses an energy management system that obtains weather data from an external data source using a network connection and has a weather forecast display (*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). EX. 1014, 34:18-20, 34:24-27, 49:1-3; *see* EX. 1015, 8, §1.4; 15, §2.1.10; EX. 1002, ¶270.

i) [1I]

Ehlers teaches that temperature control systems “may be programmed by a user with ***multiple desired temperature settings...based on time-dependent user-programmed parameters***” (*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*). EX. 1010, 1:57-64; EX. 1002, ¶271-72. To the extent that Patent Owner argues that the claimed determination must be by the “thermostat system” and without user involvement, this limitation is further disclosed by the artificial intelligence systems disclosed in Ehlers as described in Ground 1B (claim 14), and by the location-based control disclosed in Imes as described in Ground 2A (element [1L]).

j) [1J]

For the same reasons as [1I], Ehlers discloses multiple temperature setpoint parameters and associated time values. EX. 1002, ¶272.

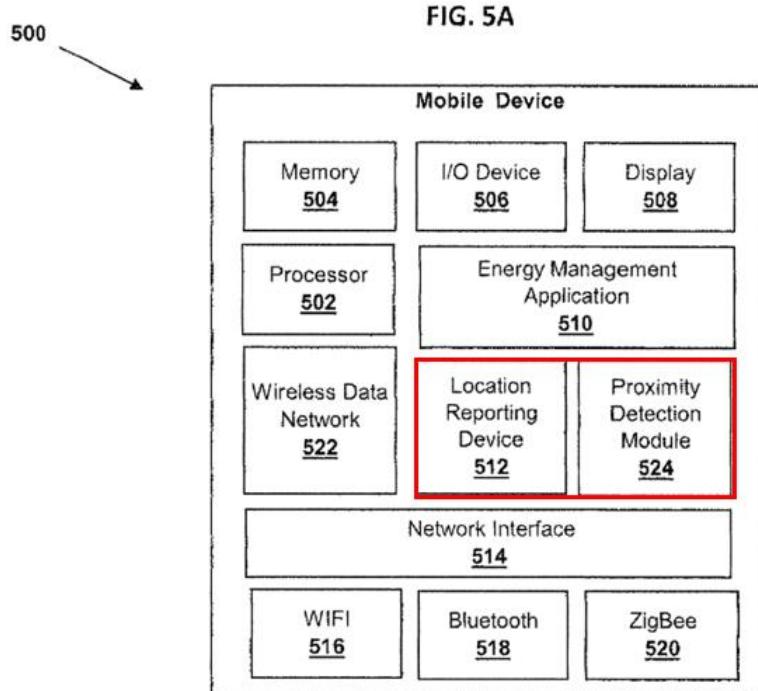
k) [1K]

For the same reasons as [1D], Imes discloses [1K]. EX. 1002, ¶¶273-275.

l) [1L]

As described with respect to Limitations [1D] and [1K], Imes discloses receiving radio frequency signals from the location-aware mobile device. As an overview, Imes describes a “[s]erver 602 [that] 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,” and the site itself may include a mobile device associated with the site and a “wireless thermostat, TSAT 628, operably coupled” to HVAC 630. EX. 1014, 34:45-48, 34:51-64; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 9, §§1.4, 2.1.8, 2.1.9; 11-12, §2.1.6; 13, §2.1.7; 28; 30; 32; EX. 1002, ¶276.

Imes describes that a mobile device can be configured to enable a user to manage energy use of a site. EX. 1014, 29:28-31; EX. 1015, 7, §1.2; 7-8, §1.3; 10, §2.1.1; EX. 1002, ¶277. As illustrated in Figure 5A (annotated) below, “[m]obile device 500 can also include a ***location reporting device 515, such as GPS technology***, cell tower location technology, triangulation technology or any combination thereof” (*receive geo-positioning data from the location-aware mobile device*). EX. 1014, 29:31-38; EX. 1015, 7-8, §1.3; 9, §1.4; 15, §2.1.8; 30; 37; EX. 1002, ¶277.



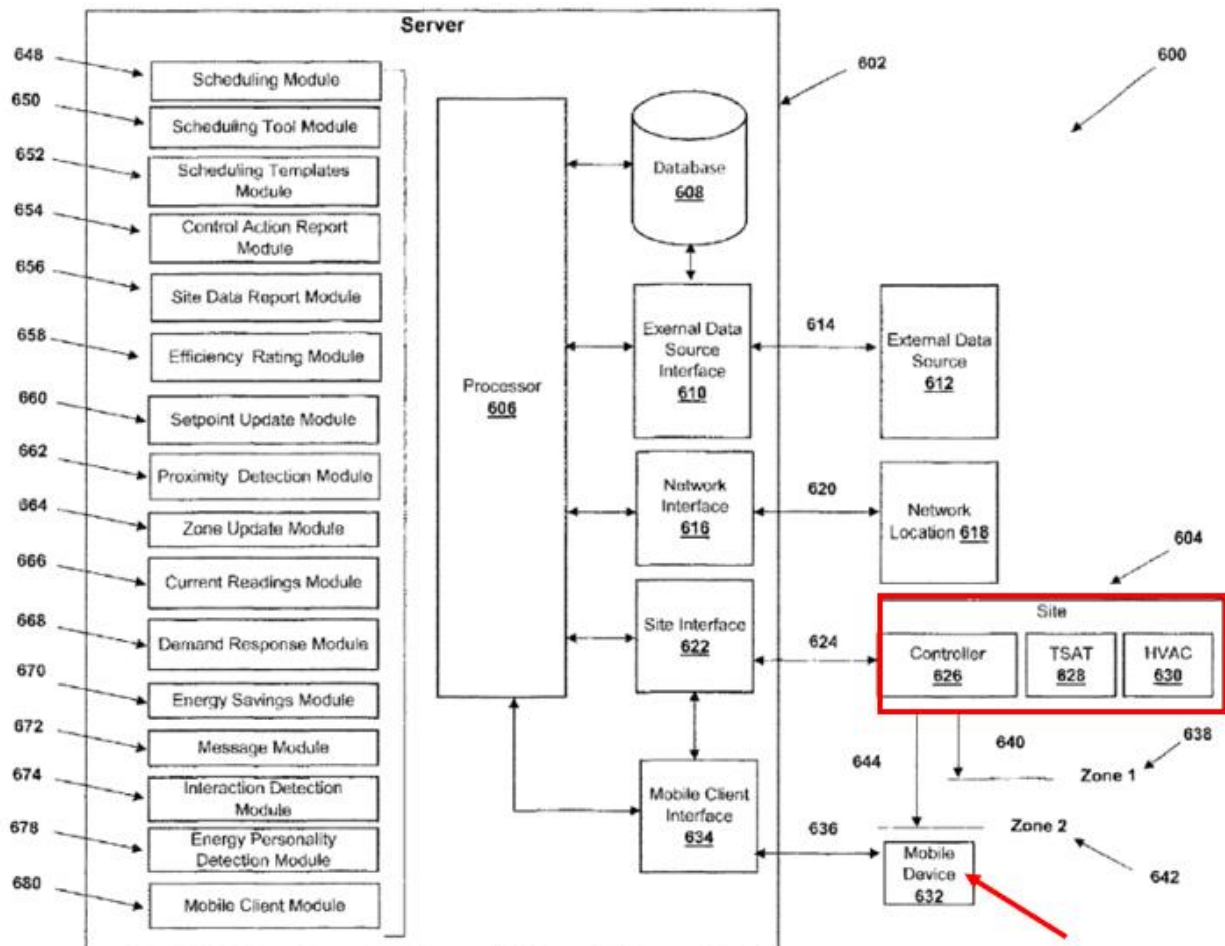
EX. 1014, Fig. 5A (annotated).

A proximity detection module may periodically request a location from the location reporting device, which then uses GPS or triangulation to detect the current location. EX. 1014, 32:8-24; EX. 1015, 7-8, §1.3; 9, §1.4; 15, §2.1.8; 30; 37; EX. 1002, ¶278. And a “proximity mode” disclosed by Imes involves “***automatically controlling*** a network device based on detecting a location the mobile device may be from the residential site.” EX. 1014, 18:59-67; EX. 1015, 10, §2.1.1; EX. 1002, ¶278.

Imes describes establishing “proximity zones” to “control TSTAT 628 and HVAC 630” by adjusting the set point of the thermostat by a certain percentage depending on the zone in which the mobile device is located in away from the home (*automatically adjust a temperature value based on the geo-positioning*

data). EX. 1014, 34:51-64, 36:25-36; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 11-12, §2.1.6; 13, §2.1.7; 28; EX. 1002, ¶¶279-80.

FIG. 6



EX. 1014, Fig. 6 (annotated).

Imes discloses that “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” (*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)¹⁰. EX. 1014, 11:10-12, 11:16-21; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 11-12, §2.1.6; 13, §2.1.7; 28; EX. 1002, ¶282. A POSITA would have understood that a mobile device moving away from a residential site indicates that the residential site is no longer unoccupied by the user using the mobile device. EX. 1002, ¶283.

m) [1M]

Ehlers discloses an energy management system that includes an input function 14 that allows a user to input data such as a temperature setpoint (*allow the user to adjust a desired temperature for the HVAC system*). EX. 1010, 9:65-10:3, 10:3-9; EX. 1002, ¶283.¹¹

To the extent Patent Owner argues that the electronic circuitry is referring to a mobile device, Imes teaches that “a user can adjust a thermostat set-point up or

¹⁰ Similar to Ground 1A, [1L], Petitioner relies on Patent Owner’s interpretation only for the purposes of this IPR. EX. 1012, 69.

¹¹ The claims suggest that “electronic circuitry” in limitations [1M], [1N], and 1[O] is different circuitry than the processor. That said, Patent Owner appears to be relying on the processor as being the same as the claimed electronic circuitry in the contentions. EX. 1012, 70-84. As such, and for the purposes of this IPR only, Petitioner has adopted this position.

down” from a mobile device. EX. 1014, 41:16-23, 41:64-67; EX. 1015, 7, §1.2; 7-8, §1.3; 11, §2.1.4; 11, §2.1.5; EX. 1002, ¶¶284-285.

n) [1N]

For the same reasons as Ground 1A, [1N], Ehlers discloses this claim element. EX. 1002, ¶¶286-88.

o) [1O]

Ehlers discloses that the energy management system may maintain data such as “[h]istorical totals of energy units usage and cost for this month, last 14 months and year to date” (*generate and communicate usage metrics pertaining to the HVAC system over time*). EX. 1010, 38:38-39:6; *see also id.* at 26:23-50; EX. 1002, ¶289. The system is able to “provide operational feedback to the premise occupant...and permit them to access information on system operation.” EX. 1010, 26:15-28; EX. 1002, ¶289.

p) [1P]

Young discloses a compressor timer that prevents a compressor from reactivating until a “startup delay” after the compressor’s deactivation has passed. EX. 1016, 2:51-61; EX. 1002, ¶¶290-91. Young also describes a compressor delay circuit “prevents wear and tear on the compressor ...” EX. 1016, 3:12-22 (*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. 1002, ¶292.

3. Claim 2

Ehlers “will use a no occupancy temperature set point for use when the premise is empty.” EX. 1010, 33:54-56; EX. 1002, ¶294. The occupancy sensor disclosed in Ehlers “permit[s] the system to generate greater savings by allowing greater use of the dead-band during periods when the premise is vacant without jeopardizing the comfort of the occupant.” EX. 1010, 21:41-47; EX. 1002, ¶294.

Regardless, Young discloses that “an occupancy sensor can be provided to sense the presence of occupants in the room” (*determine whether the building is occupied or unoccupied*). EX. 1016, 3:29-48; EX. 1002, ¶295.

To the extent Claim 2 relates to determining whether the building is occupied or unoccupied based on the location of a mobile device¹², Imes discloses that “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.” EX. 1014, 11:10-12, 11:16-21; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 11-12, §2.1.6; 13, §2.1.7; 28; EX. 1002, ¶282.

¹² Patent Owner accused products that utilize geo-fence technology, or “location-based temperature control” that “use[s] your smartphone’s location” as meeting this claim limitation. EX. 1012, 93. Petitioner will rely on Patent Owner’s interpretation for the purposes of this IPR. EX. 1002, ¶293.

4. Claim 3

As described above in Ground 1A, Claim 3, Ehlers discloses the recitations of this claim. Further, as described previously, it would have been well known to a POSITA that users typically have the ability to enter schedules of setpoint temperatures through some user interface on the thermostat. EX. 1002, ¶¶296-99.

5. Claim 4

For the same reasons as Ground 1A, Claim 4, Ehlers discloses the recitations of this claim. EX. 1002, ¶300.

Additionally, Young discloses a motion detector (*determination of whether the building is occupied or unoccupied...is based at least on a fourth data parameter received from a motion sensor*). EX. 1016, 3:29-43, 3:47-48, 5:21-29; EX. 1002, ¶¶301-302.

6. Claim 5

For the same reasons as Ground 1A, Claim 5, Ehlers discloses the recitations of this claim. EX. 1002, ¶¶303-305.

7. Claim 6

As described above in Ground 1A, Claim 5, Ehlers discloses the recitations of this claim. EX. 1002, ¶306.

8. Claim 7

As described above in Ground 1A, Claim 7, Ehlers discloses the recitations of this claim. EX. 1002, ¶¶307-310.

9. Claim 8

For the same reasons as Ground 1A, Claim 8, Ehlers discloses the recitations of this claim. EX. 1002, ¶¶311-312.

D. Ground 2B: Imes, Wedekind, Young, and Ehlers

1. Motivation to Combine

As was described in Ground 2A, the POSITA would have been motivated to combine Ehlers, Imes, and Young. The POSITA would have been motivated to combine the teachings of Wedekind with those of Ehlers, Imes, and Young for at least the following several reasons. EX. 1002, ¶313.

Ehlers emphasizes that the prior art does not “provide automatic environmental condition control based on sensed external environmental conditions, which external conditions may greatly effect [sic] internal conditions.” EX. 1010, 2:14-18; EX. 1002, ¶314. Ehlers also aims to “optimize comfort and minimize energy consumption and/or energy cost, based on user-defined parameters.” EX. 1010, 2:35-39; EX. 1002, ¶314.

Imes teaches the importance of automated temperature control systems, and the enhanced user comfort and energy savings associated with changing thermostat

setpoints when the user is away. EX. 1002, ¶315. For example, Imes describes that a processor can detect the location of a mobile device within a specific location zone and that “site 604 can be controlled on a zone by zone basis.” EX. 1014, 36:4-7, 36:25-36; EX. 1015, 7-8, §§1.2, 1.3; 10, §2.1.1; 11-12, §2.1.6; 13, §2.1.7; 28; EX. 1002, ¶315. However, Imes does not provide specific implementation details regarding how its system would calculate the percentage change value, or the distance to be used for the zones. EX. 1002, ¶315.

A POSITA would have been motivated to combine the teachings of Wedekind, because Wedekind discloses the use of inputs to “more accurately achieve predetermined temperatures at predetermined times in addition to achieving these conditions while optimizing energy consumption.” EX. 1011, 2:45-63; 1:36-41; EX. 1002, ¶¶316-17. Indeed, Wedekind discloses specific formulas that describe a thermodynamic model of the monitored enclosure and its associated climate control system that utilize thermal and thermodynamic parameters. EX. 1011, 17:53-63; EX. 1002, ¶317. More specifically, the differential equations utilized in the predictor system govern the average temperature (T') of the conditioned space, the average temperature (T) of the thermal capacitance of the enclosure, and the rate at which energy is delivered to or removed from the conditioned space by the climate control system. EX. 1011, 17:68-18:64; EX. 1002, ¶317. Thus, a POSITA would have been motivated to combine the teachings of the base references with those of

Wedekind to more accurately determine the proper start up times or percentage change in setpoint of a heating or cooling system to have an enclosure reach a desired set-point temperature when the user returns to the enclosure. EX. 1011, 2:21-26; EX. 1002, ¶317.

Moreover, Wedekind teaches an energy prediction methodology which uses certain thermal and thermodynamic parameters, along with the measured outdoor air temperature, to determine “the optimum thermostat setback schedule 80 which, while maintaining the user-specified occupancy comfort schedule 39, minimizes the input energy consumption of the climate control system 18.” EX. 1011, 17:53-67; EX. 1002, ¶318. The POSITA would have been motivated to combine Wedekind so as to be able to automatically change the setback temperature to improve energy efficiency and enhance comfort. EX. 1002, ¶318.

The POSITA would have had a reasonable expectation of success in the combination given that each of the references disclose thermostats to control heating and cooling devices as well as specific mechanisms for controlling when to activate an HVAC system so as to achieve a particular setpoint at a particular time. EX. 1002, ¶319.

Accordingly, a POSITA would have combined the teachings of Ehlers, Imes, Young, and Wedekind as described herein. Indeed, combining their teachings would have been routine to a POSITA due to this overlap and the simple software and

system modifications to adjust Ehlers so it includes the teachings of Imes, Young and Wedekind. EX. 1002, ¶320.

2. Claim 9

For the same reasons as those in Ground 1B, Claim 9, Wedekind and Ehlers discloses the recitations of this claim. EX. 1002, ¶¶321-22.

3. Claim 10

For at least the reasons described in Ground 1B, Claim 10, Wedekind and Ehlers disclose this claim. EX. 1002, ¶323.

4. Claim 11

For at least the reasons described in Ground 1 B, Claim 11, Wedekind and Ehlers disclose this claim. EX. 1002, ¶324.

5. Claim 12

For at least the reasons described in Ground 1B, Claim 12, Wedekind and Ehlers discloses the recitations of this claim. EX. 1002, ¶325.

6. Claim 13

For at least the reasons described in Ground 1B, Claim 13, Wedekind discloses the recitations of this claim. EX. 1002, ¶326.

7. Claim 14

A memory configured to store historical values of the first data parameter and second data parameter is disclosed for at least the reasons as Claim 9. And for at

least the reasons described above in Ground 1B, Claim 14, Wedekind and Ehlers disclose this claim. EX. 1002, ¶327.

8. Claim 15

For at least the reasons described in Ground 1B, Claim 15, Ehlers discloses the recitations of this claim. EX. 1002, ¶328.

9. Claim 16

Claim 16 is rendered obvious for at least the same reasons as explained above for Claims 13 and 14. EX. 1002, ¶329.

10. Claim 17

For at least the reasons described in Ground 1B, Claim 17, Wedekind and Ehlers disclose this claim. Moreover, Imes discloses receiving performance characteristics of the HVAC system through the use of an “efficiency rating module 232” that can retrieve “EMI [energy management information] stored within database 224 or a remote data source to determine an efficiency rating, thermal response,...performance data, or various other [sic] of site 202.” EX. 1014, 7:61-65; EX. 1015, 9, §1.4; EX. 1002, ¶¶330-31.

VIII. DISCRETIONARY ISSUES

A. The Petition Does Not Present the Same References

Under *Advanced Bionics*, the Board should not deny institution under §325(d). *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, No. IPR2019-01469, Paper 6 (P.T.A.B. Feb. 13, 2020), at 7 (precedential).

The Board has held that the first prong of *Advanced Bionics* is not met where “neither [the combination references] nor similar prior art was before the examiner... the prosecution history does not include any overlapping arguments directed to this prior art.” *Godbersen-Smith Constr. Co. v. Guntert & Zimmerman Const. Div., Inc.* No. IPR2021-00050, Paper 24 (P.T.A.B. May 7, 2021), at 19–21. And in such a case, the Board “need not address part two of the analysis.” *Id.* at 21.

At least one prior art reference in each ground was not cited during prosecution and is not cumulative of the art considered by the Examiner during prosecution. See §V.B, *supra*. For example, in Grounds 1A and 1B, Leen was not cited during prosecution and, in Ground 2A, Young was not cited. See *generally* EX. 1004-1007. Wedekind, which is relied on in Grounds 1B and 2B was merely cited by the Examiner as a document indicating the state of the art during prosecution. See EX. 1004, 389.

With respect to Grounds 1A and 1B, both Trundle and Ehlers appear on the face of the '890 Patent. However, the Examiner apparently overlooked the

importance of these references, as they were not discussed during prosecution. *See, e.g.*, EX. 1004, 115-124; EX. 1005, 163-166; EX. 1006, 395-401; EX. 1007, 197-200. With respect to Grounds 2A and 2B, both Imes and Ehlers appear on the face of the '890 Patent. However, the Examiner apparently overlooked the importance of these references, as they were also not discussed during prosecution. *See, e.g.*, EX. 1004, 115-124; EX. 1005, 163-166; EX. 1006, 395-401; EX. 1007, 197-200. A patent related to Imes, however, was cited and formed the basis of a rejection during the prosecution of the '554 Application. In that case, Patent Owner did not dispute that the related patent, Imes '782, was (1) prior art and (2) taught several limitations (e.g., Patent Owner did not dispute the Examiner's argument that Imes discloses "associating the at least one mobile electronic device with the structure," and "receiving with one or more computer processors, the geographic location of the at least one mobile device"). EX. 1006, 395-397, 453-460. Indeed, Patent Owner overcame Imes by adding the limitation "receiving with one or more computer processors, at least a measurement of a temperature obtained from within the structure and predicting a length of time to reach a desired temperature" to the claims, a claim recitation not found in Claim 1 of the '890 Patent. EX. 1006, 461.

The cited references are not cumulative of the prosecution because there was not an art-based rejection in the prosecution of the '890 Patent. Because the first

prong is not met, the Board need not move to the second. *See Oticon Med. AB v. Cochlear Ltd.*, No. IPR2019-00975, Paper 15 (P.T.A.B. Oct. 16, 2019), at 20.

Even if considering the second prong, Petitioner has demonstrated a material error by the Examiner by pointing out and explaining how the combinations teach the limitations of the claims. *See Cellco v. Huawei*, No. IPR2020-01117, Paper 10 (P.T.A.B. Feb. 3, 2021). Moreover, *Advanced Bionics* does not apply to the rest of the grounds because these grounds were also not before the Office. Accordingly, none of the §325(d) factors favor denial of institution.

B. The Board Should Not Deny Institution Under *Fintiv*

The Board should not deny institution under *Apple v. Fintiv, Inc.*, No. IPR2020-00019, Paper 11 (P.T.A.B. Mar. 20, 2020) (precedential). As shown above, Petitioner presented compelling evidence of unpatentability of the Challenged Claims. EX. 1020, 4, 9.

In addition, Petitioner stipulates that, if this IPR proceeding is instituted, Petitioner will not pursue in the co-pending district court litigation the grounds raised in this Petition or any grounds that could have reasonably been raised in this

Petition.¹³ See *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (precedential). As noted by the Director, “the PTAB *will not discretionarily deny* institution in view of parallel district court litigation where a petition presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB.” EX. 1020, 3.

At least because of the *Sotera* stipulation and the compelling grounds put forth herein, IPR should not be denied under *Fintiv*. EX. 1020, 9.

C. The Board Should Not Deny Institution Under *General Plastic*

The *General Plastic* factors do not apply for several reasons. First, this is the first and only *inter partes* review (“IPR”) petition filed by Petitioner with respect to the ’890 Patent. As noted in Section IX.B, the ’890 Patent was challenged in an IPR filed by Google. (IPR2022-00535), with which the Petitioner had no involvement and which was not instituted. There is no overlap between the art relied on herein

¹³ This stipulation is not intended, and should not be construed, to limit Petitioner’s ability to assert invalidity of any claim of the ’890 patent in the district court litigation under §§ 101, 112, and/or §§ 102 and/or 103, and based on any other ground that includes prior art systems and methods that were “known or used” or “in public use or on sale,” regardless of whether IPR is instituted.

and the art relied upon in the prior IPR. Second, because the earlier IPR was discretionarily denied and the Board did not substantively address the merits of the prior petition, any concerns of serial petitions are largely outweighed by the benefits to the patent system of improving patent quality by reviewing the merits of the challenges raised in this petition, which have not been addressed to date. *Code200, UAB v. Bright Data, Ltd.*, IPR2022-00861, Paper 18, 5-6 (P.T.A.B. Aug. 23, 2022) (precedential).

IX. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Party in Interest (37 C.F.R. §42.8(b)(1))

The real party in interest is Ademco, Inc. Ademco is a wholly owned subsidiary of Resideo Technologies, Inc.

B. Related Matters (37 C.F.R. §42.8(b)(2))

Pursuant to 37 C.F.R. §42.8(b)(2), Petitioner is aware of the following pending lawsuits or related matters involving the '890 Patent:

- *EcoFactor, Inc. v. Resideo Technologies, Inc.*, No. 6-22-cv-00069 (W.D. Tex., Jan. 18, 2022)
- *EcoFactor, Inc. v. Amazon.com, Inc.*, No. 6-22-cv-00068 (W.D. Tex., Jan. 18, 2022)
- *Google, LLC f/k/a Google Inc. v. EcoFactor, Inc.*, 4-21-cv-03220 (N.D. Cal. Apr. 30, 2021)
- *EcoFactor, Inc. v. ecobee, Inc.*, No. 6-21-cv-00428 (W.D. Tex., Apr. 28, 2021)

On February 3, 2022, Google filed a petition for *inter partes* review (IPR2022-00535) of the '890 Patent. Institution was denied.

C. Designation of Counsel (37 C.F.R. §42.8(b)(3))

Lead counsel is S. Benjamin Pleune (Reg. No. 52,421), of Alston & Bird LLP, One South at the Plaza, 101 South Tryon Street, Suite 4000, Charlotte, NC 28280-

4000, Tel: 704.444.1000, Fax: 704.444.1111. Backup counsel is Christopher T.L. Douglas (Reg. No. 56,950) of Alston & Bird LLP, One South at the Plaza, 101 South Tryon Street, Suite 4000, Charlotte, NC 28280-4000, Tel: 704.444.1000, Fax: 704.444.1111; Stephen R. Lareau (Reg. No. 63,273) of Alston & Bird LLP, One South at the Plaza, 101 South Tryon Street, Suite 4000, Charlotte, NC 28280-4000, Tel: 704.444.1000, Fax: 704.444.1111; and Jenny J. Wang (Reg. No. 78,883) of Alston & Bird LLP, 555 Fayetteville Street, Suite 600, Raleigh, NC 27601, Tel: 919.862.2249, Fax: 919.862.2260. Pursuant to 37 C.F.R §42.10(b), Powers of Attorney are being submitted with this Petition.

D. Service Information (37 C.F.R. §42.8(b)(4))

Petitioners consent to electronic service directed to ben.pleune@alston.com, christopher.douglas@alston.com, stephen.lareau@alston.com, and jenny.wang@alston.com.

Date: December 23, 2022

By: / S. Benjamin Pleune /
S. Benjamin Pleune
Reg. No. 52,421

CLAIMS APPENDIX

Claim	Recitation
1[pre]	A thermostat system comprising:
1A	a housing;
1B	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;
1C	a display configured to present information to a user;
1D	a wireless radio compatible with a wireless radio frequency protocol and configured to communicate bi-directionally with a location-aware mobile device
1E	a temperature sensor;
1F	one or more processors configured with electronic circuitry to;
1G	receive HVAC data parameters, including a first data parameter from the temperature sensor comprising an interior temperature inside the building; and
1H	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;
1I	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;
1J	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;
1K	receive radio frequency signals from the location-aware mobile device;
1L	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;
1M	electronic circuitry configured to allow the user to adjust a desired temperature for the HVAC system;
1N	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
1O	electronic circuitry configured to generate and communicate usage metrics pertaining to the HVAC system over time; and

1P	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.
2	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	The thermostat system of claim 2, further comprising an interface configured to allow the user to input that the building is currently unoccupied.
4	The thermostat system of claim 3, wherein the determination of whether the building is occupied or unoccupied by the one or more processors is based at least on a fourth data parameter received from a motion sensor.
5	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.
6	The thermostat system of claim 5, wherein the third data parameter from the first sensor comprises a measurement of the humidity of the building.
7	The thermostat system of claim 5, wherein the third data parameter from the first sensor comprises a measurement of sunlight.
8	The thermostat system of claim 7, wherein the second data parameter from the network connected to the thermostat further comprises a measurement of the outdoor humidity.
9	The thermostat system of claim 1, further comprising a memory configured to store historical values of the first data parameter and second data parameter.
10	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, 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.
11	The thermostat system of claim 10, 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 determining a rate of change value necessary

	for the building to reach the first temperature value by the first time value.
12	The thermostat system of claim 11, wherein the automatic adjustment of the temperature setpoint is based at least in part on the rate of change value.
13	The thermostat system of claim 10, 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.
14	The thermostat system of claim 10, further comprising a memory configured to store historical values of the first data parameter and second data parameter; 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.
15	The thermostat system of claim 14 wherein the one or more processors determines one or more intermediate temperature setpoints that have a temperature value between a current temperature of the building and the first temperature setpoint.
16	The thermostat system of claim 14, 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.
17	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.

CERTIFICATION UNDER 37 C.F.R. §42.24

Under the provisions of 37 CFR §42.24, the undersigned hereby certifies that the word count for the foregoing Petition for *inter partes* review totals 13,920 words (Sections I-VIII), which is less than the 14,000 allowed under 37 CFR §42.24(a)(i).

Date: December 23, 2022

By: / S. Benjamin Pleune /
S. Benjamin Pleune
Reg. No. 52,421

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§42.6(e), 42.105, the undersigned hereby certifies service on the Patent Owner of a copy of this Petition and its respective exhibits to Patent Owner via UPS Next Day Air on the correspondence address of record for U.S. Patent No. 10,584,890 as follows:

Tanner IP, PLLC
149 West Gilpin Avenue
Norfolk, VA 23503

Petitioner also certifies that a courtesy copy of this Petition was sent via email to Patent Owner's litigation counsel:

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